BME Design-Fall 2020 - ADELINE DRIER
Complete Notebook

PDF Version generated by

KEVIN TAN

on

Dec 09, 2020 @02:21 PM CST

Table of Contents

Team contact Information

MADISON BUGEL - Oct 07, 2020, 1:14 PM CDT

Last Name	First Name	Role	E-mail	Phone	Office Room/Building
Kinney	Melissa	Advisor	melissa.kinney@wisc.edu		
Dauman	Ryan	Client	RDauman@UWhealth.org	608-265-1682	
Drier	Adeline	Leader	avdrier@wisc.edu	651-252-7476	
Tan	Kevin	Communicator	kktan2@wisc.edu	608-334-9375	
Bugel	Madison	BSAC	mbugel@wisc.edu	651-278-0664	
Turinske	Thomas	BWIG	tturinske@wisc.edu	651-587-3329	
Pudzisz	Chris	BPAG	cpudzisz@wisc.edu	262-488-0458	

Project description

ADELINE DRIER - Oct 07, 2020, 1:14 PM CDT

Course Number: BME 200 - 300 - 400

Project Name: Mohs TurnAround Time Tracking

Short Name: Mohs TAT

Project description/problem statement:

Function:

The goal of this project is to modify and update the existing Turnaround Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper time cards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Client requirements:

- The timestamps that must be recorded are:

    ○ when the tissue specimen arrives at the lab

    ○ when a technician begins to work on the tissue specimen

    ○ when the finished slide is returned to the physician

    ○ when the slide has been read by the physician

- The barcode contains 2 patient identifiers and will be used to assign individual specimens to the time at which they were scanned at each stage. All of this information must be recorded on a computer in ideally Excel format.

- The system must be able to handle cases in which a specimen needs additional work in the laboratory. Additional timestamps must be recorded.

- Eliminate human error from the system and minimize the manual work done to produce the timestamp data

About the client:

The client is Mr. Ryan Dauman, a supervisor at UW Health who has been working with the lab technicians and the Mohs surgeon to find a time tracking system to measure TAT.

![Mohs Lab icon] **Mohs Lab Layout and Key**

THOMAS TURINSKE - Sep 24, 2020, 5:18 PM CDT

Mohs_Flow_with_Key.png(207 KB) - download

Lab Video Walk-through

THOMAS TURINSKE - Sep 24, 2020, 5:18 PM CDT

Mohs_Lab_Tour.mp4(24.9 MB) - download

Mohs TAT Workflow Draft

KEVIN TAN - Oct 01, 2020, 12:57 PM CDT

Using Timecards to track Turnaround Time in Mohs.

Objective:

Track how long a specimen takes to be completed and handed to physicians after it has been brought to lab.

How:

Using timecards and an automatic time stamping machine to track:

1. When the specimen is dropped off by the physician
2. When the technician picks up the specimen from the inking area
3. When the technician delivers the finished Mohs slides

The 4th time will be hand written by the physician on the map, below the drawing.

Workflow:

When a physician brings in tissue from the patient room into lab and inks the specimen, the physician will grab a timecard from a plastic divider labeled "Blank Timecard" and insert it into the machine to punch a time. Along with bringing in the specimen, an extra label will be printed off by an MA to be placed on top of the timecard. This label should have at least 2 patient identifiers and contain the site number if there are more than one sites. The first time that is punched onto the timecard will be the time the specimen arrived into lab.

Next, when a technician picks up the specimen to work on it, they will insert the timecard a line lower in the time stamper to indicate the time they picked up the specimen to work on it. The second time listed therefore indicates when someone began working on the specimen.

Following staining of completed slides, the timecard will be punched a third time indicating that the slides are being delivered to the physician. The timecard will then be placed into a plastic divider next to the time stamper, in a "In Progress" labeled spot. The timecard will not follow the specimen to the physician, but rather be placed in the plastic divider until the specimen is either cleared or another stage is needed.

When the slides are read by the physician, the time at which they were read will be indicated below their specimen drawing on the map, separate from the timecard.

If the specimen is determined clear, the timecard associated with that patient and site will be placed into the "Timecard Finished" spot of the plastic divider.

If a specimen is not cleared and another stage is needed, then a red line will be drawn below the most recent time punch on the timecard and that timecard will be used again for the next stage of the same site, with the specimen's drop off time being punched below the red line that was drawn.

At the end of the day, the timecards should all be in the "Timecard Finished" spot of the plastic divider, which will be collected by a lab technician for data entry. The times written on the map indicating when slides were read will be transcribed from the map by the lab technician soon after they have been scanned into Beaker (approximately 1 week later).

Mohs_TAT_Workflow_Draft.docx(991.9 KB) - download

9/11 First Client Meeting

ADELINE DRIER - Oct 06, 2020, 11:12 PM CDT

Title: First Client Meeting

Date: September 11, 2020

Content by: Adeline Drier

Present: via WebEx All Team Members (Adeline, Kevin, Thomas, Christopher, and Madison), Ryan Daumer (client), Haley Kovac

Goals: Gain a better understanding of the project from the client and get our initial questions answered.

Content:

- What is the budget?
    - $200, would be able to use the existing equipment
    - Over $5000 needs approval but have authority over purchasing some equipment
- What specific improvements do you expect to be made? Would you like it to be completely computerized, or to remain using the timestamp machine currently being used?
    - Ideally use a program that uses the program to upload into an excel file that would load the timecards without having to manually copy the data
    - Streamlined way to record how long it takes to get the slides back to the physician
        - How can we make a better process?
    - Minimize the work the surgeon has to do
- If we go digital would it be best to retain the same format as the current timestamp card?
- How would the new system help eliminate human error?
    - Goal is to eliminate human error
- What feedback do the doctors have about the current system? What would they like improved about the system?
    - Ran out of time cards they are ordering more
    - Wait until they get more time cards
    - Clunky system
- TJ:
    - How many iterations have to be performed? Does the physician ever request a third or fourth stage?
        - 1-3 is average
        - 7 stages, 8 stage
    - Is there performance ratings on the readings? False positives or negatives that could be incorporated into the accuracy vs. time to read the slides?
        - This is more on finding the balance between efficiency and precision
        - 1 or 0 scale on readable-- incorporate in to minimum times
    - How many slides are being actively read at the same time?

- Would a reusable system be better?

    - 5 patients in morning, get first skin samples

    - Making decisions about closing or taking a second sample

    - Physician drop off, physician finished reading

        - Sometimes more than 1 specimen at a time from different sites

            - Three separate time cards for each site

    - Not set to time stamps, currently trial run

    - No more than 20 sites done in a day

        - site=time stamp card

- Maintain the handwritten final time from the doctors

- Try to eliminate human error

- Doctors are willing to do the work but the system could be streamlined

- Problem: more than one specimen from different sites (each site needs a different time stamps)

    - Tough and time consuming on busy days

    - Scan the petri dishes and automatically track the time

- Super open to any ideas that we might have

- Still in the early stages of the time cards so are willing to change based on our ideas

- Keep tracking by sites and specimens (not by patient)

- Ideas:

    - In any lab (not specific), turn around time tracking is a lab standard

    - For mohs: slightly different process because of the nature of the recordings - written on paper then loaded into the computer

- Specifically for quality assurance but the involved member are also interested in their efficiency as a lab

- Be creative !

- Biweekly meetings

- Don't have label printers in the lab, in registration

- Mr dauman will be sending a map of the lab to the team by the end of the day

    - Can show us an example barcode as well

- Slides are used for that day only then stored to maybeee be used later

- Wireless scanner ? have a computer open and running and then use a wireless scanner that is close to where the slides are brought in and prepared

- Willing to sacrifice turnaround time to maximize quality of specimen

- Would want a readable or not readable tracker (0 or 1 scale / yes or no)

- Should have a minimum time set to maximize the quality and readability of the samples

- Clinic runs 7:15am-2pm

    - No more than half an hour to show the process

- Patient labels are automatically printed when the patient arrives at the clinic

- What kind of barcode scanners do you have?

    - One by one of the computers but not being used for mohs

- How do you make sure the time card follows the petri dish around

    Stickers on the petri dish

Conclusions/action items:

Begin brainstorming and research based on the information given to us by the client.

9/25 Advisor and Client Meeting Notes

CHRISTOPHER PUDZISZ - Oct 07, 2020, 12:42 PM CDT

Title: Client and Advisor Meeting

Date: 9/25/2020

Content by: Adeline Ofer

Present: All Team Members(Adeline, Kevin, TJ, Madison, Christopher), Mr. Ryan Dosmar, Haley Kovac

Goals:

- Update the client on what has been accomplished in the past 2 weeks
- Show the preliminary design matrix and the criteria we evaluated

Content:

- Busy days = monday wednesday thursday
- Wires won't be a problem if the scanners are near computers
- Didn't like RFID chip
    - Don't have resources in the lab to re-use
- 4 scanners:
    - Work for going with the specimen throughout the lab
    - Would need something smaller for slides after sample
        - Currently use barcodes for specimen and QR codes for slides
        - Switch to QR codes at step 2
        - Barcode and QR code links to the same information
- Need a system that reads barcodes and QR codes
- Could use computers
    - Don't currently have enough computers in the lab for a scanner at each station
    - All 4 time stamps could be done at the check-mark table on the map
- Also wants a timestamp for when the doctor finishes reading the slide
    - Would be easier to just have a scan for that instead of manual
- Add barcodes specific to slides
- scanners that are labeled to make it easier to know when steps are skipped? No, too many scanners that would make it busy
- Have a QR code scanner in lab and maybe one sitting around somewhere that isn't being used
- No more than 7 specimen from each site
- Would want it to be possible to be able to print multiple QR codes for the same site if the tissue sample is large and will end up needing multiple slides.
- First 3 scans can be done at the check-mark table and the 4th one can be done in the microscope room
- QR code to be printed at the second time stamp (label the slides)

09_25_2020_Client_Meeting_and_Advisor_Meeting_Notes.pdf(154.3 KB) - download

10/9 Client Meeting Notes

ADELINE DRIER - Dec 08, 2020, 6:38 PM CST

Title: 10/9 Client Meeting Notes

Date: 10/09/2020

Content by: Adeline

Present: All Team Members (Adeline, Kevin, Chris, Madison, Thomas (TJ)), Ryan Dauman, Haley Kovac

Goals: Update the client on the progress of the project

Content:

- Scan to sheets app:
    - Test time delay between scans
    - Won't disrupt the work flow if the first three scans are at the same stations
    - More cost effective than scanners -- only $5 per month for unlimited scans
    - Can also do manual entries -- could work if you gets missed or if it needs site specification
    - Won't look at spreadsheet until the end of the day but that can be manipulated in the sheet if needed
        - Could add site hardness/difficulty in the future if that is implemented
        - Add information if the technician is working on more than one site
    - Multiple sites for the same patient -- don't need to be separated -- could make it a policy to work on one site at a time to minimize this error
    - Seems to work slightly different on android and apple
- What are qr codes being used for?
    - Not being used
    - Would need a printer for qr codes (connected to barcode printers)
    - Don't currently have a way to make qr codes -- client will do this part
    - Qr code for one piece of tissue that comes in
- Outlets?
    - Few open outlets where we would put the scanners
    - At least 2 open spots at the checkmark table
    - Open outlets in the microscope room as well
- Time 2 -- technician picks up specimen -- barcode scan
- Time 4 -- drop off for physician

Conclusions/action items:

- Move forward with the Smart design
- Think about having technicians manually entering T4 or purchasing another tablet for the microscope room

- Do some testing on the scan to sheets app - delay time, etc

  - Research other apps that could work

- The client is going to look for devices that could work

10/30 Client Meeting Notes

ADELINE DRIER - Dec 08, 2020, 6:44 PM CST

Title: 10/30 Client Meeting Notes

Date: 10/30/2020

Content by: Adeline

Present: All Team Members (Adeline, Kevin, Chris, Madison, Thomas (TJ)), Ryan Dauman

Goals: Get updates from the client and get feedback from preliminary report.

Content:

- Needs to make sure if security will allow it
    - Need a device that has to encrypted
    - Might be more patient information that can be pulled from a barcode
    - Can't scan until there is an encrypted device
- Didn't really like time option to mark what the expected time would be for the specimen -- can just take the data from the time stamps
- Don't need the specimen/stage number -- this data is included in the barcode
- We basically created an EPIC system outside of EPIC -- he's very impressed
    - If they can't get approved for devices -- they are just going to take the workflow to their EPIC programmer
    - Basically want to give our work to EPIC and they do everything that we have done but in their programming ?
- Not really sure about the technician name dropdown -- it is mostly denoted on the petri dish
    - The first scan will always be the physician
    - Doesn't want to delay the technicians -- doesn't mind doing the work on the backend
- Would take 2 years to get the Epic system up and running -- would want the encrypted smart devices until the epic software works
- What do we do if we can't get encrypted devices ? back up option -- get handheld scanner connected to their computers they have
- we need a back up plan asap

Conclusions/action items:

- **create a back up plan if we can't use smart devices**
- **possibly switch to the scanner design ?**

11/6 Client Meeting Notes

ADELINE DRIER - Dec 08, 2020, 6:47 PM CST

Title: 11/6 Client Meeting Notes

Date: 11/06/2020

Content by: Adeline

Present: All team members and Ryan Dauman

Goals: Receive security updates from the client.

Content:

- Barcodes don't have patient information
- Submitting service ticket to verify
- Won't have to worry about phones if we have a wireless scanner -- hooked up to a computer to track specimen
- Bypass what is on the barcode and need for encrypted device if we use wireless scanner
- Could spend more money to get a more expensive wireless scanner
- Computer could be used solely for the barcode scanning -- wireless scanner would work like a bluetooth mouse -- scanner would read to the computer
- No options for adding additional data -- would have to have the spreadsheet open on the computer -- would allow for manual entry into the document
- Need to figure out where the scanner loads data into
- Still two scanners -- one in lab and one in microscope room
- Test:
  - Two scanners going to the same computer on the same google sheet
  - If that doesn't work -- two scanners on two computers going to the same google sheet
- Might be able to get the app for the computer and connect the wireless scanners to the app
  - He's going to contact support to see if you can use it on a computer
- Would be willing to send the scanner we order to the engineering department so someone could test it
- Move forward with wireless scanners -- could also work with EPIC once we get there
- Is going to prove that the barcodes don't have any information so that the HIPPA compliance of the data won't really matter
- Analysis -- weekly
  - Averages
  - Statistical analysis
  - Std deviation
  - Box plot ??
  - Histogram ??
- Scanners

- Bluetooth

- Usb power cables

- Cordless

- Handheld

- Zebra -- start here

Conclusions/action items:

- **move forward with scanner design -- client liked this more**
- **start thinking about how to analyze the data once it is collected**
- **start researching scanners**

- Bluetooth

- Usb power cables

- Cordless

11/20 Client Meeting Notes

ADELINE DRIER - Dec 08, 2020, 6:50 PM CST

Title: 11/20 Client Meeting Notes

Date: 11/20/2020

Content by: Adeline

Present: All team members and Ryan Dauman

Goals: Update the client on data processing/analysis progress and get updates about scanners from client.

Content:

- Meeting with client today to pick up scanner -- will have cords (giving us scanners that are currently not being used)
    - Have a couple extra -- could add one to the station where technicians are reading slides
    - Long cords -- space shouldn't be an issue
- Will also be giving us sample barcodes
- No patient information on the barcode but still waiting to hear back from the IT department
- Would be super easy to add scanner to microscope room for physicians
    - Also could just have last scan in lab because the physician has to go back to lab to tell the technicians if the patient is clear
        - Tells the technicians what site is clear
- Don't really need a scanner that scans a qr codes -- would take a little longer tho because barcodes wouldn't be on slides -- works until they get a qr code printer
- Slides have mrn and first and last name so it would be easy to match up slides with barcode on data sheet for the day
- Could work with a corded scanner until they get a second wireless scanner
    - Two computers so two scanners wouldn't be a problem
    - Would prevent technicians from doing non-work-related things on the computers while they are working
- Data processing progress:
    - All within google
    - Reads data from spreadsheet -- brings data into code and does processing on the data
    - Can be run once a week -- could append the data every week or could archive the data for the week and get new data for each week
    - Would want to add every week to get more accurate data/averages/etc
    - Client is happy with what we have so far
        - Mainly wants averages and standard deviation
        - Wants outliers reported to go back and see what went wrong with that sample

- Graphs? No … but eventually … so yes ? but not right now but it would be easier to do it right now

- Can add tabs for data processing display for each week

- Would want to save info of specimen that are missing timestamps to analyze what went wrong or how frequent errors are occurring in the lab

Conclusions/action items:

- pick up scanner from client
- start testing with the scanner for preliminary data
- continue working on data processing

9/18/2020 - Brainstorming Meeting

ADELINE DRIER - Oct 06, 2020, 11:06 PM CDT

Title: Team Meeting and Advisor Meeting

Date: 9/18/2020

Content by: TJ Turinske

Present: All Team Members (Adeline, Kevin, Chris, Madison, Thomas (TJ)) and Dr. Kinney

Goals:

-Share brainstorming ideas

-Finish PDS

-Narrow down ideas in accordance to PDS

Content:

- Finished the last couple of items on the PDS draft
- Only competition is the existing system
- Shared brainstorming ideas
    - Use barcode scanning system
    - Is the number read by the barcode the same number as the patient ID number?
    - Warning system to release slide to next stage
        - Set amount (minimum) time a slide is read
        - Look at unreadable time data to establish a minimum time
            - Data analysis
    - Need a solution for "step skipping" (Kevin Brainstorming):
        - 3 or 4 scanners, each connected to one computer
            - Computer to detect which scanner is being used- ports and data
            - Switch around USB= bad
        - 2 step process, need initial to send through (Madison)
            - Not ideal
        - 4 computers
        - 4 different micro controls or raspberry pi
            - Might want screens for feedback
        - Edit bar codes- 4 per site
            - Need to scan correct code
            - A lot easier to make it miss a stage
        - Switch to QR- use their phone
            - Might not have phone for sanitary purposes

- - - Cheap tablet alternatives

        - Link that sends data to cloud or spread sheet

    - Tablet or phone would be nice to see

        - Display lasted scan and allow

    - Four sticker scan

        - Addresses double scan

        - Can't go back around for second

    - Scanning chip RFID

        - Hotel entry card

        - Do not know how complicated this would be

- Three bin for first two timestamps due to the relatively close proximity

    - How are multiple slides organized? Specifically at the first stage and moving to second stage?

    -

- Manual enter at fourth station?

    - Digitize the whole process

    - Touch screen at fourth microscope stage

        - Yes or no for read

        - Confirm time

- Skipping scan is WORSE than double scan

- Two Parts:

    - Data collection

    - Data analysis

Meeting with Advisor:

- Summarized PDS and talked about measuring error

Conclusions/action items:

Questions for Client:

- Is the number read by the barcode the same number as the patient ID number?

- How are multiple slides organized? Specifically at the first stage and moving to second stage?

- Manual enter of data at fourth station?

9/23/2020 - Design Matrix Meeting

ADELINE DRIER - Oct 06, 2020, 11:07 PM CDT

Title: Team Meeting and Advisor Meeting

Date: 9/18/2020

Content by: Adeline

Present: All Team Members (Adeline, Kevin, Chris, Madison, Thomas (TJ)) and Dr. Kinney

Goals:

- Finalize our initial design ideas
- Create criteria for design matrix
- Assign values to each design

Content:

- Decided to move forward with two design matrices
    - One for data collection
    - One for data analysis
- Data collection:
    - Criteria and definitions:
        - Accuracy: eliminates as much human error as possible, records accurate timestamps
        - Ease of use: not super complicated for the lab members to use, easily transported around the lab if necessary
        - Efficiency: Doesn't require a large amount of time to record a data point, quick
        - Ease of Implementation: Does not require the lab to be reorganized to implement the product, blends well with their lab flow and processes
        - Durability: Able to sustain repeated use and is up to date for future technology changes
        - Cost: the cheaper the better
        - Safety: not interfering with the tissue samples, does not injure the lab members, patient confidentiality
- Data Analysis:
    - Criteria and definitions:
        - Reliability: analyzes or stores data without error
        - Feasibility: builds on the strengths or prior knowledge of the team
        - Efficiency: quick and accurate, data does not get backlogged
        - Cost: cheaper the better
        - Adaptability: can keep up with future technology, allows for quality control systems to be added on and to upload to medical databases such as EPIC
        - Accessibility: results are easy to access
        - Interfacing/Connectivity: Technology it interfaces with to analyse or transmit data is easy to use and connect between
        - Safety: Patient confidentiality

Conclusions/action items:

Rework the design matrix after meeting with the client and receiving his feedback on our designs.

to-do list for the remainder of the semester

ADELINE DRIER - Dec 08, 2020, 6:52 PM CST

Title: To-Do List

Date: 11/06/2020

Content by: All Team Members

Present: All Team Members

Goals: Lay out the rest of the semester and goals for when we want things to be done.

Content:

- **11/6-11/13 -** Get the Scanner from client- anyone in Madison
- **11/6** -Email client about meeting for pick-up/drop-off at ECB with barcodes and scanner- **Kevin**
- 11/6-11/20 - Write/create google form for qualitative use of scanners-
    - How is using this system vs. the last system (1-10)? Etc. **- Madison and Chris**
- 11/6-11/20 Testing
    - 11/13-11/20 Develop/write testing procedures for preliminary/fake data - Adeline
    - 11/13-11/20 Guidance/setup doc or call for the devices and returning data - TJ and Chris
    - **12/2 -** Determine date for data return to team?? **- TJ**
    - 12/3 - Finalize testing/statistics for improvement- how much better our is
- **11/6-11/20** Data processing- **Kevin and TJ**
    - **11/6-11/20-** Write preliminary code with fake data- outline scenarios
        - Perform tests/error catching
    - 11/20 - Present graphics/summary information to client, receive feedback
    - 12/3 - Finalize program
- 11/23 Make drive account
-
- 11/6-12/3 Final poster
    - 11/13-11/20 Begin outlining and putting basic information into poster - TJ
        - Abstract
        - Motivation
        - Problem statement
        - Background Research
        - Design Specifications
    - 11/20-12/3
        - Final Design
        - Material Costs

- Testing

- Discussion/Future Work

- Acknowledgments

- References

- **11/6-12/9** Final deliverables - report

    - 11/6-11/13 - Testing procedures

    - 11/13-11/20 - Guidance doc/set up (appendix)

    - 11/20-11/27 - Update conclusion and begin revising other sections

    - 11/27- 12/4 - Implement final code (appendix), testing results, improvement from prior system

    - 12/4-12/9- Proof reading and finalizing

- **12/4** Final Poster Presentations

- **12/11** Final Deliverables

Conclusions/action items: Finish the semester.

![Design Matrix icon] **Design Matrix Sept 25**

Design_Matrix_Pic_1.pdf(298.5 KB) - download

Design_Matrix_Pic_2.pdf(125.9 KB) - download

Testing Procedure for Team

ADELINE DRIER - Dec 08, 2020, 7:04 PM CST

Title: Testing Procedure for Team Testing

Date: 11/13/2020

Content by: Adeline, Chris, Thomas, Madison

Present: Adeline, Chris, Thomas, Madison

Goals: Create a testing procedure for the team with the Walmart scanner

Content:

1. Set up scanner by plugging in, download driver

2. Pull up testing google spreadsheet

3. Take a couple test scans to determine what metrics are recorded by the scanner

    1. If no time stamps are recorded - need to work on that ASAP

4. Once time stamps are acquired, begin trials:

    1. Perfect scan (4 timestamps)

    2. Double scan (5 scans total)

    3. Missed scan (less the 4 timestamps)

5. Use the custom code to analyze the data

Conclusions/action items: Use the information from team testing to change the set up and procedure for the client.

Testing Procedure for the Client

ADELINE DRIER - Dec 08, 2020, 7:06 PM CST

Title: Testing Procedure for the Client

Date: 11/13/2020

Content by: Adeline

Present: Adeline

Goals: Create a testing procedure for the client

Content:

1. Provide the client with the instructions to set up and run the system

2. Set up the scanner on the lab computer

3. Pull up official data collection spreadsheet

4. Ensure scanner is working

5. Start scanning samples for patients

6. At the end of the day, run the code with that day's data

Conclusions/action items: Analyze the data gathered from the lab for efficiency.

12/04/2020 All Testing Data

Title: 12/04/2020 All Testing Data

Date: 12/04/2020

Content by: Entire Team

Present: Entire Team

Goals: Record raw data

Content:

Survey responses:

	Response 1	Response 2	Response 3
Timestamp	12/3/2020 9:35:23	12/3/2020 9:48:33	12
How well did the TIME CARD system integrate into your workflow?	2	3	
How well did the SCANNER system integrate into your workflow?	3	4	
How difficult was the TIME CARD system to learn?	1	1	
How difficult was the SCANNER system to learn?	4	3	
How congested was the TIME CARD station?	3	4	
How congested was the SCANNER station?	5	5	
Were there any technical problems when using the TIME CARD system?	2	3	
Were there any technical problems when using the SCANNER?	3	4	
Is there anything else about the TIME CARD system that we should know (advantages of card, inconviences, etc.)?	time cards only have so much space for time stamps	Physicians occasionally forgot to scan cards.	It was confusing to keep track of tir the specimen they belonged to.
What would you like to see change in the SCANNER system?	More scanners	A scanner for each cryostat, and an extra computer for the cryostat wihtout one.	A scanner for everyone.
Overall, how would you compare the two systems?	5	4	
How readable and interpretable was the raw data presented in the spreadsheet?	5		
How readable and interpretable were the data graphs and analysis presented in the spreadsheet?	3		
How hard was it to enter data in the sheets?	5		
Were there any difficulties with accessing, processing, or entering data? If so, please list them below:	There did not appear to be any graphs in the spreadsheet. Not really sure what the analysis part showed.	I didn't look at the spreadsheets.	N/A

Scanner data

site id	time stamp
A	11/25/2020 08:17:00
A	11/25/2020 08:17:00
B	11/25/2020 08:27:00
B	11/25/2020 08:33:00
C	11/25/2020 08:43:00
A	11/25/2020 08:45:00
A	11/25/2020 08:45:00
C	11/25/2020 08:51:00
B	11/25/2020 09:03:00
D	11/25/2020 09:05:00
B	11/25/2020 09:05:00
D	11/25/2020 09:09:00
C	11/25/2020 09:17:00
C	11/25/2020 09:18:00
D	11/25/2020 09:34:00
D	11/25/2020 09:34:00
E-1	11/25/2020 09:53:00
E-2	11/25/2020 09:53:00
E-1	11/25/2020 09:53:00
E-2	11/25/2020 09:53:00
E-1	11/25/2020 10:27:00
E-2	11/25/2020 10:27:00
E-1	11/25/2020 10:27:00
E-2	11/25/2020 10:27:00
E-1	11/25/2020 10:35:00
E-1	11/25/2020 10:35:00
F	11/25/2020 10:48:00
F	11/25/2020 10:48:00
E-1	11/25/2020 10:57:00
E-1	11/25/2020 11:01:00
G	11/25/2020 11:03:00
G	11/25/2020 11:03:00
E-1	11/25/2020 11:07:00
E-1	11/25/2020 11:07:00
F	11/25/2020 11:12:00
F	11/25/2020 11:12:00
F	11/25/2020 11:21:00
F	11/25/2020 11:24:00
E-1	11/25/2020 11:33:00
E-1	11/25/2020 11:33:00
G	11/25/2020 11:41:00
G	11/25/2020 11:41:00
F	11/25/2020 11:41:00
F	11/25/2020 11:42:00
A	11/27/2020 08:01:00
A	11/27/2020 08:01:00
A	11/27/2020 08:27:00
A	11/27/2020 08:30:00
B	11/27/2020 08:32:00

Timecard Data

site id	time stamp
A	8/25/2020 09:51:00
A	8/25/2020 10:24:00
B	8/25/2020 10:32:00
B	8/25/2020 10:52:00
B	8/25/2020 11:20:00
D	8/25/2020 10:15:00
D	8/25/2020 11:08:00
F	8/25/2020 11:16:00
F	8/25/2020 11:23:00
F	8/25/2020 12:25:00
G	8/27/2020 09:17:00
G	8/27/2020 09:18:00
G	8/27/2020 09:45:00
H	8/27/2020 08:44:00
H	8/27/2020 08:48:00
H	8/27/2020 09:27:00
I	8/27/2020 07:54:00
I	8/27/2020 07:59:00
I	8/27/2020 08:21:00
J	8/27/2020 08:46:00
J	8/27/2020 08:49:00
J	8/27/2020 09:16:00
K	8/27/2020 08:13:00
K	8/27/2020 08:26:00
K	8/27/2020 08:55:00
L	8/27/2020 08:29:00
L	8/27/2020 08:32:00
L	8/27/2020 08:58:00
M	8/27/2020 07:35:00
M	8/27/2020 07:41:00
M	8/27/2020 08:15:00
N	8/27/2020 07:40:00
N	8/27/2020 07:41:00
N	8/27/2020 08:05:00
O	8/27/2020 11:16:00
O	8/27/2020 11:36:00
O	8/27/2020 12:12:00
P	8/27/2020 11:13:00
P	8/27/2020 11:14:00
P	8/27/2020 11:45:00
P	8/27/2020 12:03:00
P	8/27/2020 12:03:00
P	8/27/2020 12:26:00
Q	8/27/2020 11:12:00
Q	8/27/2020 11:13:00
Q	8/27/2020 11:45:00
R	8/27/2020 10:44:00
R	8/27/2020 10:45:00
R	8/27/2020 11:07:00

site id	time stamp
B	11/27/2020 08:32:00
B	11/27/2020 08:55:00
B	11/27/2020 09:00:00
B	11/27/2020 09:18:00
B	11/27/2020 09:18:00
B	11/27/2020 09:40:00
B	11/27/2020 09:42:00
A	11/30/2020 07:50:00
A	11/30/2020 07:50:00
A	11/30/2020 08:21:00
A	11/30/2020 08:21:00
A	11/30/2020 08:53:00
A	11/30/2020 09:05:00
A	11/30/2020 09:39:00
A	11/30/2020 09:55:00
B	11/30/2020 07:52:00
B	11/30/2020 07:52:00
B	11/30/2020 08:14:00
B	11/30/2020 08:25:00
B	11/30/2020 08:38:00
B	11/30/2020 08:57:00
B	11/30/2020 09:20:00
B	11/30/2020 09:21:00
C	11/30/2020 08:06:00
C	11/30/2020 08:06:00
C	11/30/2020 08:30:00
C	11/30/2020 09:02:00
D	11/30/2020 08:09:00
D	11/30/2020 08:12:00
D	11/30/2020 08:44:00
D	11/30/2020 09:19:00
E	11/30/2020 08:23:00
E	11/30/2020 08:24:00
E	11/30/2020 08:49:00
E	11/30/2020 09:00:00
F	11/30/2020 08:28:00
F	11/30/2020 08:33:00
F	11/30/2020 09:19:00
F	11/30/2020 09:40:00
G	11/30/2020 08:33:00
G	11/30/2020 08:41:00
G	11/30/2020 09:05:00
G	11/30/2020 09:08:00
H	11/30/2020 08:54:00
H	11/30/2020 09:10:00
H	11/30/2020 09:45:00
H	11/30/2020 09:38:00
H	11/30/2020 09:54:00
H	11/30/2020 09:56:00
H	11/30/2020 10:36:00
H	11/30/2020 10:37:00
H	11/30/2020 11:20:00
H	11/30/2020 11:24:00
H	11/30/2020 12:00:00
H	11/30/2020 12:02:00
H	11/30/2020 12:24:00
H	11/30/2020 12:25:00
H	11/30/2020 13:04:00
H	11/30/2020 13:15:00
H	11/30/2020 13:26:00
H	11/30/2020 13:26:00
H	11/30/2020 13:50:00
H	11/30/2020 13:51:00
I	11/30/2020 09:03:00
I	11/30/2020 09:28:00

site id	time stamp
R	8/27/2020 11:16:00
R	8/27/2020 11:31:00
R	8/27/2020 11:52:00
S	8/27/2020 09:56:00
S	8/27/2020 09:57:00
S	8/27/2020 10:32:00
T	8/27/2020 08:07:00
T	8/27/2020 08:11:00
T	8/27/2020 08:37:00
T	8/27/2020 08:57:00
T	8/27/2020 09:06:00
T	8/27/2020 09:27:00
U	8/27/2020 08:44:00
U	8/27/2020 08:48:00
U	8/27/2020 09:27:00
U	8/27/2020 09:41:00
U	8/27/2020 09:45:00
U	8/27/2020 10:12:00
V	8/27/2020 08:00:00
V	8/27/2020 08:02:00
V	8/27/2020 08:37:00
W	8/28/2020 08:05:00
W	8/28/2020 08:12:00
W	8/28/2020 08:31:00

site id	time stamp
I	11/30/2020 10:05:00
I	11/30/2020 10:14:00
J-1	11/30/2020 09:07:00
J-1	11/30/2020 09:30:00
J-1	11/30/2020 10:09:00
J-1	11/30/2020 11:00:00
J-1	11/30/2020 11:19:00
J-1	11/30/2020 11:19:00
J-1	11/30/2020 11:55:00
J-1	11/30/2020 12:13:00
J-1	11/30/2020 12:21:00
J-1	11/30/2020 12:21:00
J-1	11/30/2020 12:43:00
J-1	11/30/2020 12:45:00
J-2	11/30/2020 09:12:00
J-2	11/30/2020 09:32:00
J-2	11/30/2020 10:09:00
J-2	11/30/2020 11:00:00
J-2	11/30/2020 11:13:00
J-2	11/30/2020 11:13:00
J-2	11/30/2020 11:45:00
J-2	11/30/2020 12:14:00
K	11/30/2020 10:31:00
K	11/30/2020 10:31:00
K	11/30/2020 10:58:00
K	11/30/2020 11:40:00
K	11/30/2020 11:45:00
K	11/30/2020 11:51:00
K	11/30/2020 12:12:00
K	11/30/2020 12:15:00
L	11/30/2020 11:07:00
L	11/30/2020 11:07:00
L	11/30/2020 11:34:00
L	11/30/2020 11:40:00
L	11/30/2020 12:17:00
L	11/30/2020 12:19:00
L	11/30/2020 12:46:00
L	11/30/2020 12:46:00
M	11/30/2020 11:34:00
M	11/30/2020 11:48:00
M	11/30/2020 12:19:00
M	11/30/2020 12:25:00
N	11/30/2020 12:10:00
N	11/30/2020 12:10:00
N	11/30/2020 12:34:00
N	11/30/2020 12:35:00
N	11/30/2020 12:57:00
N	11/30/2020 12:57:00
N	11/30/2020 13:29:00
N	11/30/2020 13:40:00
N	11/30/2020 13:50:00
N	11/30/2020 13:50:00
N	11/30/2020 14:10:00
N	11/30/2020 14:19:00
A	12/1/2020 10:31:00
A	12/1/2020 10:31:00
A	12/1/2020 10:56:00
A	12/1/2020 11:02:00
B	12/1/2020 10:37:00
B	12/1/2020 10:37:00
B	12/1/2020 11:05:00
B	12/1/2020 11:05:00
B	12/1/2020 11:51:00
B	12/1/2020 11:54:00
B	12/1/2020 12:11:00

site id	time stamp
B	12/1/2020 12:11:00
C	12/1/2020 10:40:00
C	12/1/2020 10:50:00
C	12/1/2020 11:12:00
C	12/1/2020 11:14:00
C	12/1/2020 11:35:00
C	12/1/2020 11:35:00
C	12/1/2020 12:11:00
C	12/1/2020 12:11:00
C	12/1/2020 12:43:00
C	12/1/2020 12:43:00
C	12/1/2020 13:02:00
C	12/1/2020 13:40:00
C	12/1/2020 13:43:00
C	12/1/2020 13:43:00
C	12/1/2020 14:05:00
C	12/1/2020 14:25:00
C	12/1/2020 14:30:00
C	12/1/2020 14:30:00
C	12/1/2020 14:48:00
C	12/1/2020 14:55:00
C	12/1/2020 15:13:00
C	12/1/2020 15:13:00
C	12/1/2020 15:35:00
C	12/1/2020 15:36:00
C	12/1/2020 15:48:00
C	12/1/2020 15:48:00
C	12/1/2020 16:09:00
C	12/1/2020 16:09:00
C	12/1/2020 16:25:00
C	12/1/2020 16:25:00
C	12/1/2020 16:50:00
C	12/1/2020 16:50:00
C	12/1/2020 17:11:00
C	12/1/2020 17:11:00
C	12/1/2020 17:34:00
C	12/1/2020 17:34:00
D	12/1/2020 11:15:00
D	12/1/2020 11:16:00
D	12/1/2020 11:54:00
D	12/1/2020 11:56:00
E	12/1/2020 11:17:00
E	12/1/2020 11:17:00
E	12/1/2020 11:40:00
E	12/1/2020 11:54:00
A	12/2/2020 07:45:00
A	12/2/2020 07:45:00
A	12/2/2020 08:10:00
A	12/2/2020 08:20:00
B	12/2/2020 07:52:00
B	12/2/2020 07:57:00
B	12/2/2020 08:25:00
B	12/2/2020 08:30:00
C	12/2/2020 08:05:00
C	12/2/2020 08:05:00
C	12/2/2020 08:47:00
C	12/2/2020 08:49:00
D-1	12/2/2020 08:05:00
D-1	12/2/2020 08:10:00
D-1	12/2/2020 08:30:00
D-1	12/2/2020 08:40:00
D-2	12/2/2020 08:05:00
D-2	12/2/2020 08:30:00
D-2	12/2/2020 08:47:00
D-2	12/2/2020 09:07:00

site id	time stamp
D-2	12/2/2020 09:21:00
D-2	12/2/2020 09:39:00
D-2	12/2/2020 10:04:00
D-2	12/2/2020 10:15:00
E	12/2/2020 08:10:00
E	12/2/2020 08:37:00
E	12/2/2020 09:05:00
E	12/2/2020 09:08:00
F	12/2/2020 08:16:00
F	12/2/2020 08:38:00
F	12/2/2020 09:00:00
F	12/2/2020 09:25:00
F	12/2/2020 09:35:00
F	12/2/2020 09:49:00
F	12/2/2020 10:07:00
F	12/2/2020 10:14:00
G	12/2/2020 08:29:00
G	12/2/2020 08:47:00
G	12/2/2020 09:23:00
G	12/2/2020 09:26:00
H	12/2/2020 08:50:00
H	12/2/2020 09:02:00
H	12/2/2020 09:31:00
H	12/2/2020 09:37:00
I	12/2/2020 08:54:00
I	12/2/2020 09:07:00
I	12/2/2020 09:56:00
I	12/2/2020 09:58:00
I	12/2/2020 10:15:00
I	12/2/2020 10:15:00
I	12/2/2020 10:53:00
I	12/2/2020 11:03:00
I	12/2/2020 11:10:00
I	12/2/2020 11:10:00
I	12/2/2020 11:35:00
I	12/2/2020 11:36:00
J	12/2/2020 09:06:00
J	12/2/2020 09:07:00
J	12/2/2020 10:15:00
J	12/2/2020 10:21:00
J	12/2/2020 10:44:00
J	12/2/2020 10:44:00
J	12/2/2020 11:21:00
J	12/2/2020 11:22:00
K	12/2/2020 10:21:00
K	12/2/2020 10:21:00
K	12/2/2020 10:59:00
K	12/2/2020 11:23:00
K	12/2/2020 11:34:00
K	12/2/2020 11:34:00
K	12/2/2020 11:54:00
K	12/2/2020 12:10:00
L	12/2/2020 10:59:00
L	12/2/2020 10:59:00
L	12/2/2020 11:35:00
L	12/2/2020 11:40:00
M	12/2/2020 11:14:00
M	12/2/2020 11:14:00
M	12/2/2020 11:40:00
M	12/2/2020 11:58:00
N	12/2/2020 11:52:00
N	12/2/2020 11:52:00
N	12/2/2020 12:20:00
N	12/2/2020 13:10:00
N	12/2/2020 13:20:00

site id	time stamp
N	12/2/2020 13:21:00
N	12/2/2020 13:45:00
N	12/2/2020 14:05:00

Conclusions/action items:

All raw data used for analysis is recorded here.

PDS Draft Sept 18

CHRISTOPHER PUDZISZ - Oct 07, 2020, 12:41 PM CDT

Product Design Specification Version I
Mohs TurnAround Time Tracking
9/18/2020

Team:
Client: Mr. Ryan Dasman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Tanaske
(BSAC) Madison Bagel
(BPAG) Christopher Pudzisz

Function:

The goal of this project is to modify and update the existing Turnaround Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper time cards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Client requirements:

- The timestamps that must be recorded are:
  o when the tissue specimen arrives at the lab
  o when a technician begins to work on the tissue specimen
  o when the finished slide is returned to the physician
  o when the slide has been read by the physician
- The barcode contains 2 patient identifiers and will be used to assign individual specimens to the time at which they were scanned at each stage. All of this information must be recorded on a computer in ideally Excel format.
- The system must be able to handle cases in which a specimen needs additional work in the laboratory. Additional timestamps must be recorded.
- Eliminate human error from the system and minimize the manual work done to produce the timestamp data

Mohs-PDS_Draft.pdf(86.4 KB) - download

PDS Version 2 Oct 23

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:39 PM CST

Product Design Specification Version II
Mohs TurnAround Time Tracking
10/23/2020

Team:

Client: Mr. Ryan Dauman

Advisor: Dr. Melissa Kinney

Team: (Leader) Adeline Drier
        (Communicator) Kevin Tan
        (BWIG) Thomas Tarkoski
        (BSAC) Madison Bagel
        (BPAG) Christopher Pudzisz

Function:

The goal of this project is to modify and update the existing Turnaround Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper time cards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Client requirements:

- The timestamps that must be recorded are:
  - when the tissue specimen arrives at the lab
  - when a technician begins to work on the tissue specimen
  - when the finished slide is returned to the physician
  - when the slide has been read by the physician
- The barcode contains 2 patient identifiers and will be used to assign individual specimens to the time at which they were scanned at each stage. All of this information must be recorded on a computer in ideally Excel format.
- The system must be able to handle cases in which a specimen needs additional work in the laboratory. Additional timestamps must be recorded.
- Eliminate human error from the system and minimize the manual work done to produce the timestamp data.
- Updated requirements as of 10/23/2020:
  - Distinguish between lab technicians and the slides they are processing
  - Identify the difficulty of site being processed
  - Site number

Mohs-PDS_10_23_2020.pdf(87.5 KB) - download

Show and Tell Oct 30

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:35 PM CST

The Mohs laboratory analyzes cancerous skin lesions (sites) taken during Mohs demographic surgery at UW School of Public Health and Medicine. This analysis is time-sensitive with surgery and analysis occurring in a single patient appointment. Currently, the lab uses a physical time card system for monitoring their turnaround time (TAT). This system has been inaccurate with frequent human error and inefficient due to manual data entry and backlog of time cards.

The solution utilizes the patient barcode with two Android devices to take time stamps. Through the Barcode to Google Sheets app, the barcode can be easily scanned and automatically uploaded to a Google Sheet. The data from the Google Sheet will be processed once a week using custom code to present various timing statistics for that week (average time, number of sites, busiest days, etc.).

Due to the nature of the product, the team's priorities were the safety and confidentiality of the client's information. Dedicated devices will be used in order to maximize security and minimize the risk of information leaks. It is believed that this will provide a trustworthy outcome that increases the speed of analysis to allow for faster patient visits, whilst still maintaining the quality of care that patients are accustomed to. Ultimately, the "Smart" design (see the diagram below) will allow time to be better spent on the analysis of sites and patient care rather than tracking tissue samples.

The need for device encryption and HIPAA compliant storage of data is at the forefront of the client's concerns as the barcodes being scanned for time tracking may contain confidential patient information. The client's higher-ups believe there may be more than the lab specific specimen number stored on the barcode. The client has been asked to obtain encrypted devices but this may take time. Furthermore, it is possible that in some cases, google sheets may not be HIPAA compliant. The team would like suggestions on how they can ensure that HIPAA is not violated while the data is collected and stored securely.

https://bmedesign.engr.wisc.edu/projects/f20/mohs_TAT

Show_and_Tell.pdf(87.3 KB) - download

Client Expenses

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:37 PM CST

Materials Costs Table

Item/Desc.	Mfr.	Part No. (ASIN)	Qty.	Price
Xenon 1900 - USB wired, healthcare 2D barcode scanner	Honeywell	B07MR5TCQ2	1	N/A*
NuScan 3500TB - bluetooth wireless, antimicrobial, waterproof 2D barcode scanner	Adesso	B07NBKT3NC	1	$150.02 (Amazon)

*The Xenon 1900 Scanner was already owned by the lab

Client_Expenses_Updated.pdf(73.2 KB) - download

Preliminary Report

UW BME Design

Mohs Turnaround Time Tracking:
Preliminary Report

Biomedical Engineering Design 200 - 300
Date: 10/07/2020
Client: Mr. Ryan Dunman, UW Health Supervisor
Advisor: Dr. Melissa Kinney
Team Members: Adeline Drier (Team Leader), Kevin Tan (Communicator), Madison Bugel (BSAC), Thomas Turinske (BWIG), Christopher Pudzior (BPAG)

Mohs-Preliminary_Report.pdf(754.2 KB) - download

![Preliminary Presentation icon] **Preliminary Presentation**

ADELINE DRIER - Dec 08, 2020, 7:23 PM CST

Preliminary_Oral_Presentation.pdf(452.6 KB) - download

Progress Report 1 (Sept 4-10)

CHRISTOPHER PUDZISZ - Oct 07, 2020, 12:38 PM CDT

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Deeman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Turinske
(BSAC) Madison Hagel
(BPAG) Christopher Pudzisz
Dates: Friday September 4th, 2020 - Thursday September 10th, 2020

Problem Statement

The goal of this project is to modify and update the existing TurnAround Time Tracking system for Mohs Surgery tissue specimen. This will implement the current barcode system to track the tissue specimen at the 4 stages listed below:

1. when the tissue specimen arrives at the lab
2. when a technician begins to work on the tissue specimen
3. when the finished slide is returned to the physician
4. when the slide has been read by the physician

The barcode should also be able to digitally list 2 patient identifiers and the time at which the specimen was scanned at each stage. The tracking of the specimen turnaround time will also be able to provide the user with a baseline time for the specimen at each stage, ensuring the highest quality and most efficient process.

Brief Status Update

We have reached out to our client to set up our first meeting and are waiting to hear back to figure out a time. We have also started to compile a list of questions that the team has for the client that we will be asking him to answer at our first meeting.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - assigned roles
  - contacted client
  - completed progress report
- Adeline Drier:
  - created lab notebook for the team
  - started the progress report
- Kevin Tan:
  - Contacted client and set up meeting
  - Set up weekly advisor meetings
- Madison Hagel:
  - Create some questions for the client
- Thomas Turinske:
  - Updated team roles on website
  - Created team photo

Mohs-Progress_Report_1.docx.pdf(71.4 KB) - download

Progress Report 2 (Sept 11-17)

CHRISTOPHER PUDZISZ - Oct 07, 2020, 12:39 PM CDT

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dorman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Tanhabe
(BSAC) Madison Bagel
(BPAG) Christopher Pudzisz
Date: Friday September 11, 2020 - Thursday September 17, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

We had our first meeting with our client and one of the lead doctors at the lab on Friday and we were able to gain a better understanding of the client's expectations. Additionally, we were able to get all of our questions regarding the project answered. This week, our team has begun our initial research and brainstorming for the project.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Met with client
  - Began research
  - Began brainstorming
- Adeline Drier:
  - Researched other turnaround time tracking systems
  - Worked on the initial pds draft
- Kevin Tan:
  - Work on the PDS draft
  - Set up a meeting with the client to see the lab
  - Brainstormed ideas for timestamp data collection
- Madison Bagel:
  - Work on PDS draft
  - Brainstorm new ideas
  - Research competitive designs

Mohs-Progress_Report_2.pdf(72.1 KB) - download

Progress Report 3 (Sept 18-24)

CHRISTOPHER PUDZISZ - Oct 07, 2020, 12:40 PM CDT

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dasman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
  (Communicator) Kevin Tan
  (BWIG) Thomas Tarleske
  (BSAC) Madison Bagel
  (BPAG) Christopher Pudzisz
Date: Friday September 18, 2020 - Thursday September 24, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week, we finalized our six designs to use for the design matrix and what criteria these designs were to be evaluated for. We decided to proceed with 2 design matrices, one for the data collection part of the project and one for the data reporting/analysis portion. We also received a video of the lab from the client, which will be used to evaluate how much space we have to work with.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Completed design matrix
    - Finalized designs for data collection and data reporting/analysis
    - Created and weighted criteria for evaluation
    - Assigned scores to each design
  - Received video of Mohs lab
- Adeline Drier:
  - Continued research based off of our initial brainstorming meeting
  - Helped with design matrix design and evaluation
  - Watched the video of the lab layout
  - Finalized brainstorming
- Kevin Tan:
  - Obtained a video tour of the lab from the client
  - Helped create design criteria and assign scores
- Madison Bagel:
  - Look at the lab layout video

Mohs-Progess_Report_3.pdf(75.6 KB) - download

Progress Report 4 (Sept 25-Oct 1)

CHRISTOPHER PUDZISZ - Oct 07, 2020, 12:41 PM CDT

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dooman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
    (Communicator) Kevin Tan
    (BWIG) Thomas Turinske
    (BPAG) Madison Bagel
    (BPAG) Christopher Pudzisz
Date: Friday September 25, 2020 - Thursday October 1, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week we have mainly been focusing on narrowing down our design ideas after our meeting with the client on Friday. We have also been spending time putting together the Preliminary Presentation for tomorrow. Additionally, we have started researching different technologies that could be used in each of the designs.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Redesigned the current design matrix to accompany different scanning methods and setups
  - Completed and recorded preliminary design presentation
- Adeline Drier:
  - Helped to rework the design matrix to better highlight the process rather than a product
  - Researched barcode/QR code scanners
  - Organized the preliminary report
- Kevin Tan:
  - Researched a ndroid app for scanning barcode and QR code
  - Researched a ndroid devices
  - Reworked design matrix to fit new information on android products
- Madison Bagel:
  - Take a look at the PDS draft and go through to see the most important parts that will fit with our current design options
- Thomas Turinske:

Mohs-Progress_Report_4.pdf(68.5 KB) - download

Progress Report 5 (Oct 2-Oct 8)

ADELINE DRIER - Dec 08, 2020, 7:08 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dasman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Turtinke
(BSAC) Madison Bagel
(BPAG) Christopher Puddisz
Date: Friday October 2, 2020 – Thursday October 8, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week we mainly finished up the preliminary presentation and worked diligently on the preliminary report. Other than that, we have just been doing research on different scanners that could be used and further developing our design.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Presented the preliminary presentation
  - Completed the preliminary report
- Adeline Drier:
  - Worked on an formatted preliminary report
  - Looked in to scanners that could be used
- Kevin Tan:
  - Created flow diagrams for the three designs
- Madison Bagel:
  - Worked on more research about the biology and surgical procedure of Mohs surgery
  - Worked on background and editing/revising the report
- Thomas Turtinke:
  - Updated website
  - Wrote abstract, introduction, and conclusion of preliminary report
    - Edited various sections of report
- Christopher Puddisz:
  - Fixed digital notebook and updated entries

Mohs-Progress_Report_5.pdf(68 KB) - download

Progress Report 6 (Oct 9-Oct 15)

ADELINE DRIER - Dec 08, 2020, 7:09 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dusman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Turinske
(BSAC) Madison Bagel
(BPAG) Christopher Pudelar
Date: Friday October 9, 2020 - Thursday October 15, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week we met with the client and finalized that we are going to be moving forward with the Smart design. Based on this decision we have been independently researching products for this design.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Met with client and advisor
  - Finalized preliminary design choice
- Adeline Drier:
  - Looked more into the Scan to Sheets app
  - Began researching devices that could be used
- Kevin Tan:
  - Compared available apps
  - Updated flow diagram to client's specifications
- Madison Bagel:
  - Research the difference of excel and sheets to find the most effective for scanning
- Thomas Turinske:
  - Updated website status
  - Compiled list of devices compatible for scanning app
- Christopher Pudelar:
  - Brainstormed functions that could be used in google sheets for calculating optimal preparation time for sites and researched how to color code values automatically

Mohs-Progress_Report_6.pdf(65.3 KB) - download

Progress Report 7 (Oct 16-Oct 22)

ADELINE DRIER - Dec 08, 2020, 7:11 PM CST

Mohs-Progress_Report_7.pdf(63.3 KB) - download

Progress Report 8 (Oct 23-Oct 29)

ADELINE DRIER - Dec 08, 2020, 7:12 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dasman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
        (Communicator) Kevin Tan
        (BWIG) Thomas Turineke
        (BSAC) Madison Bagel
        (BPAG) Christopher Pudzisz
Date: Friday October 23, 2020 - Thursday October 29, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround and time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week was mainly focused on creating the Show and Tell presentation for Friday. Additionally, we received more information from the client that allows us to move forward with choosing an app and device for the design.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Acquired further information from the client about their progress
- Adeline Drier:
  - Worked on Show and Tell presentation
- Kevin Tan:
  - Contacted client about QR code stickers and android devices
- Madison Bagel:
  - Helped with show and tell
  - Looked into apps compatible to apple products
- Thomas Turineke:
  - Met with Sanguest SMART laboratory management system
  - Helped with Show and Tell presentation
- Christopher Pudzisz:
  - Helped with Show and Tell Presentation
  - Looked more into code that could be used for google sheets for desired data

Mohs-Progress_Report_8.pdf(65.8 KB) - download

Progress Report 9 (Oct 30-Nov 5)

ADELINE DRIER - Dec 08, 2020, 7:14 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dasman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Turinske
(BSAC) Madison Bagel
(BPAG) Christopher Puddicz
Date: Friday October 30, 2020 - Thursday November 5, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround and time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week we learned that there might be security issues with using a smart device and google sheets in our design, however, we have decided to continue to move forward with this design assuming that we will get security clearance.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Met with the client
- Adeline Drier:
  - Completed show and tell responses for other projects
  - Looked into device stands for the phones
- Kevin Tan:
  - Set up google colab to process google sheets data
  - Managed the show and tell piazza post
- Madison Bagel:
  - Contributed to Show and Tell forum
  - Research device stands for phones in lab
  - Look more into HIPAA and google
- Thomas Turinske:
  - Wrote code to parse our text data
  - Contributed to Show and Tell forum
- Christopher Puddicz:
  - Did research On HIPAA compliance with Google suite

Mohs-Progress_Report_9.pdf(65.4 KB) - download

Progress Report 10 (Nov 6-Nov 12)

ADELINE DRIER - Dec 08, 2020, 7:15 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dasman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
  (Communicator) Kevin Tan
  (BWIG) Thomas Turinske
  (BSAC) Madison Bagel
  (BPAG) Christopher Puddicz
Date: Friday November 6, 2020 - Thursday November 12, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week, after meeting with our client, we have continued working on the code for analyzing the time tracking data. We have also learned that our client will be providing us with a scanner of their choosing and delivering it to us so that we are able to run some tests and set it up for the use within the Mohs lab.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Met with the client
- Adeline Drier:
  - Helped create timeline for the rest of the semester
  - Brainstormed on how we could test the scanner to best mimic the settings within the lab
- Kevin Tan:
  - Coding data analysis
- Madison Bagel:
  - Helped create the to do list for the rest of the semester.
  - Helped brainstorm a testing plan for the scanner.
- Thomas Turinske:
  - Outlined rest of tasks for the semester to complete project on time
  - Continued work on code
- Christopher Puddicz:

Mohs-Progress_Report_10.pdf(65.7 KB) - download

Progress Report 11 (Nov 13-Nov 19)

ADELINE DRIER - Dec 08, 2020, 7:17 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Drumm

Advisor: Dr. Melissa Kinney

Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Turinske
(BSAC) Madison Bugel
(BPAG) Christopher Padrez

Date: Friday November 13, 2020 - Thursday November 19, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technician are tasked with punching paper time cards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week, after meeting with our client, we have continued working on the code for analyzing the time tracking data. We anticipated receiving a scanner this week to do testing, but was not able to happen, so testing procedures are being modified to account for this set back.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Developed testing procedure
  - Received updates from the client about scanner
- Adeline Drier:
  - Worked on testing procedure
- Kevin Tan:
  - Finished basic data analysis
- Madison Bugel:
  - Help develop the testing procedure
  - Figure out what areas we need on the poster and what we need to change from the background information
- Thomas Turinske:
  - Updated website
  - Worked on "How to implement" directions
  - Began laying out poster sections
- Christopher Padrez:
  - Brainstormed questions for satisfaction survey and how to have client rate each category

Mohs-Progress_Report_11.pdf(69 KB) - **download**

Progress Report 12 (Nov 20-Nov 26)

ADELINE DRIER - Dec 08, 2020, 7:18 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dauman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
  (Communicator) Kevin Tan
  (BWIG) Thomas Turinske
  (BSAC) Madison Bagel
  (BPAG) Christopher Puddicz
Date: Friday November 20, 2020 - Thursday November 26, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround and time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week we received the Walmart scanner from our client to begin testing on our side of things and the client received the scanner that will actually be implemented in the lab. Due to thanksgiving, we haven't been able to do testing yet, so we finalized the testing procedure and satisfaction survey.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Received Wired scanner from client
  - Set up google account for client
- Adeline Drier:
  - Finished testing protocol
  - Worked on satisfaction survey to compare the two systems
- Kevin Tan:
  - Reprogrammed scanner to add CR suffix
  - Added automated timestamp with site ID entry
  - Outlier reporting and plotting for all time
- Madison Bagel:
  - helped with satisfaction survey
- Thomas Turinske:
  - Worked on more code analysis
  - Helped with survey
- Christopher Puddicz:
  - Continued work on satisfaction survey

Mohs-Progress_Report_12.pdf(70.7 KB) - download

Progress Report 13 (Nov 27-Dec 3)

ADELINE DRIER - Dec 08, 2020, 7:19 PM CST

Mohs TurnAround Time Tracking (Mohs)

Client: Mr. Ryan Dorman
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
        (Communicator) Kevin Tan
        (BWIG) Thomas Turinske
        (BSAC) Madison Bagel
        (BPAG) Christopher Puddar
Date: Friday November 27, 2020 - Thursday December 3, 2020

Problem Statement

The goal of this project is to modify and update the existing Turnaround and Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper timecards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround and time tracking system that utilizes the existing barcode on each tissue specimen.

Brief Status Update

This week we have finished getting the quantitative and qualitative data from the client and running our analysis on the data we received. We have used this data to complete our poster for the final poster presentation tomorrow.

Summary of Weekly Team Member Design Accomplishments

- Team:
  - Poster presentation
- Adeline Drier:
  - Helped to complete poster outline
  - Finalized changes to testing procedure based on the clients needs
- Kevin Tan:
  - Helped with formatting data
  - Combined code into a single block to run and get data report
- Madison Bagel:
  - Helped with the outline of the poster
  - Put together poster with outline
- Thomas Turinske:
  - Helped finish up data analysis code
  - Helped format scanner data into readable structure to run analysis
  - Helped on final poster presentation
- Christopher Puddar:
  - Finished satisfaction survey

Mohs-Progress_Report_13.pdf(70.4 KB) - download

Final Report Dec 9

CHRISTOPHER PUDZISZ - Dec 09, 2020, 2:14 PM CST

Mohs_TAT-Final_Report.pdf(975.3 KB) - download

Final PDS Dec 9

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:41 PM CST

Product Design Specification Final Version
Mohs TurnAround Time Tracking
12/09/2020

Team:
Client: Mr. Ryan Dasinan
Advisor: Dr. Melissa Kinney
Team: (Leader) Adeline Drier
(Communicator) Kevin Tan
(BWIG) Thomas Tartaglia
(BSAC) Madison Bagel
(BPAG) Christopher Pudzisz

Function:

The goal of this project is to modify and update the existing Turnaround Time Tracking system used in the Mohs surgery laboratory. Mohs surgery involves the removal of tissue specimens from the patient and subsequent laboratory work on each specimen. To ensure the quality and efficiency of this procedure, the laboratory has adopted a time tracking system. Currently, the physician or lab technicians are tasked with punching paper time cards at each transition in the laboratory process. Physical time cards are inefficient and may lead to misplaced or incomplete data. Thus the team is tasked with creating a more automated turnaround time tracking system that utilizes the existing barcode on each tissue specimen.

Client requirements:

- The timestamps that must be recorded are:
  - when the tissue specimen arrives at the lab
  - when a technician begins to work on the tissue specimen
  - when the finished slide is returned to the physician
  - when the slide has been read by the physician
- The barcode contains 2 patient identifiers and will be used to assign individual specimens to the time at which they were scanned at each stage. All of this information must be recorded on a computer in Google Sheets.

Final_PDS.pdf(131.8 KB) - download

Poster Presentation Dec 3

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:35 PM CST
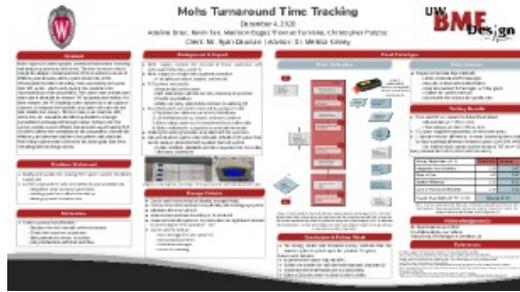
Final_Poster_Presentation_-_Whole_Poster.pdf(898.6 KB) - download

Mohs Lab Research

ADELINE DRIER - Oct 07, 2020, 12:25 AM CDT

Title: Mohs Lab Research

Date: 09/05/2020

Content by: Adeline Drier

Present: Adeline Drier

Goals: Gain some insight as to what goes on at the Mohs lab.

Content:

https://www.uwhealth.org/mohs/mohs-and-dermatologic-surgery/10631

- history of the lab:
    - 1930s - started by Dr. Frederic Mohs
    - mohs surgery treats basal and squamous cell carcinoma

https://www.uwhealth.org/healthfacts/cancer/4616.html

- Mohs surgery info:
    - spares normal tissue
    - "highest cure rate" - if found/treated early

https://www.uwhealth.org/health/topic/surgicaldetail/mohs-micrographic-surgery-for-nonmelanoma-skin-cancer/aa40884.html

- Mohs micrographic surgery:
    - specifically for non-melanoma skin cancer
    - removes one layer of skin to be examined
    - allows for minimal tissue to be removed
    - surgery is done once no cancer cells are seen in a tissue layer
    - recovery is 2-4 weeks
    - uses:
        - cancer that will likely return to the same area
        - on areas where it is desirable for as much skin to be preserved as possible (face, ears, etc.)
        - quickly growing
        - high risk of spreading throughout the body
        - on kids

Conclusions/action items:

Use this information to apply the tracking system to the lab design.

Lab Turnaround Time Research

ADELINE DRIER - Oct 07, 2020, 12:40 AM CDT

Title: TurnAround Time Research

Date: 09/05/2020

Content by: Adeline Drier

Present: Adeline Drier

Goals: Gain a basic understanding of turnaround time tracking systems and their functions.

Content:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2282400/

- indicates lab performance levels
- can be used to determine the quality of the lab
- Lundberg - "total testing cycle"
    - ordering
    - collection
    - identification
    - transportation
    - preparation
    - analysis
    - reporting
    - interpretation
    - action
- most likely just going to be focused on preparation through interpretation for this project
- most commonly used in emergency room
- ultimate goal = fast turnaround time
    - "the more timely and rapidly testing is performed the more efficient and effective will be the treatment"
    - will be especially important in this case so the patients can get their results as fast as possible
    - minimize the amount of time a patient has to be in surgery
    - fast turnaround time = fast results and fast action if more tissue needs to be taken

Conclusions/action items: Use this information to apply it to the Mohs Lab and what information we need to be tracking in the lab.

Current Mohs Lab TurnAround Time Tracking System

ADELINE DRIER - Oct 07, 2020, 12:53 AM CDT

Title: Current Mohs Lab TurnAround Time Tracking System

Date: 09/08/2020

Content by: Adeline Drier

Present: Adeline Drier

Goals: Take some notes on the workflow information provided by the client.

Content: client-provided document is attached below

- super easy for the lab technicians to skip a step - messes up the whole time tracking of that sample
- issue - ran out of time cards ... ideally would want something more digital or reusable
- remove the need for the physician to handwrite the final time when the slide gets read
- figure out a way to remove the need for manual insertion of data into an Excel file
- use something that would analyze the time data and provide the lab with information about their quality and efficiency within the lab

Conclusions/action items: Brainstorm ideas of how to make the current system more accurate and efficient.

ADELINE DRIER - Oct 07, 2020, 12:49 AM CDT

Mohs_TAT_Workflow_Draft.docx(991.9 KB) - download Document provided by Ryan Dauman. It explains the work flow of the lab and their current time tracking system.

Scanner Research

ADELINE DRIER - Oct 07, 2020, 1:18 AM CDT

Title: Scanner Research

Date: 09/25/2020

Content by: Adeline Drier

Present: Adeline Drier

Goals: Research possible barcode/QR code scanners

Content:

Inateck Bluetooth Barcode Scanner: **$69.99 on Amazon or $72.99 with a stand**

https://www.amazon.com/Inateck-Wireless-Automatic-scanning-BCST-70/dp/B074M6RTM3/ref=sr_1_5?
dchild=1&keywords=barcode+scanner&qid=1602050710&sr=8-5

- full charge lasts 15 days
- works within 35 meters
- can be dropped a lot and still be good
- uses bluetooth - might now be compatible with the computers in the lab
- has auto-sensing and continuous-scanning ---- could not need to be touched to use --- sanitary

Tera Wireless 2D QR Barcode Scanner: **$54.89 on Amazon**

https://www.amazon.com/Tera-Compatible-Bluetooth-Connection-Vibration/dp/B07T5KG5JC/ref=sr_1_3?
dchild=1&keywords=qr+code+scanner+wireless&qid=1602051255&sr=8-3

- claims it doesn't have delays
- vibrates when scan is successful -- could help the lab technicians more accurately record data -- minimizes likelihood that a step gets skipped
- compatible with Excel
- full charged gives 16.5-19.5 working hours --- could last up to two work days
- protective features built in
- also scans barcodes -- could be used for all time stamps

Conclusions/action items: Bring these items to the team to see if they work with our designs.

Brainstorming 9/13

Title: Brainstorming

Date: 09/13/2020

Content by: Adeline Drier

Present: Adeline Drier

Goals: Brainstorm some rough ideas for the time tracking system.

Content:

- use microcontrollers (arduino ?) to load data onto a google sheets (like we did in 201 with the temperature data for the bioreactor)
- get reusable time cards that could be scanned or copied and the data could be uploaded to a cloud server (EPIC ?)
- use barcode scanners for all time stamps - would utilize the patient barcodes already in place
- place scanners at each station where the individual steps are completed so that it would be less likely that a technician would forget to scan a sample
- use a matlab code (or something similar) to analyze the time data and the mean turnaround time each day or week

Conclusions/action items: Bring ideas to the rest of the team and start to create more developed design ideas.

10/ 5/ 20 Mohs Surgery Research

MADISON BUGEL - Oct 07, 2020, 12:33 PM CDT

Title: Mohs Surgery Research

Date: 10/5/20

Content by: Madison Bugel

Present: Madison Bugel

Goals: To get a broad understanding of how Mohs surgery work in the ways of the surgery itself and the analysis.

Content:

- Mohs Surgery is one that deals with skin cancer on the surface of the skin, it is a relatively easy procedure with outpatient care.
- First, a surgeon will take a tissue sample from the patient where it is then delivered to technicians who will analyze the tissue to see how deep the cancerous spot goes.
- The technician takes the tissue and cuts the tissue into small sections to then dye them and put them on a slide to test for cancer.
- If one of the sections comes back with cancer, the surgeon will then go back and perform another surgery on the patient taking more tissue only from the section the cancer was located to determine how deep it goes.
- Once all of the sections come back clear of cancer, the procedure is considered done.

Conclusions/action items: Mohs is a relatively simple surgery but there is a lot of busy work going on behind the scenes in the analysis of the tissue sample.

10/30/20 HIPAA Compliance Research

MADISON BUGEL - Dec 08, 2020, 6:57 PM CST

Title: HIPAA compliance research

Date: 10/30/20

Content by: Madison

Present: Madison

Goals: To see how HIPAA compliment Google services actually are

Content:

- **Since July of 2020, Google changed their functionality so that they could now be HIPAA compliant through Business Associate Amendment**
    - **The administrator of the G suite has to do this but signing and turning the BAA on will cause their account to have HIPAA compliance**
    - **the following are compliant with HIPAA as long as the BAA is signed:** Gmail, Google Drive (including Docs, Sheets, Slides, and Forms), Google Calendar, Google Sites, and Google Apps Vault

https://static.googleusercontent.com/media/gsuite.google.com/en//files/hipaa-implementation-guide.pdf

Conclusions/action items: Along as the administrator goes through the protocol with BAA, the entire G suite included with the sheets will be considered to be HIPAA compliant

9/21/20 Competition Research

MADISON BUGEL - Sep 21, 2020, 9:42 AM CDT

Title: Competition Research

Date: 9/21/20

Content by: Madison Bugel

Present: Madison Bugel

Goals: Research to find any competing designs or any patents in the making.

Content:

Competition:

- Current time card of having to use a printer to print on the time at each checkpoint. Lots of human error in people being lazy and not doing it.

- Physician draws a map of the lab and at each time point, they write down or print the time on it, again there is room for a lot of human error with the not getting it done.

- So far no one has created any patents in tissue tracking related projects as it is usually a unique process depending on the hospital.

Conclusions/action items: Our project is unique as most hospitals have their own process that matches the needs of their own staff so there have been no major designs relating to tissue tracking.

9/21/20 Brainstorming Ideas

MADISON BUGEL - Sep 21, 2020, 9:46 AM CDT

Title: Brainstorming Ideas

Date: 9/21/20

Content by: Madison Bugel

Present: Madison Bugel

Goals: Create design ideas that are helpful for what we intend to do which is to create a program that takes time stamps at each checkpoint while still reducing the human error and making it time-efficient.

Content:

- Overall goal: to create a program that can successfully take the timestamps of the three different time points without making an error of taking too many times while still making it time-efficient for the busy days.

- Ideas:

  - Must click on which number checkpoint they are using on the computer before scanning. If there are multiple scans for one timestamp the program will ask if it is sure it wants to replace the previous scan.

    - Pros: avoids multiple scans error.

    - Cons: is not the most time-efficient and people may still skip a time point.

  - After every time the site is scanned, a "receipt" is printed out and goes on the site to show that a timestamp was taken at a specific time to reduce the error of taking too many scans.

    - Pros: avoids the multiple scans error and will give evidence when people do a scan and do not.

    - Cons: time-consuming, has to have a printer in the lab that would be able to print a time sticker that attaches to the site.

Conclusions/action items: Overall there are a lot of ideas out there that could be successful its just finding one that is effective for us while we also all agree on the idea.

11/13/20 Possible Testing Procedure/Conditions

MADISON BUGEL - Dec 08, 2020, 4:12 PM CST

Title: Possible Testing Procedure/Conditions

Date: 11/13/20

Content by: Adeline, Chris, Madison, Thomas

Present: Adeline, Chris, Madison, Thomas

Goals:

- Use client barcode information or just use home barcodes
  - Generate QR code for the barcode
- Kevin and I can test data over several days (mimics end of week lab analysis)
- Run a couple different scenarios
  - Double scan
  - Missed scan
  - No closing scan/failed sample
- Needs to show efficiency for lab - in some manner
  - Need to generate a metric - quantitative
    - Someone writing down the times physically (mimic a timecard use)
    - Manually enter data and time how long it takes
  - If get testing done in the actual lab -- survey among lab technicians to get numbers to compare to the opinions of the two systems - qualitative/quantitative

Content:

PROCEDURE:

1. Set up scanner by plugging in, download driver
2. Pull up testing google spreadsheet
3. Take a couple test scans to determine what metrics are recorded by the scanner
   1. If no time stamps are recorded - need to work on that ASAP
4. Once time stamps are acquired, begin trials:
   1. Trial: Missing Time Stamp
      1. Create a scenario where only two stamps are recorded and see how a discard data function would work
   2. Trial: Scanning too many times
      1. Scan twice within seconds to perform scanning too many times and see how scanning more than once in a given period will discard one of the stamps
   3. Trial: Multiple sites for a patient
      1. A patient has multiple sites/specimen going through the lab, need to be able to scan the same barcode in two different situations at a similar time interval

4. Trial: Nothing wrong perfect scenarios

1. Have everything going right to have something to compare the rest of the trials to

Conclusions/action items: The testing procedure must fit with the different situations in a lab on a day to day basis so must undergo the four trials(and maybe more) to show how the group has thought of every possible scenario.

11/6/20 Rough Ghannt Chart

MADISON BUGEL - Dec 09, 2020, 1:25 PM CST

Title: Rough Ghannt Chart

Date: 11/6/20

Content by: Madison

Present: Madison, Thomas, Chris

Goals: To create a timeline that will fit with the rest of the semester to guarantee success

Content:

- **11/6-11/13 -** Get the Scanner from client- anyone in Madison
- **11/6** -Email client about meeting for pick-up/drop-off at ECB with barcodes and scanner- **Kevin**
- 11/6-11/20 - Write/create google form for qualitative use of scanners-
    - How is using this system vs. the last system (1-10)? Etc. **- Madison and Chris**
- 11/6-11/20 Testing
    - 11/13-11/20 Develop/write testing procedures for preliminary/fake data - Adeline
    - 11/13-11/20 Guidance/setup doc or call for the devices and returning data - TJ and Chris
    - **12/2 -** Determine date for data return to team?? **- TJ**
    - 12/3 - Finalize testing/statistics for improvement- how much better our is
- **11/6-11/20** Data processing- **Kevin and TJ**
    - **11/6-11/20-** Write preliminary code with fake data- outline scenarios
        - Perform tests/error catching
    - 11/20 - Present graphics/summary information to client, receive feedback
    - 12/3 - Finalize program
- 11/23 Make drive account
-
- 11/6-12/3 Final poster
    - 11/13-11/20 Begin outlining and putting basic information into poster - TJ
        - Abstract
        - Motivation
        - Problem statement
        - Background Research
        - Design Specifications
    - 11/20-12/3
        - Final Design
        - Material Costs

- Testing

- Discussion/Future Work

- Acknowledgments

- References

- **11/6-12/9** Final deliverables - report

  - 11/6-11/13 - Testing procedures

  - 11/13-11/20 - Guidance doc/set up (appendix)

  - 11/20-11/27 - Update conclusion and begin revising other sections

  - 11/27- 12/4 - Implement final code (appendix), testing results, improvement from prior system

  - 12/4-12/9- Proof reading and finalizing

- **12/4** Final Poster Presentations

- **12/11** Final Deliverables

Conclusions/action items: In order to have a successful rest of the semester with the least amount of stress, the timeline should be followed as accurately as possible even though things are subject to change because of talking to client and ability to get scanner on time.

10/15/20 Research on Refurbished Devices

MADISON BUGEL - Dec 08, 2020, 4:00 PM CST

Title: Research on Refurbished Devices

Date: 10/15/20

Content by: Madison

Present: Madison

Goals: Find a good device that can be bought for cheap

Content:

APPLE:

- Amazon has refurbished IPads for as low as $249 for a 32 GB Air
    - Iphone X 64 GB: $403
    - Iphone 7 32 GB: $180
    - Iphone 8 64 GB: $243
- Apple also sells their own refurbished products but they are only Iphone X / XS and newer IPads for over 500$
- Best Buy has items as low as $229 for Ipads and $200 for iPhones

GALAXY:

- On Amazon, they are all similar in price range of about $250 depending on kind and GB range
- Samsungs website includes different refurbished from S9($320) to Note 10 ($725)
- Walmart also sells some for as low as $169 for an S7 32 GB

Conclusions/action items: Galaxies are the preferred for this project due to their flexibility's in the apps themselves and the ease of use, they are also much more portable and cheaper than Apple IPads.

11/22/20 Brainstorming Survey Questions

MADISON BUGEL - Dec 09, 2020, 1:17 PM CST

Title: Brainstorming Survey Questions

Date: 11/22/20

Content by: Madison

Present: Madison and Chris

Goals: To create a professional survey that will be able to compare our product to the old one.

Content:

How much did the system inconvenience your workflow due to the amount of time needed to use it?

Rate: 1 (Created lots of delays) - 5 (No Impact to work flow)

How complicated was it to learn the system?

Rate: 1 (Took multiple days of trial and error with mis-inputs) - 5 (Learnable to a usable and understandable extent in under 1 day)

How congested was the scanning station?

Rate: 1 (Multiple people constantly lined up due to wait time) - 5 (Station was always or very close to always open)

Was there any technical problems when scanning?

Rate: 1 (Lots of scanning problems / Wouldn't scan) - 5 (No problems)

If there was a problem please list it below

How would you compare this system with the last?

Rate 1(other system more) - 5 (new system)

For those accessing sheet information:

How readable and interpretable was the raw data presented in the spreadsheet?

Rate: 1 (Hard to find data that you are looking for) - 5 (Can easily find necessary data and information)

How readable and interpretable were the data graphs and analysis presented in the spreadsheet?

Rate: 1 (Hard to understand the meaning behind the data) - 5 (Can easily understand the data)

How hard was it to enter data in the sheets (Names, etc)?

Rate: 1 (Hard to find columns or places to enter data correctly) - 5 (Data columns match up exactly with barcode numbers making it easy to enter technician/other's names)

If you had to change anything what would it be?

Conclusions/action items: We have to finalize the survey with other group members along with putting it into a google form that will be concise yet professional so we can get it to the client ASAP.

11/30/20 Satisfaction Survey Final

MADISON BUGEL - Dec 08, 2020, 3:28 PM CST

Title: Satisfaction Survey Final

Date: 11/30/20

Content by: Madison

Present: Madison, Chris

Goals: Edit the survey questions to create a concise and professional survey.

Content: https://forms.gle/bq6foQeuPrB9GVHt8

> **Questions:**

- How well did the TIME CARD system integrate into your workflow?
    - Rate 1 (Created a lot of delayes) -5 (Seamless integration & No extra delays created)
- How well did the SCANNER system integrate into your workflow?
    - Rate 1 (Created a lot of delayes) -5 (Seamless integration & No extra delays created)
- How difficult was the TIME CARD system to learn?
    - Rate 1 (Took a lot of trial and error (Very Confusing)) - 5 (Easy to get down with no errors in inputs)
- How difficult was the SCANNER system to learn?
    - Rate 1 (Took a lot of trial and error (Very Confusing)) - 5 (Easy to get down with no errors in inputs)
- How congested was the TIME CARD station?
    - Rate 1 (Constant long wait times to use the scanners) - 5 (Station was always open to use)
- How congested was the SCANNER station?
    - Rate 1 (Constant long wait times to use the scanners) - 5 (Station was always open to use)
- Were there any technical problems when using the TIME CARD system?
    - Rate 1 (Lots of scanning problems / Wouldn't scan) - 5(No problems)
- Were there any technical problems when using the SCANNER?
    - Rate 1 (Lots of scanning problems / Wouldn't scan) - 5(No problems)
- Is there anything else about the TIME CARD system that we should know (advantages of card, inconviences, etc.)?
    - Short Answer
- What would you like to see change in the SCANNER system?
    - Short Answer
- Overall, how would you compare the two systems?
    - Rate 1 (Last System Preferred greatly) - 5 (Current system preferred greatly)

For those accessing sheet/data information:

- How readable and interpretable was the raw data presented in the spreadsheet?
    - Rate 1 (Hard to find data needed) - 5 (Can easily find needed data)
- How readable and interpretable were the data graphs and analysis presented in the spreadsheet?
    - Rate 1(Hard to understand the data) - 5 (Can easily understand the data)
- How hard was it to enter data in the sheets?
    - Rate 1(Extremely Hard) - 5(Easy)
- Were there any difficulties with accessing, processing, or entering data? If so, please list them below:
    - Short Answer

Conclusions/action items: Send out this survey to get real results from lab technicians and physician.

12/3/20 Satisfaction Survey Results

MADISON BUGEL - Dec 08, 2020, 3:37 PM CST

Title: Satisfaction Survey Results

Date: 12/3/20

Content by: Madison

Present: Thomas, Madison, Chris

Goals: Read the data and compare what we have gotten to show how well our product works

Content: SEE GOOGLE SHEET BELOW

There is not a lot of data given because of how only 3 people were there to take the survey. Because of only 3 people taking it, there was a chance data could be skewed in the averages but of the responses they all three were very similar making the data not skewed. Despite only having three people taking it, the results show that they do prefer the new system more even though they do have some requests to make it better overall including:

- A scanner for each technician and physician
- And to make graphs clear in the google sheets to show a better analysis

Conclusions/action items: From the responses we got, it shows that the scanner system is highly in favor over the timecard system being a 4.33. As long as more scanners are available the technicans believe this project is quite successful.

MADISON BUGEL - Dec 09, 2020, 1:24 PM CST

Screen_Shot_2020-12-09_at_1.23.43_PM.png(179.4 KB) - download

12/4/20 Brainstorming Final Problems

MADISON BUGEL - Dec 08, 2020, 4:29 PM CST

Title: Brainstorming final problems

Date: 12/4/20

Content by: Madison

Present: Madison

Goals: Brainstorm any final problems that we have encountered to show possible future work and solutions to them.

Content:

- Problem 1: Not enough scanners
    - The most requested thing from a satisfaction survey was the ability to have more scanners so each technician gets one
    - Antimicrobial scanners are needed, the client must get these and a charging system would need to be put in place to make sure that no one's scanner dies.
    - Would go around with the technician while they work so they would need more than just the one computer to connect to due to different locations (one being in the microscope room)
    - Need to test the range of the Bluetooth range as if the scanner is pulled out of the range it will not upload to the google sheets when scanned
- Problem 2: Patient information on barcodes
    - The client said that due to the information on the barcodes, had to manually enter data to give to us because HIPAA concerns
    - This is mainly on our part being involved as they cannot give us access to information but if they need help in the future from us, barcodes should not hold patient data in any way
    - A solution is instead of printing a barcode that correlates to patient ID, the barcode could be printed with random numbers when a new patient comes in and that number could go along with the file from the patient so that the number would not contain any data and it would be stored with the file of the patient if they ever needed to look at the patient's specific data.
- Problem 3: No graphs in the analysis of data
    - In the survey results, the response was that they were confused at the analysis as it did not show any graphs
    - A graph could be imposed showing averages on a day to day basis along with any outliers shown on that day to be looked at
    - The analysis we have is good it's just confusing to those looking at it from an outsider perspective.

Conclusions/action items: Talk to the client about future work and how to fix barcodes and graphs along with buying more scanners

Scanning Sequence Map 10/12/2020

THOMAS TURINSKE - Dec 09, 2020, 1:19 PM CST
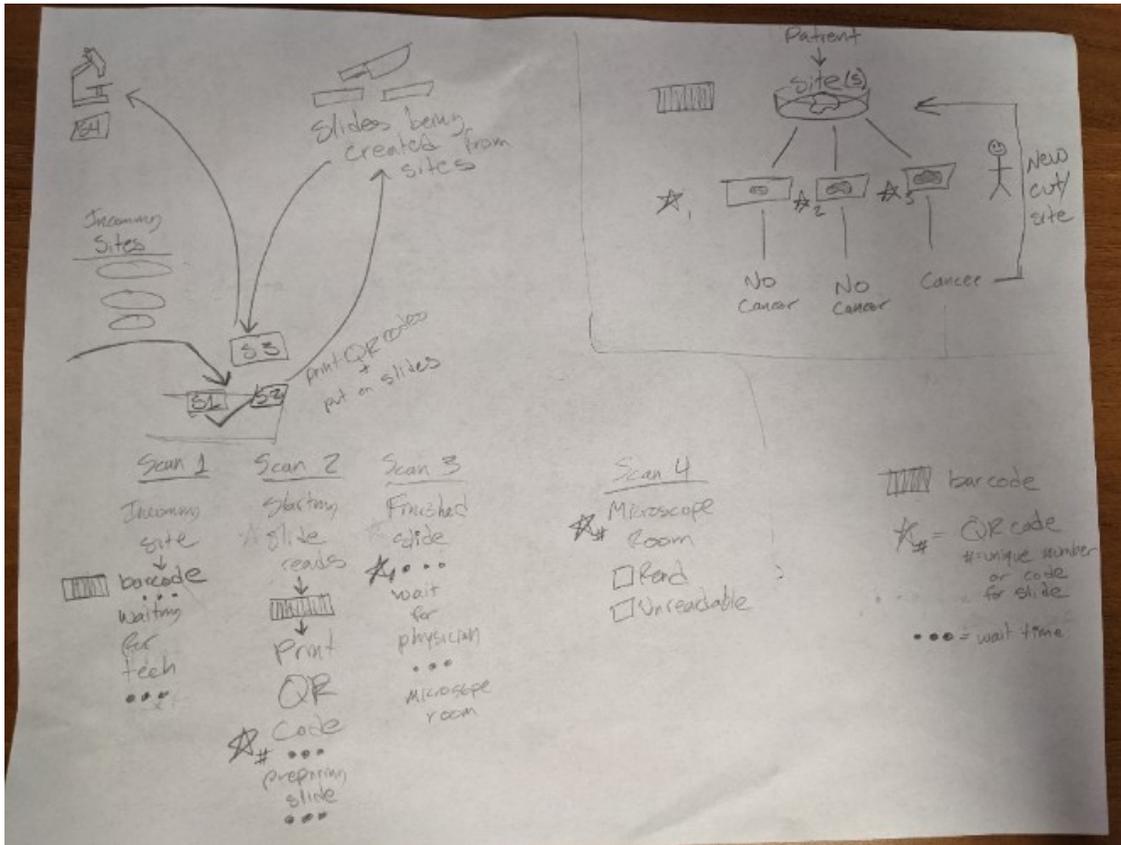
A rough draft highlighting how the Mohs Laboratory is tracking TAT currently. In addition, the time stamps they would like our system to cover are included.

Device Research 10/15/2020

THOMAS TURINSKE - Oct 20, 2020, 7:55 PM CDT

Title: Finding Suitable Devices for Scan2GoogleSheets App

Date: 10/15/2020

Content by: Thomas Turinske

Present: Thomas Turinske

Goals:

Compile list of smart devices to utilize in Mohs laboratory for scanning barcodes and QR codes

Content:

- General criteria to look for:
    - App compatibility is #1
    - Camera- good camera quality (1080p min)
        - Low latency?
    - Wifi and bluetooth connection
    - Port type- microUSB ? USB C?

List of possible devices:

Amazon Fire 7 Tablet - $65 for no ads

- 7" IPS display; 16 or 32 GB of internal storage (add up to 512 GB with microSD)
- Faster 1.3 GHz quad-core processor
- Up to 7 hours of reading, browsing the web, watching video, and listening to music
- Hands-free with Alexa, including on/off toggle
- 1 GB of RAM
    - Think this is enough
- 2 MP front and rear-facing cameras with 720p HD video recording
    - Is this good enough???
- Dual-band Wi-Fi
- Micro-B USB port
- Add up to 512 gb with micro sd card
    - This is a plus if storing directly on device
- Scan2googlesheets- NOT COMPATIBLE directly through Amazon app store
    - Need to import google app store through external website
    - Sketchy, not most reliable, but would work

Samsung - Galaxy Tab A (2019) - 8" - 32GB - Black - $100 Best Buy

- 8 MP rear camera- this is perfect
- Storage, battery life, RAM is all good, microsd slot available

- Runs Android 9.0 Pie
    - Uses google play store- compatible with app then

Refurbished Ipad Mini - cheapest is like $130

- I think the ipad would be fine, need to see if it can run a more up to date IOS
- Probably not the best option though for price

Conclusions/action items:

Samsung galaxy tab A seems like the ideal tablet for the job we want to do, will look into where we can buy this through or if our client has other ideas

Competing Design Research

Title: Competing Design Research

Date: 10/21/2020

Content by: Thomas Turinske

Present: Thomas Turinske

Goals: Highlight competing designs from past research in a formal document

Content:

Current system: Time Card's

- Pros:
    - Physical card, not computers for possible connectivity errors
    - Straight forward
- Cons:
    - Have to order cards, can be delayed
    - Human error is much more frequent- double stamps, missed stamps, misaligned
    - Requires human collection and hand processing of data

System on the Market: Sunquest Laboratory™ Specimen Management Routing and Tracking (SMART)

- Description: FROM WEBSITE

    - Reduce Missing Or Lost Specimens
        - Monitor specimens from the moment an order is placed
        - Track the location of specimens at each specimen point of tracking (SPOT)
        - Route specimens to lab workbenches quickly
        - Create container IDs and print on labels

      Drive Cost Efficiencies
        - Reduce time spent looking for misplaced specimens
        - Reduce manual intervention required by techs to walk specimens to each station
        - Leverage laboratory automation systems

      Increase Revenue
        - Reduce turnaround time (TAT) to optimize laboratory throughput
        - Reduce lab tech time spent on manual interventions

      Improve Quality Of Care
        - Avoid unnecessary needle sticks to redraw for misplaced specimens
        - Improve turnaround time for specimen results by eliminating delays incurred by missing specimens

- Pros:
    - Seems to do what the lab is looking for in terms of time tracking and goals for accuracy
- Cons:
    - Do not know price or how system is integrated
    - Requires contacting company to learn more
- Other information:

- Sent contact form to see if they will reply, no response as of 10/21/2020
- They use a similar barcode tracking system... interested to see what they propose for the Mohs Lab if they respond
  - Patent or copyright issues here?

No other designs or company's offer anything that is remotely applicable to Mohs Labortary. End of competing design research.

Conclusions/action items:

Waiting on response from SMART company.

Meeting with Sunquest SMART

Title: Meeting With Sunquest SMART

Date: 10/26/2020

Content by: Thomas Turinske

Present: Thomas Turinske, SAMIR AHMETOVIC - Sunquest Rep

Goals: Learn more about this competing design- price, how it functions, what size laboratory

Content:

Specimen management training, one module apart of the system.

Can't sell outside as a single device, EPIC beaker system already being used.

Have to utilize Sunquest system, much much larger scale than that.

Could reach out to Epic -- should have something similar to help.

Barcode system--- lets go with it

SMART system uses barcode tracking system, creates specimen ID number and tracked through system.

Conclusions/action items:

Nope, they "compete" but need the whole Sunquest system to utilize SMART tracking.

Brainstorming 9/11/2020

THOMAS TURINSKE - Oct 20, 2020, 7:54 PM CDT

Title: Brainstorming various Mohs Projects

Date: 9/11/2020

Content by: TJ Turinske

Present: TJ

Goals:

-Brainstorm a wide range of ideas for our project

Content:

- Barcode readers that are hooked up to computers or raspberry pi that uploads data to a website or a USB stick
    - Do not know what is "read" from the barcode. What does the reader see? What does the computer receive?
        - Need more research in this area
- Scan the barcode, activates rfid chip with patient information and gets carried with petri dish. Just tap it at each location, data uploaded to main computer
    - Reusable, but pointless if barcodes work as they are already printed out beforehand
- Perform analysis with Python?
    - Interfaces really well with CSV
    - Slow compared to other programming languages
- Ideally, have a website or screen that the Mohs team only has access to that displays all the data (timers) really nicely, maybe even a live timer with active sites and patient names or number??? Now I am getting ambitious >:)
    - Show minimum read times (negative countdown per station) to minimize misreads and maximize efficiency

Accounting for poor site reads/unreadable sites produced by the lab:

- Need a final stage scan, possibly small coded app? scantron? Touch screen button? That can indicate if the site was readable or not.
    - Could be used to close the loop on the sample and upload info to the cloud or download to a USB stick

Conclusions/action items:

Overall, I believe there are many different ways to work with the current barcode system. I do not know much about barcode technology and need to do some research before I create a more indepth plan. Also, I am interested in live time tracking and which programming language would interface best between the scanners and a cloud based system.

⬡ Troubleshooting Google Collab 11/25/2020

THOMAS TURINSKE - Nov 25,

Title: Troubleshooting Google Collab

Date: 11/25/2020

Content by: TJ Turinske

Present: TJ Turinske

Goals:

Fix issue with improper authentication of Google Collab Sheet

Content:

- As I was working on the code today, I attempted to run the clients version through their Google account
- In the first step, authentication, I accidentally signed in using my Wisc email.
- This led to improper authentication as the Colab notebook is not shared with that email account.
- Here is how to fix the issue of failed/accidental authentication problems:
  - At the top, select "runtime" and then "factory reset runtime":
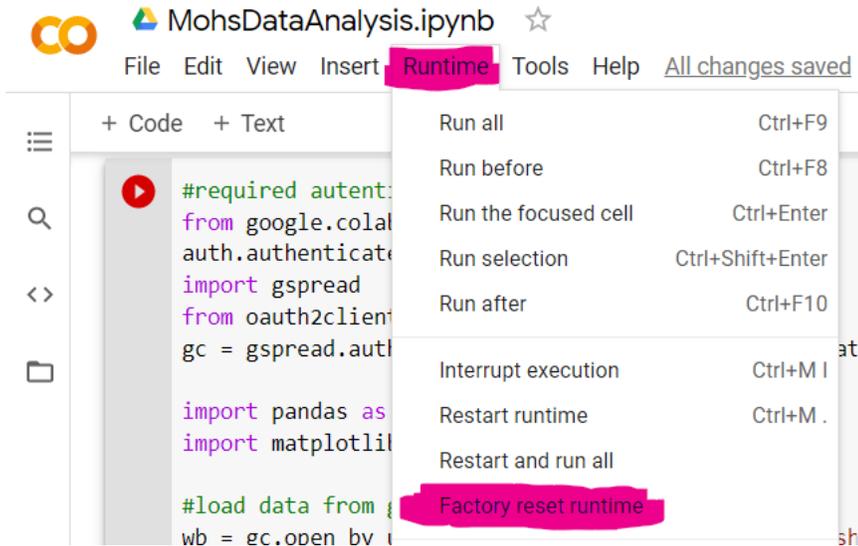
- Then, click reconnect:

- Finally, run the code as instructed (clicking the play button) and make sure to ***use the MohsTATSystem@gmail.com account to authenticate***

Conclusions/action items:

The client must use the designated Google account to authenticate the code when they go to run it every week. If that does not occur, they will need to follow the directions as lis

Updating/Modifying Survey 11/25/2020

THOMAS TURINSKE - Nov 25, 2020, 2:07 PM CST

Title: Modifying Survery Questions

Date: 11/25/2020

Content by: TJ Turinske

Present: TJ Turinske, Chris

Goals:

Update the survey created by Madison and Chris to include direct comparisons between the time card system and the new scanner system

Content:

Here is the old survey link created by Madison and Chris:

https://docs.google.com/forms/d/e/1FAIpQLScQq3co_jMOVfHRY8RaZsPbOIbt7hG3PXEvF3lDK8sDjJTg7g/viewform?usp=sf_link

Here is the updated survey link where I duplicated and modified some of the questions to get a better grasp of how much our system is helping or hindering the lab:

https://docs.google.com/forms/d/e/1FAIpQLSeZhldVCOK5rDK5ld5vZQDHQsqxZweRWv1aKNDaJlHkl9xwRA/viewform?usp=sf_link

Conclusions/action items:

Overall, we are very close to having a final survey that we can use to compare our system to the prior system.

A big issue is the amount of time left between having the lab use our system and then sending out the survey and getting responses in a decently fast time.

Presentation of Data Analysis Brainstorm 11/27/2020

THOMAS TURINSKE - Nov 27, 2020, 3:59 PM CST

Title: Brainstorming Presentation Options for Data Analysis

Date: 11/27/2020

Content by: TJ Turinske

Present: TJ Turinske

Goals:

- Methodically determine what is the best and most relevant information to present to the client
- Goals from workbook:
    - #Using sites with 4 time stamps - perfect collections
      #Big Picture - All time/whole data
      #Weekly graph - overall average time for a site each week - pools all data - Modified to daily average table for all time
      #Smaller Picture - Weekly Summary
      #Daily graph - for that week, each day, what was the average time
      #WEEK IN REVIEW: Average time between stations for that week (last 6 days) and number of incomplete for that week
      #5 number summary for each interval - omitted, don't think it is as pertinent
      #Outliers - table with outliers, identifying number, time stamp
      #How many went back for a second site?
      #Time to start the fifth time/second site - looking at the same patient id, with modified site (xx-1), time between
   #Saving the incompletes to a seperate workbook?"

Content:

Regular text is what is currently being displayed for the client

Items in Italics are something that wants to be added into a respective category and is helpful

- Timestamps are bucketed into groups of 4 for completed sets
    - The incomplete (not equal to 4 timestamps) are placed into an incomplete list
- <u>Printing</u> "All-time Statistics" - using only completed data!
    - <u>Printing</u> overall mean TAT and stdev
    - For each interval:
        - <u>Printing</u> patient ID, time interval location, and time interval - **This may be an issue in preliminary data sets, but as more data is collected, the range for the outliers will shift**
        - <u>Displaying </u>boxplot with distribution for each interval
- <u>Printing</u> "By Day Analysis:"
    - <u>Displaying</u> Table of averages for each interval as well as TAT by DATE

Halfway through this process, I decided it would be easier to create a graphic with all the information we want to present the client.
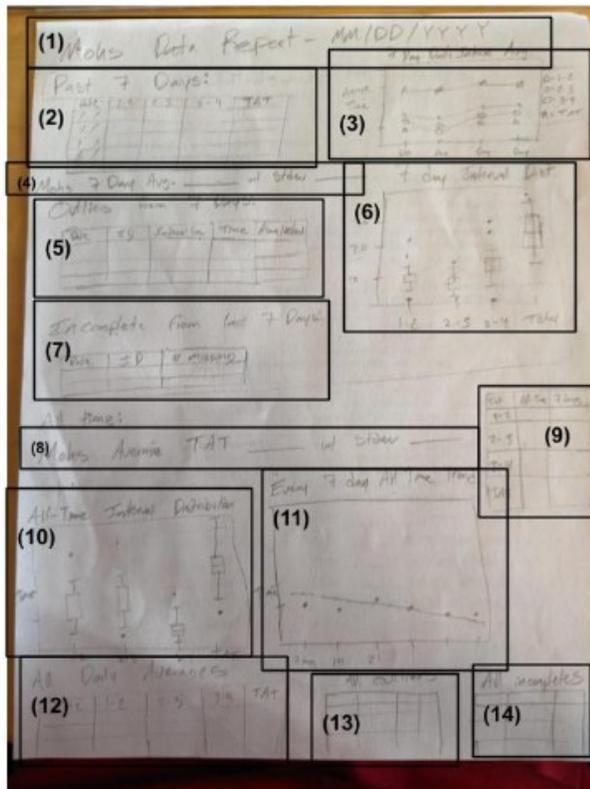
1. Todays Date
2. Averages for intervals by day for past 7 days
3. Plot of each average interval by day
4. 7 day TAT average w/std dev
5. Outliers from 7 days of data
6. Box + Whisker of each interval - Raw interval time being plotted (no averages)
7. Incomplete data from last 7 days w/patient ID

All time stats

8. All time average w/ std dev
9. All time interval averages vs. last 7 day interval averages
10. All-time interval box+whisker distribution - raw interval time plotted
11. 7 day moving average of some sort
12. All time average by day
13. All time outliers
14. All time incomplets

Approaches to each step:

1. Easy, get date from a datetime
2. Need to define the last 7 days, then slice out of all daily averages table
3. This will be more difficult, start by plotting the TAT and then add other interval layers if wanted
4. Easy, take from step 2 table
5. Using Kevins outlier detector, apply to the last 7 days of time intervals
6. From 7-day interval chart, plot box and whisker
7. Easy, take incomplete all time and slice out last 7 days - may need to be careful if no incompletes are present - display NaN
8. **Completed - Kevin has code**
9. Take 7-day averages for each interval, slice out of the all-time daily interval averages table, recalculate all-time average and compare to 7-day average
10. **Completed - Kevin as an all-time df to plot**
11. This will be more difficult, bucket every 7 days, plot and apply some sort of regression model to it
12. **Completed - TJ wrote code**
13. **Completed - Kevin wrote code**
14. **Completed - Kevin Wrote Code**

Conclusions/action items:

This was a good brainstorming session sorting out what has been completed and what needs to be completed. This should help present our client a clean and easily readable format to find what is most important for the lab.

A majority of the remaining code will be manipulating the data structures we have already created.

An area of concern I have is in the instance of a quick double-scan

Data analysis Final Presentable 12/6/2020

KEVIN TAN - Dec 07, 2020, 7:50 PM CST

ADELINE DRIER-Nov 25, 2020, 1:50 PM CST

Title: Final Data Analysis Presentable to Client

Date: 12/6/2020

Content by: Thomas Turinske, Kevin Tan

Present: Thomas Turinske, Kevin Tan

Goals:

Explain final code output delivered to the client

Highlight personal contributions to code

Content:

Final Output for the client:

- In the final output, the client receives:
    - All-time median, average, and standard deviations for each interval as defined (print statement)
    - Total number of sites seen (print statement)
    - Outliers in the data (table)
    - All-time interval boxplot distribution (chart)
    - Daily means from the past seven days (table)
    - Average TAT graph of the past seven days (chart)
    - Incomplete data (table)

Important notes about the code:

To alter the number of intervals change the # in "NUM_TIME_STAMPS = #" to the number of time stamps being taken

To alter the number of days you want to review for daily averages change the # in "NUM_DAYS= #" to the number of wanted days

The first step in the code is pulling the data from the Google Sheets table. Make sure it is formatted as follows (make sure you are using 24 hour time):

site id	time stamp
AAAA	MM/DD/YYYY HH:MM:SS

To ensure this format, Kevin provided an easy way to concatenate the date with with time if they are in two separate cells:

```
=CONCATENATE("MM/DD/YYYY",TEXT(B2,"hh:mm"),":00")
```

You manually set the date in the function and put the time in column B2 (or any other column you specify).

Caution: This neglects seconds and may need to be changed if the lab begins to report seconds directly.

In addition, the code pulls from a designated tab in the google sheet. To change this in the code, look for:

```
sheet = wb.worksheet('data analysis')
```

To change tabs, rename 'data analysis' to the tab you want to analyze. The first and second columns in this sheet must follow the format as above.

Code:

```
#required autentication
from google.colab import auth
auth.authenticate_user()
import gspread
from oauth2client.client import GoogleCredentials
gc = gspread.authorize(GoogleCredentials.get_application_default())

import pandas as pd
import matplotlib.pyplot as plt
import time
import datetime
```

```python
#load data from google sheets
wb =
gc.open_by_url('https://docs.google.com/spreadsheets/d/1_yBW7Ru3XNIL9vjDs6FnFARy8Qn_OfF6YqJxhpdbPuk/edit#gid=0')
sheet = wb.worksheet('data analysis')
data = sheet.get_all_values()
df = pd.DataFrame(data)
#add column headers
df.columns = df.iloc[0]
#remove document headers
df = df.iloc[1:]

site_id_head = df.columns[0]
time_stamp_head = df.columns[1]

NUM_TIME_STAMPS = 3
NUM_DAYS = 7

def get_unix_time(raw_time_string):
  #
  # gets unix time given a date string. milliseconds are ignored
  #
  time_string = raw_time_string.partition(".")[0]
  result = time.mktime(datetime.datetime.strptime(time_string, "%m/%d/%Y %H:%M:%S").timetuple())
  return result

def get_unix_time_mins(raw_time_string):
  #
  # gets unix time given a date string. milliseconds are ignored
  #
  time_string = raw_time_string.partition(".")[0]
  result = time.mktime(datetime.datetime.strptime(time_string, "%m/%d/%Y %H:%M:%S").timetuple())
  return result/60

# calculate unix time
unix_time = [get_unix_time_mins(time) for time in df[time_stamp_head]]

#create a new column for unix time or overwrite an old column of the same name
if "unix time" in df:
  df["unix time"] = unix_time
else:
  df.insert(1, "unix time", unix_time, True)

df = df.sort_values(by=["unix time"])

times = df["unix time"]
bucketed = []
incomplete = []
#iterate over unique patient ids
for id in set(df[site_id_head]):
  site_array = []
  #iterate over timestamps with that given id
  for time in times[df[site_id_head] == str(id)].values:
    site_array.append(time)
    #if  NUM_TIME_STAMPS timestamps have been added, append it and reset the site_array
    if len(site_array) ==  NUM_TIME_STAMPS:
      bucketed.append((id,site_array))
      site_array = []
  #check if site array still contains elements. If so our data is incomplete and we can report it as such
  if site_array:
    incomplete.append((id,site_array))

##########################################################
#ALL TIME
print("\nStatistics of All Time:\n")

import statistics as stats
```

```python
intervals_list = []
for id,timestamps in bucketed:
  #find the differences between each timestamp in seconds
  intervals = [j-i for i, j in zip(timestamps[:-1], timestamps[1:])]
  if any(interval for interval in intervals if interval < 0):
    print("Warning: negative interval calculated")
  intervals_list.append((id,intervals))


at_df = pd.DataFrame()
#at_df[site_id_head] = [id for id,intervals in intervals_list]

#column header strings
header = []
for i in range(NUM_TIME_STAMPS-1):
  label = "T"+str(i+1)+"-T"+str(i+2)
  header.append(label)

#now we want to analyze each interval in the time tracking scheme
each_step_at=[]
for i in range(NUM_TIME_STAMPS-1):
  #compile the time intervals for a given step
  step = [intervals[i] for id,intervals in intervals_list]
  #add this step information to dataframe
  at_df[header[i]]= step
  #record the mean and population standard deviation of each step
  each_step_at.append("Interval {}  median = {}  mean = {} with standard deviation = {}".format(header[i],
str(round(stats.median(step),3)), str(round(stats.mean(step),3)), str(round(stats.pstdev(step), 3))))


for step in each_step_at:
  print(step)


turnaround_times = [sum(intervals) for id,intervals in intervals_list]

print("Turn Around Time  median = {}  mean = {} with standard deviation = {}".format(
    str(round(stats.median(turnaround_times),3)),
    str(round(stats.mean(turnaround_times),3)),
    str(round(stats.pstdev(turnaround_times), 3))))
print("\nTotal Sites Seen: ", len(intervals_list))
#find outliers

outliers_at= []
q1 = at_df.quantile(q=.25)
q3 = at_df.quantile(q=.75)
iqr = q3 - q1
upper = q3 + 1.5*iqr
lower = q1 - 1.5*iqr
for id,index in zip([id for id,intervals in intervals_list],range(len(intervals_list))):
  for column in at_df.columns:
    if at_df[column].iloc[index-1] > upper[column]:
      outliers_at.append((id,df[df[site_id_head]== id]["time stamp"].iloc[-1][:10].strip("
"),str(column),at_df[column].iloc[index-1], "upper"))
    if at_df[column].iloc[index-1] < lower[column]:
      outliers_at.append((id,df[df[site_id_head]== id]["time stamp"].iloc[-1][:10].strip("
"),str(column),at_df[column].iloc[index-1], "lower"))

outliers_df_at=pd.DataFrame(columns= [site_id_head,"date","interval location", "time interval", "outlier type"],
data= outliers_at).sort_values("date")
print("\nOutliers")
display(outliers_df_at)

#Adding in sum column for TAT
copy_at_df= at_df.copy(deep=True)
copy_at_df["sum"]=copy_at_df.sum(1)

plt.figure(1)
boxplot = copy_at_df.boxplot(column=list(copy_at_df.columns))
```

```python
plt.title("All Time Intervals")
plt.xlabel("Interval")
plt.ylabel("Minutes")
plt.show()


def get_date(raw_time_string):
  result = raw_time_string[:10].strip(" ")
  return result


#get date
date_i= [get_date(time) for time in df["time stamp"]]
if "date" in df:
  df["date"] = date_i
else:
  df.insert(1,'date', date_i, True)
  #Bucketing each site to it's respective day - TJ
dates = df["date"]
intervals_list
date_dict= {}
for site in intervals_list:
  x=df[df[site_id_head]==site[0]]
  day= x["date"].iloc[-1]
  #print(day)
  if day in date_dict.keys():
    date_dict[day.strip(" ")].append(site)
  else:
    date_dict[day.strip(" ")] = [site]


#Bucketing each site to it's respective day - TJ
dates = df["date"]
intervals_list
date_dict= {}
for site in intervals_list:
  x=df[df[site_id_head]==site[0]]
  day= x["date"].iloc[-1]
  if day in date_dict.keys():
    date_dict[day.strip(" ")].append(site)
  else:
    date_dict[day.strip(" ")] = [site]


#ALL TIME DAILY AVERAGES
#Generate daily average stats- Table of Splits and TAT- TJ and Kevin


days= date_dict.keys()
average_daily_intervals = {}
for d in days:
  for interval in range(NUM_TIME_STAMPS-1):
    day_array = date_dict[d]
    if not d in average_daily_intervals.keys():
      average_daily_intervals[d] = []
    average_daily_intervals[d].append(stats.mean([site[1][interval] for site in day_array]))


average_daily_intervals
avg_daily_int_df= pd.DataFrame.from_dict(average_daily_intervals, orient ='index', columns=
[header]).sort_index()
avg_daily_int_df["sum"]= avg_daily_int_df.sum(1)


print("\nDaily means")
display(avg_daily_int_df)


#this seems simpler to me just get the last 7 entries -KEVIN
n_day_averages = avg_daily_int_df.iloc[max(0,len(avg_daily_int_df)-NUM_DAYS):len(avg_daily_int_df)]


# 3 # Plot of average interval time for most recent n days
x= list(n_day_averages.loc[:"sum"].index)
y_tat = n_day_averages[["sum"]]
```

```
plt.figure(2)
plt.scatter(x, y_tat, color="b")
plt.plot(x, y_tat, color="b")
plt.title("Average TAT for {} Days".format(NUM_DAYS))
plt.xlabel("Date")
plt.ylabel("Minutes")
plt.show()

# Incomplete time stamps - TJ and Kevin
incomplete_w_date= []
for site in incomplete:
    incomplete_w_date.append((site[0] , df[df[site_id_head]== site[0]]["date"].iloc[-1]))
inc_df= pd.DataFrame(columns = [site_id_head, "date"], data=incomplete_w_date)
print("\nIncomplete data: ")
display(inc_df)
```

Data:

site id	time stamp
A	8/25/2020 09:51:00
A	8/25/2020 10:24:00
B	8/25/2020 10:32:00
B	8/25/2020 10:52:00
B	8/25/2020 11:20:00
D	8/25/2020 10:15:00
D	8/25/2020 11:08:00
F	8/25/2020 11:16:00
F	8/25/2020 11:23:00
F	8/25/2020 12:25:00
G	8/27/2020 09:17:00
G	8/27/2020 09:18:00
G	8/27/2020 09:45:00
H	8/27/2020 08:44:00
H	8/27/2020 08:48:00
H	8/27/2020 09:27:00
I	8/27/2020 07:54:00
I	8/27/2020 07:59:00
I	8/27/2020 08:21:00
J	8/27/2020 08:46:00
J	8/27/2020 08:49:00
J	8/27/2020 09:16:00
K	8/27/2020 08:13:00
K	8/27/2020 08:26:00
K	8/27/2020 08:55:00
L	8/27/2020 08:29:00
L	8/27/2020 08:32:00
L	8/27/2020 08:58:00
M	8/27/2020 07:35:00
M	8/27/2020 07:41:00
M	8/27/2020 08:15:00
N	8/27/2020 07:40:00
N	8/27/2020 07:41:00
N	8/27/2020 08:05:00
O	8/27/2020 11:16:00
O	8/27/2020 11:36:00
O	8/27/2020 12:12:00
P	8/27/2020 11:13:00
P	8/27/2020 11:14:00
P	8/27/2020 11:45:00

site id	time stamp
P	8/27/2020 12:03:00
P	8/27/2020 12:03:00
P	8/27/2020 12:26:00
Q	8/27/2020 11:12:00
Q	8/27/2020 11:13:00
Q	8/27/2020 11:45:00
R	8/27/2020 10:44:00
R	8/27/2020 10:45:00
R	8/27/2020 11:07:00
R	8/27/2020 11:16:00
R	8/27/2020 11:31:00
R	8/27/2020 11:52:00
S	8/27/2020 09:56:00
S	8/27/2020 09:57:00
S	8/27/2020 10:32:00
T	8/27/2020 08:07:00
T	8/27/2020 08:11:00
T	8/27/2020 08:37:00
T	8/27/2020 08:57:00
T	8/27/2020 09:06:00
T	8/27/2020 09:27:00
U	8/27/2020 08:44:00
U	8/27/2020 08:48:00
U	8/27/2020 09:27:00
U	8/27/2020 09:41:00
U	8/27/2020 09:45:00
U	8/27/2020 10:12:00
V	8/27/2020 08:00:00
V	8/27/2020 08:02:00
V	8/27/2020 08:37:00
W	8/28/2020 08:05:00
W	8/28/2020 08:12:00
W	8/28/2020 08:31:00

Code Output:

Statistics of All Time:

Interval T1-T2 median = 4.0 mean = 5.739 with standard deviation = 5.78
Interval T2-T3 median = 27.0 mean = 29.783 with standard deviation = 8.973
Turn Around Time median = 32.0 mean = 35.522 with standard deviation = 10.814

Total Sites Seen: 23

Outliers

	site id	date	interval location	time interval	outlier type
0	T	8/27/2020	T1-T2	20	upper
1	S	8/27/2020	T2-T3	62	upper
2	U	8/27/2020	T1-T2	20	upper

All Time Intervals
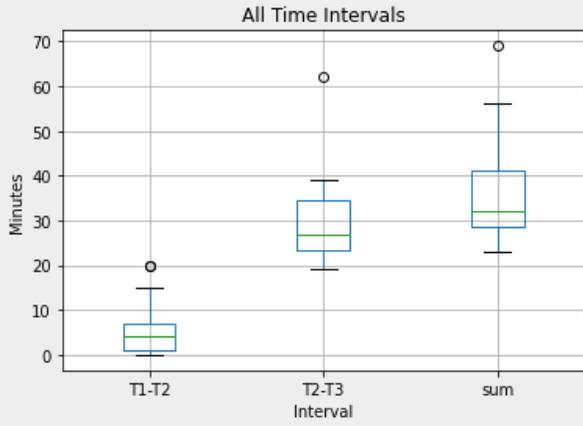
Daily means

	T1-T2	T2-T3	sum
8/25/2020	13.5	45	58.5
8/27/2020	4.9	28.8	33.7
8/28/2020	7	19	26

Average Time Intervals for 7 Days
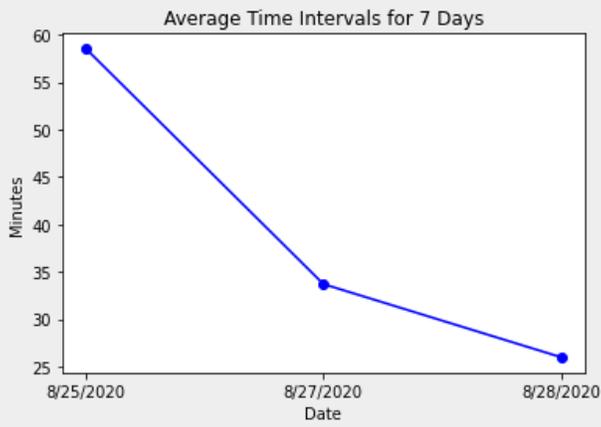
Incomplete data:

	site id	date
0	A	8/25/2020
1	D	8/25/2020

Conclusions/action items:

Overall, the data analysis should be decently representative of what the client is looking for. Any other additions can be addressed prior to the end of the semester.

Testing Procedure, Code, and Results 12/7/2020

THOMAS TURINSKE - Dec 07, 2020, 7:53 PM CST

Title: Testing Procedure, Code, and Results

Date: 12/7/2020

Content by: Thomas Turinske

Present: Thomas Turinske

Goals: Record testing procedure, code and the results

Content:

Procedure:

- F-test was used to determine if equal variances could be assumed between samples
- Two sample t-test was used to test if there was a significant difference between time card and scanner time intervals
    - Used first three time stamps of scanner intervals due to time card reporting on three intervals
    - All incomplete sites were excluded, 7 from time card, 0 from scanner
- Three days worth of data was used from both time card and scanner data sets (that was the maximum data given by the time card system)
- Matlab R2020 was used to perform these tests

Code:

```
%% TAT 2 sample T-test analysis
T1_2_mean_tc = 5.739;
T1_2_std_dev_tc= 5.78;
T2_3_mean_tc= 29.783;
T2_3_std_dev_tc= 8.973;
tat_mean_tc = 35.522;
tat_std_dev_tc = 10.814;
n_tc= 23;

T1_2_mean_scan = 4.577;
T1_2_std_dev_scan= 7.441;
T2_3_mean_scan= 28.628;
T2_3_std_dev_scan= 8.442;
tat_mean_scan = T1_2_mean_scan+T2_3_mean_scan;   %compare processing time due to lack of read in timecard info
tat_std_dev_scan = sqrt(T1_2_std_dev_scan^2+T2_3_std_dev_scan^2);   %need to do sum of variances to get std
n_scan = 78;
%% T1-T2 analysis
f_stat_12= (T1_2_std_dev_tc)^2/(T1_2_std_dev_scan)^2
f_pval= fcdf(f_stat_12,n_tc,n_scan) %assume that they are equal at alpha= 0.05 level, equal variances, accept H0

t_val = (T1_2_mean_tc - T1_2_mean_scan)/sqrt((T1_2_std_dev_tc)^2/n_tc + (T1_2_std_dev_scan)^2/n_scan)

p_val= 1-tcdf(t_val, n_scan+n_tc-2)+tcdf(-t_val, n_scan+n_tc-2)

%% T2-T3 analysis
f_stat_23= (T2_3_std_dev_tc)^2/(T2_3_std_dev_scan)^2
f_pval= 1-fcdf(f_stat_23,n_tc,n_scan) %assume that they are equal at alpha= 0.05 level, equal variances, accept H0

t_val = (T2_3_mean_tc - T2_3_mean_scan)/sqrt((T2_3_std_dev_tc)^2/n_tc + (T2_3_std_dev_scan)^2/n_scan)

p_val= 1-tcdf(t_val, n_scan+n_tc-2)+tcdf(-t_val, n_scan+n_tc-2)

%% TAT analysis
f_stat_tat= (tat_std_dev_tc)^2/(tat_std_dev_scan)^2
f_pval= fcdf(f_stat_tat,n_tc,n_scan) %CANNOT assume that they are equal at alpha= 0.05 level, reject H0

t_val = (T2_3_mean_tc - T2_3_mean_scan)/sqrt((T2_3_std_dev_tc)^2/n_tc + (T2_3_std_dev_scan)^2/n_scan)
```

p_val= (1-tcdf(t_val,n_scan+n_tc-2))+tcdf(-t_val, n_scan+n_tc-2)

Results:

	F-Statistic	p-value	T-statistic	p-value
T1-T2	0.6034	0.0860	0.7902	0.4313
T2-T3	1.1298	0.3349	0.5497	0.5837
T1-T3	0.9235	0.4313	0.5497	0.5837

All intervals failed to reject the null hypothesis that there was a significant difference in the mean interval time between samples. This shows that the scanner system was just as comparable to the time card system in lab processing times. Improved efficiency could not be concluded due to the nature of Moh's site analysis (larger sites take inherently longer, increased time with no correlation to the system).

Conclusions/action items:

Overall, testing was successful of the system and proved that our system was an adequate replacement for the time card system.

Older Iterations of Analysis Code 12/9/2020

Title: Older/Preliminary Iterations of Code

Date: 12/9/2020

Content by: Thomas Turinske

Present: Thomas Turinske

Goals:

Show the interactive process and changes made from initial code to the final code

Retrospectively Compile old structures and loops

Content:

Date bucketing mechanism:

```python
dates = df["date"]
intervals_list
date_dict= {}
for site in intervals_list:
 x=df[df[site_id_head]==site[0]]
 day= x["date"].iloc[-1]
 #print(day)
 if day in date_dict.keys():
   date_dict[day.strip(" ")].append(site)
 else:
   date_dict[day.strip(" ")] = [site]
```
Daily averages
```python
#ALL TIME DAILY AVERAGES
#Generate daily average stats- Table of Splits and TAT- #TJ
# daily tat avg= {date: avg_1-4}
# daily splits = {date: (avg_1-2, avg 2-3, avg 3-4)}
days= date_dict.keys()
daily_tat_avg= {}
daily_splits_avg= {}
raw_daily_splits = {}
for d in days:
 # puting the splits into lists to be analyzed
 t1_2= []
 t2_3= []
 t3_4= []
 t1_4= []
 daily_interval=date_dict[d]
 for site in daily_interval:     #looking at each site for a day
  #print(site)
  if len(site[1]) == 3:
    t1_2.append(site[1][0])
    t2_3.append(site[1][1])
    t3_4.append(site[1][2])
    t1_4.append(sum(site[1]))     #sum of all splits= total tat for that site
  else:
    pass              #currently looking at only completed time stamps
 t1_2= [number / 60 for number in t1_2]
 t2_3= [number / 60 for number in t2_3]
 t3_4= [number / 60 for number in t3_4]
 t1_4= [number / 60 for number in t1_4]
 daily_splits_avg[d] = (stats.mean(t1_2), stats.mean(t2_3), stats.mean(t3_4), stats.mean(t1_4))
 raw_daily_splits[d]= (t1_2, t2_3, t3_4, t1_4)
 daily_tat_avg[d]= stats.mean(t1_4)
daily_splits_avg
daily_tat_avg
pd.DataFrame(daily_splits_avg, index=sorted(daily_splits_avg.keys()), columns= ["T1-T2", "T2-T3", "T3-T4"])
daily_splits = pd.DataFrame.from_dict(daily_splits_avg,  orient ='index', columns= ["T1-T2", "T2-T3", "T3-T4", "T1-T4 (TAT)"]).sort_index()
```

Finding most recent day and weekdays:
```python
today= date.today() #- gave me wrong date later when it got past a certain time

most_recent_day= df.sort_values("unix time").iloc[-1]["time stamp"][:10].strip(" ")
```

```python
today_mod= most_recent_day
week_ago = (datetime.datetime.strptime(most_recent_day, '%m/%d/%Y') - datetime.timedelta(days=7)).strftime("%m/%d/%Y")
prelim_six_days = (datetime.datetime.strptime(most_recent_day, '%m/%d/%Y') - datetime.timedelta(days=6)).strftime("%m/%d/%Y")  #This is a six day look back, will be used if dates do not line
try:
  seven_day_averages = daily_splits.loc[week_ago:today_mod]
except:
  seven_day_averages = daily_splits.loc[prelim_six_days:today_mod]
week_days = []
i = 14
while i >= 0:
  week_days.append((today - datetime.timedelta(days=i)).strftime("%m/%d/%Y"))
  i += -1
t1_4_7day_conc= []         #This will be useful for comparing the all time averages to the 7 day time split averages
t1_2_7day_conc= []
t2_3_7day_conc= []
t3_4_7day_conc= []
if week_days[-1] != most_recent_day:
  week_days= week_days[:-1]
for day in week_days:
  try:
    t1_4_7day_conc += raw_daily_splits[day][3]
    t1_2_7day_conc += raw_daily_splits[day][0]
    t2_3_7day_conc += raw_daily_splits[day][1]
    t3_4_7day_conc += raw_daily_splits[day][2]
  except KeyError:    #This is me passing days that don't have any data
pass
```

Conclusions/action items:

These are some of the notable structures and code I wrote that were not included in the final code. This was due to the switch from 4 time stamps to a universal variable.

Website Status Update Log

THOMAS TURINSKE - Dec 06, 2020, 1:35 PM CST

Title: Status Update

Date: 10/1/2020

Content by: Thomas Turinske

Present: N/A

Goals: Update Website Status

Content:

"We have narrowed down our preliminary designs to three process-based solutions. All designs involve using bar codes and QR codes for the various time tracking steps but differ in location and equipment. More recently, we discovered an app that integrates bar code and QR code scans with time stamps and automatically uploads to a Google Sheets file. This app based solution is being researched more by the team."

Conclusions/action items:

Update status when applicable

Title: Status Update

Date: 10/11/2020

Content by: Thomas Turinske

Present: N/A

Goals: Update Website Status

Content:

"In our preliminary report, we preemptively choose "Scanner" strictly on design matrix score, but after a meeting with our client, we are pursuing the "Smart" design. We were able to demonstrate the bar code/QR code scanning app to our client, which he approved of due to its ease of use and integration with technology. This design works best with either one or two smart devices and allows for easy manual entry of data, an aspect the client expressed great interest in. Future work involves researching smart devices, getting preliminary test scans or replicating scans for testing, and writing code to perform the TOT analysis."

Conclusions/action items:

Update status when applicable

Title: Status Update

Date: 11/6/2020

Content by: Thomas Turinske

Present: N/A

Goals: Update Website Status

Content:

The team has decided to return to the "Scanner" design. After a meeting with the client, concerns about encrypting the smart devices made this design option less feasible in comparison to the "Scanner" design. An ongoing task is ensuring the barcodes do not contain confidential patient information, and upon approval, will allow the team to continue saving timestamps to a Google Sheets document. Acquiring the scanner, generating test data, improving the data analysis code, and returning the scanners to Mohs lab for in-field data are the next steps in this project. (Updated 11/6/2020)

Conclusions/action items:

Update status when applicable

Title: Status Update

Date: 12/6/2020

Content by: Thomas Turinske

Present: N/A

Goals: Update Website Status

Content:

The team has decided to return to the "Scanner" design. After a meeting with the client, concerns about encrypting the smart devices made this design option less feasible in comparison to the "Scanner" design. The barcodes ended up containing confidential patient information, requiring scans to be routed into EPIC. This process requires slightly more manual formatting, but the convenience of the scanners has been proven effective in the lab. The data analysis code has been completed and provides a thorough review of the Mohs Lab TAT and is expandable to unlimited time stamp intervals. (Updated 12/6/2020)

Conclusions/action items:

Update status when applicable

Materials Research 10/1/2020

Title: Materials Research 10/1/2020

Date: 10/1/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: Research products that could be used in our designs

Content:

Simple android phone. Might be too cheap and too slow/difficult to work with

https://www.bestbuy.com/site/simple-mobile-tcl-a1-black/6325619.p?skuId=6325619

Amazon fire tablet. These have good reviews and should work fine. They are larger than a phone but this might make it easier to interact with the screen

https://www.amazon.com/dp/B07FKR6KXF

Stand for tablet:

https://www.amazon.com/AmazonBasics-Adjustable-Tablet-Holder-Stand/dp/B006ZT4VA0

Handheld barcode/QR code scanner (Wireless). Supports bluetooth connection to another device that receives data

https://www.walmart.com/ip/Aibecy-Handheld-2-4G-Wireless-1D-2D-QR-Barcode-Scanner-Bar-Code-Reader-with-USB-Receiver-4000-Code-Storage-Capacity-for-POS-PC-Android-IOS/141387852

Desktop QR reader. Would require physical connection to a computer or other device

https://www.walmart.com/ip/Aibecy-2200-1D-2D-QR-Bar-Code-Scanner-CMOS-Image-Desktop-Barcode-Reader-USB-Omnidirectional-Screen-Barcode-Scanner/622075932?wmlspartner=wlpa&selectedSellerId=101001360

Conclusions/action items:

Discuss with client whether any of these products would work. It seems like having dedicated scanners might be more accurate but more costly since they require an interfacing device. They will also be likely easier to use and more secure in terms of data security.

Brainstorming Individual 9/17/20

KEVIN TAN - Sep 17, 2020, 6:17 PM CDT

Title: Brainstorming Individual 9/17/20

Date: 9/17/20

Content by: Kevin Tan

Present: Kevin Tan

Goals: Brainstorm ideas for the project

Content:

Ideas for how to avoid assigning a time to the wrong timestamp in the event that a scan is skipped or done twice.

- 4 wireless scanners at each step and somehow have the computer detect which scanner is being used. This will depend on knowing which port the scanner is connected to. issue: it may not be possible with the hardware/software
- 4 wired or wireless scanners at each step plus 4 computers at each step. the data must be uploaded to the cloud or compiled at the end of each week. issue: requires more hardware which could be pricey
- 4 wired or wireless scanners plus a microcontroller such as an arduino and a usb host shield. the arduino could upload data to the cloud. issue: the microcontrollers would need power and internet access
- have a "cooldown" period between scans. This will make it less likely that a barcode gets scanned twice. issue: this doesn't eliminate skipped scans and it could be problematic if lab staff are moving quickly
- print out 3 or 4 different barcodes (or just have multiple on the same sticker) the correct barcode must be scanned at each step. issue: need to change the existing barcodes also human error if scan the wrong barcode
- switch to qr stickers and have lab workers scan using mobile device. issue: How would the phone interface with the data collection system and how would the qr encode this. A phone app would be difficult to develop. need to switch to new stickers

Conclusions/action items:

There are several approaches I can think of off the top of my head. Discuss with teammates and client and do research to explore the plausibility of each idea.

Preliminary Design Flowcharts 10/6/2020

Title: Preliminary Design Flowcharts 10/6/2020

Date: 10/6/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: Create a graphics for all three of our preliminary designs

Content:

The following are flow diagrams that describe the current lab process (yellow boxes) and proposed time tracking system (pink boxes)

the labels T1, T2, T3 and T4 are the times that the time tracking system is required to track.

Scanner design
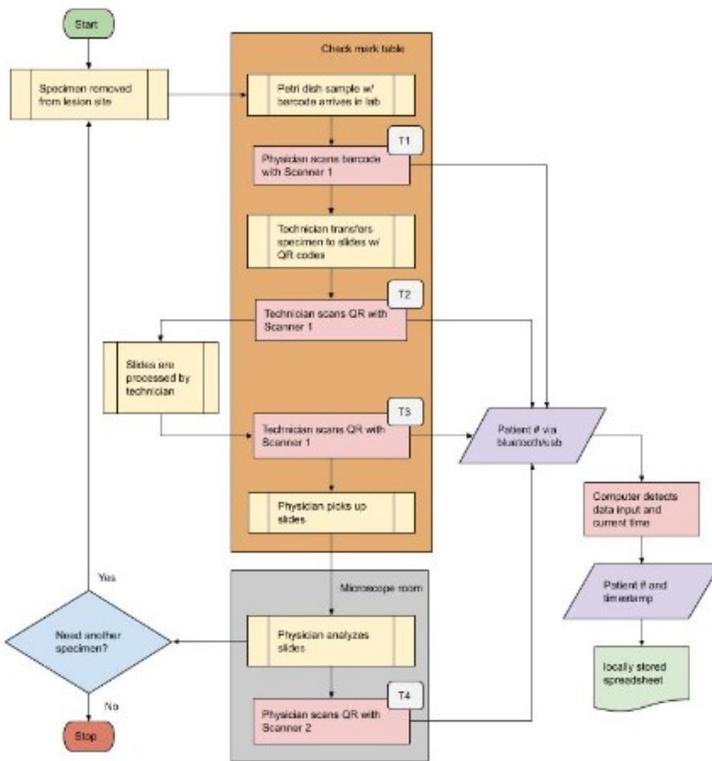
Smart Design
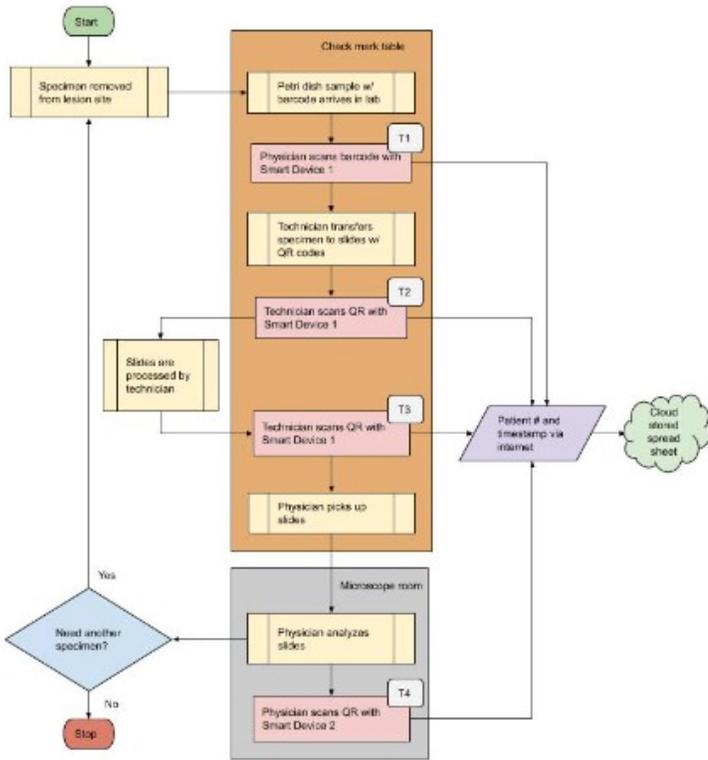
Mixed Design
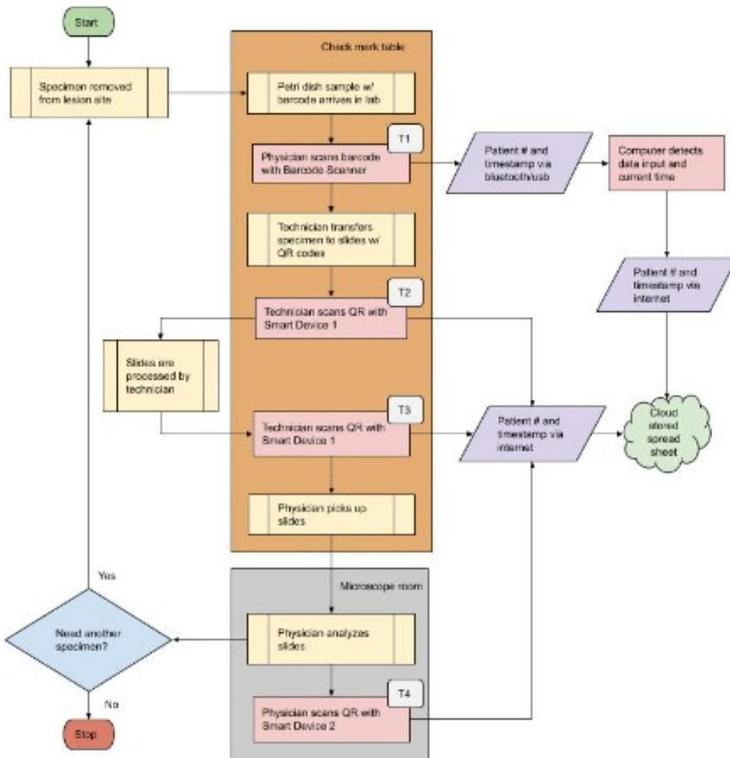
Conclusions/action items:

Include diagrams in the preliminary report. Make sure the client agrees with the flow diagrams and make any changes.

App Research 10/15/2020

KEVIN TAN - Oct 15, 2020, 7:41 PM CDT

Title: App Research 10/15/2020

Date: 10/15/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: Research possible apps to use

Content:

Barcode to Google Sheets by Bong Cheung

https://play.google.com/store/apps/details?
id=com.bong.barcode2sheets&hl=en_US&gl=US

Pros: allows user to enter in extra data after every scan. can have default values.
Pro version is a 1 time payment

cons: have to press "send data" each time. Also has ads but there is an option to
pay to get rid of ads

Scan to Google sheets by Felix Huneburg

https://play.google.com/store/apps/details?id=dynamiqdata.s2s&hl=en_US&gl=US

Pros: no ads in free version. Scans quickly with no popup after scan

Cons: adding additional data to scan is tricky and does not work on some devices
(It does not work on my phone but worked on the client's phone) Requires 5$/mo
for unlimited scans

Orcascan by Cambridge App Lab

https://play.google.com/store/apps/details?
id=com.orcascan.bulkbarcodescanner&hl=en_US&gl=US

Pros: lots of settings, customizability and has it's own cloud service (don't need to
use google sheets) Google / Excel integration with business plan

Cons: somewhat confusing to work with. 20$/mo for starter plan (1k rows)
100$/mo for business plan (20k rows)

Conclusions/action items:

Ask the client to review these apps and inquire about his price margin. I my opinion, the Barcode to google sheets seems like the cheapest option
and also seems like it will work for what we need.

Fake Test Data 10/23/2020

Title: Fake Test Data 10/15/2020

Date: 10/15/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: Create fake data to test data processing on

Content:

Crazyhair Bob		
Lil Chicken		
Watson AI		

https://www.barcodesinc.com/generator/index.php

using Barcode to Sheets app I recorded fake data. I pretended that I was the physician and my team members were technicians. I scanned barcodes for the first two time stamps and QR codes for the second two as it will be in the lab. Crazyhair Bob's initial specimen required another sample so that's why he shows up twice. Note: the time stamps are closer in time than will be expected in lab since I scanned repeatedly.

time stamp	patient ID	technician/physician	estimated time demand	Specimen No.	discard data?
2020-10-23 13:03:05.643	465421	Kevin Tan	medium	1	false
2020-10-23 13:05:49.641	465421	TJ Turinski	medium	1	false
2020-10-23 13:06:17.141	465421	TJ Turinski	medium	1	false
2020-10-23 13:06:31.142	465421	Kevin Tan	medium	1	false
2020-10-23 13:07:15.364	107706	Kevin Tan	long	1	false
2020-10-23 13:07:45.221	107706	Addie Drier	medium	1	false
2020-10-23 13:08:48.945	107706	Chris Pudzisz	medium	1	false
2020-10-23 13:09:08.019	107706	Kevin Tan	medium	1	false
2020-10-23 13:09:40.898	465421	Kevin Tan	short	2	false
2020-10-23 13:10:11.236	465421	anonymous	short	1	false
2020-10-23 13:10:53.958	465421	Madison Bugel	medium	1	false
2020-10-23 13:11:07.276	465421	Kevin Tan	medium	2	false
2020-10-23 13:11:39.584	165445	Kevin Tan	medium	1	false
2020-10-23 13:11:59.591	165445	TJ Turinski	medium	1	false
2020-10-23 13:12:21.088	165445	Kevin Tan	medium	1	true

Conclusions/action items:

Do data analysis on the data. Discuss the column choices with the client.

Data Analysis Code 11/12/2020

Title: Data Analysis Code 11/12/2020

Date: 11/12/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: Load data from google sheets and extract important information

Content: (python code)

```python
#required autentication
from google.colab import auth
auth.authenticate_user()
import gspread
from oauth2client.client import GoogleCredentials
gc = gspread.authorize(GoogleCredentials.get_application_default())

import pandas as pd
#load data from google sheets
wb = gc.open_by_url('https://docs.google.com/spreadsheets/d/1XNcwpygx5qF0zdGf-ijK-
W1hWElEPx3gj4KeZgYJ8Vs/edit#gid=1636026912')
#sheet = wb.worksheet('kevin_phone')
sheet = wb.worksheet('wireless_scanner')
data = sheet.get_all_values()
df = pd.DataFrame(data)
#add column headers
df.columns = df.iloc[0]
#remove document headers
df = df.iloc[1:]

import time
import datetime
def get_unix_time(raw_time_string):
  #
  # gets unix time given a date string. milliseconds are ignored
  #
  time_string = raw_time_string.partition(".")[0]
  result = time.mktime(datetime.datetime.strptime(time_string, "%Y-%m-%d %H:%M:%S").timetuple())
  return result
# calculate unix time
unix_time = [get_unix_time(time) for time in df["time stamp"]]
#create a new column for unix time or overwrite an old column of the same name
if "unix time" in df:
  df["unix time"] = unix_time
else:
  df.insert(1, "unix time", unix_time, True)
times = df["unix time"]

bucketed = []
#iterate over unique patient ids
for id in set(df["patient ID"]):
  site_array = []
  #iterate over timestamps with that given id
  for time in times[df["patient ID"] == str(id)].values:
    site_array.append(time)
```

```
      #if 4 timestamps have been added, append it and reset the site_array
      if len(site_array) == 4:
        bucketed.append((id,site_array))
        site_array = []
    #check if site array still contains elements. If so our data is incomplete but we can append it anyways
    if site_array:
      bucketed.append((id,site_array))

import statistics as stats
intervals = []
for id,timestamps in bucketed:
  #find the differences between each timestamp in seconds
  intervals.append((id,[j-i for i, j in zip(timestamps[:-1], timestamps[1:])]))
print(intervals)

#now we want to analyze each interval in the time tracking scheme
for i in range(3):
  #compile the time intervals for a given step given they exist
  step = [interval[i] for id,interval in intervals if len(interval)>i]
  #print the mean and population standard deviation of each step
  print("mean time between timestamp", i+1, "and", i+2, "=", stats.mean(step), "seconds \twith standard
deviation", str(stats.pstdev(step)))
```

Sample (formatted) Code output:

```
[
('107706', [30.0, 63.0, 20.0]), ('807701', [90.0, 63.0, 20.0]),
('465422', [164.0, 28.0, 14.0]), ('107707', [30.0, 63.0, 20.0]),
('465421', [164.0, 28.0, 14.0]), ('465421', [31.0, 42.0, 14.0]),
('107708', [30.0, 63.0, 20.0]), ('165445', [20.0, 22.0])
]
```

mean time between timestamp 1 and 2 = 69.875 seconds with standard deviation 57.97938750107662

mean time between timestamp 2 and 3 = 46.5 seconds with standard deviation 17.298843892006193

mean time between timestamp 3 and 4 = 17.429 seconds with standard deviation 2.9692299955832361

Conclusions/action items:

Find and report outliers

We may want to exclude incomplete data from analysis and instead report it as user error

Report the data in a separate worksheet or as visual plots

The way that the function get_unix_time works will need to change depending on how the time stamp looks with scanners.

Scanner Setup 11/21/2020

KEVIN TAN - Nov 22, 2020, 9:45 PM CST

Title: Scanner Setup 11/21/2020

Date: 11/21/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: Set up the wired scanner that was given to me by the client

Content:

Initially the scanner was set up to output the following when scanning a patient barcode

```
\D20-03363 A\
```

This was probably used for the previous usage of the scanner. I wanted to re-program it to output a carriage return (enter key) after each scan so it would populate the spreadsheet.

I found the user manual for the scanner at https://www.honeywellaidc.com/-/media/en/files-public/technical-publications/barcode-scanners/xenon/xenon-ug.pdf which contained barcodes used for reprogramming the scanner

Scanning the following barcode reset the scanner to factory default which did not contain the "\" prefix and suffix

DEFOVR.
Restore Factory Defaults

In order to add a carriage return after each scan, I scanned the following code:

PAP_AT.
IBM PC AT and Compatibles with
CR suffix

Next, since the Honeywell Xenon scanners do not have an internal Real Time Clock (RTC) A timestamp needed to be recorded in google sheets each time a new patient id was entered

entering the following function into cell B1 (the top row and second column)

```
=IF(A1<>"", IF(B1="",NOW(),B1), "")
```

Then highlighting the entire A column and pressing ctrl+enter puts the function into every single column. What the function does is it enters a timestamp into the A column if a value gets entered into the B column and there isn't already a timestamp

This function was sourced from https://excelribbon.tips.net/T013233_Automatically_Entering_a_Data_Entry_Time.html#:~:text=The%20simplest%20way%20to%20go,time%20as%20you%20want%20it.

Importantly: you must change file > settings > calculation to the following to allow iterative calculation:

Settings for this spreadsheet   ✕

General   Calculation

Recalculation

[On change ▾]   This affects how often NOW, TODAY, RAND, and RANDBETWEEN are
                               updated.

Iterative calculation

[On ▾]   Determines whether formulas with circular references are resolved
                               by iterative calculation. Learn more about iterative calculation.

Max number of iterations

[50]   The maximum number of calculation rounds to perform during
                               iterative calculation.

Threshold

[0.05]   The threshold value such that calculation rounds stop when
                               successive results differ by less.

                               [Cancel]   [Save settings]

Conclusions/action items:

Edit python code to handle the new timestamp format. Figure out if the client's other scanners/new scanner operates in the same manner. Reprogramming scanners is confusing but with usage of the correct user manual, it is doable.

Wired Scanner Fake Test Data 11/20/2020

Title: Wired Scanner Fake Test Data 11/20/2020

Date: 11/21/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: Create some fake data using sample patient labels and a wired scanner received from the client

Content:

time stamp	patient ID
11/21/2020 16:15:47	D20-03363 A
11/21/2020 16:15:53	D20-03363 B
11/21/2020 16:15:58	D20-03363 A
11/21/2020 16:16:01	D20-03363 B
11/21/2020 16:16:06	D20-03363 A
11/21/2020 16:16:09	D20-03363 B
11/21/2020 16:16:12	D20-03363 A
11/21/2020 16:16:15	D20-03363 B
11/21/2020 16:16:19	D20-03363 B
11/21/2020 16:16:21	D20-03363 B
11/21/2020 16:16:24	D20-03363 B
11/21/2020 16:16:30	D20-03363 B
11/21/2020 16:16:35	D20-03363 C
11/21/2020 16:16:53	D20-03363 C
11/21/2020 16:16:56	D20-03363 C
11/21/2020 16:17:01	D20-03363 C
11/21/2020 16:17:05	D20-03363 D
11/21/2020 16:17:08	D20-03363 D
11/21/2020 16:17:12	D20-03363 D
11/21/2020 16:17:16	D20-03363 E
11/21/2020 16:17:26	D20-03363 E
11/21/2020 16:17:31	D20-03363 E
11/21/2020 16:17:36	D20-03363 E
11/21/2020 16:17:43	D20-03363 E
11/21/2020 16:17:47	D20-03363 E
11/21/2020 16:17:52	D20-03363 E
11/21/2020 16:17:56	D20-03363 F
11/21/2020 16:18:01	D20-03363 G
11/21/2020 16:18:05	D20-03363 F
11/21/2020 16:18:13	D20-03363 F
11/21/2020 16:18:19	D20-03363 F
11/21/2020 16:18:27	D20-03363 G
11/21/2020 16:18:33	D20-03363 G
11/21/2020 16:18:50	D20-03363 H
11/21/2020 16:19:05	D20-03363 H
11/21/2020 16:19:19	D20-03363 H
11/21/2020 16:19:27	D20-03363 H
11/21/2020 16:19:37	D20-03363 I

time stamp	patient ID
11/21/2020 16:19:39	D20-03363 H
11/21/2020 16:19:48	D20-03363 H
11/21/2020 16:19:58	D20-03363 H
11/21/2020 16:20:03	D20-03363 H
11/21/2020 16:20:07	D20-03363 H
11/21/2020 16:20:12	D20-03363 H
11/21/2020 16:20:17	D20-03363 H
11/21/2020 16:20:22	D20-03363 H
11/21/2020 16:20:29	D20-03363 J
11/21/2020 16:20:33	D20-03363 J
11/21/2020 16:20:38	D20-03363 J
11/21/2020 16:20:41	D20-03363 J
11/21/2020 16:20:45	D20-03363 J
11/21/2020 16:20:48	D20-03363 J
11/21/2020 16:20:52	D20-03363 J
11/21/2020 16:20:55	D20-03363 J

Conclusions/action items:

Use this data to validate the python code

Data Analysis Code 11/23/2020

Title: Data Analysis Code 11/23/2020

Date: 11/23/2020

Content by: Kevin Tan

Present: Kevin Tan

Goals: record changes to the code. this code should be easy for the client to use

Content:

```python
#required autentication
from google.colab import auth
auth.authenticate_user()
import gspread
from oauth2client.client import GoogleCredentials
gc = gspread.authorize(GoogleCredentials.get_application_default())

import pandas as pd
import matplotlib.pyplot as plt

#load data from google sheets
wb = gc.open_by_url('https://docs.google.com/spreadsheets/d/1_yBW7Ru3XNIL9vjDs6FnFARy8Qn_OfF6YqJxhpdbPuk/edit#gid=0')
sheet = wb.worksheet('data collection')
data = sheet.get_all_values()
df = pd.DataFrame(data)
#add column headers
df.columns = df.iloc[0]
#remove document headers
df = df.iloc[1:]

site_id_head = df.columns[0]
time_stamp_head = df.columns[1]

import time
import datetime

def get_unix_time(raw_time_string):
  #
  # gets unix time given a date string. milliseconds are ignored
  #
  time_string = raw_time_string.partition(".")[0]
  result = time.mktime(datetime.datetime.strptime(time_string, "%m/%d/%Y %H:%M:%S").timetuple())
  return result

# calculate unix time
unix_time = [get_unix_time(time) for time in df[time_stamp_head]]

#create a new column for unix time or overwrite an old column of the same name
if "unix time" in df:
  df["unix time"] = unix_time
else:
  df.insert(1, "unix time", unix_time, True)

times = df["unix time"]
bucketed = []
incomplete = []
#iterate over unique patient ids
```

```python
for id in set(df[site_id_head]):
  site_array = []
  #iterate over timestamps with that given id
  for time in times[df[site_id_head] == str(id)].values:
    site_array.append(time)
    #if 4 timestamps have been added, append it and reset the site_array
    if len(site_array) == 4:
      bucketed.append((id,site_array))
      site_array = []
  #check if site array still contains elements. If so our data is incomplete and we can report it as such
  if site_array:
    incomplete.append((id,site_array))

print("incomplete data: ", incomplete)

###########################################################
#ALL TIME
print("\nStatistics of All Time:")

import statistics as stats
intervals_list = []
for id,timestamps in bucketed:
  #find the differences between each timestamp in seconds
  intervals_list.append((id,[j-i for i, j in zip(timestamps[:-1], timestamps[1:])]))

at_df = pd.DataFrame()
#at_df[site_id_head] = [id for id,intervals in intervals_list]

#now we want to analyze each interval in the time tracking scheme
for i in range(3):
  #compile the time intervals for a given step
  step = [intervals[i] for id,intervals in intervals_list]
  #add this step information to dataframe
  header = "T"+str(i+1)+"-T"+str(i+2)
  at_df[header]= step
  #print the mean and population standard deviation of each step
  print("interval", header, "median =", stats.median(step), "\tmean =", stats.mean(step), "seconds \twith standard deviation", str(stats.pstdev(step)))

turnaround_times = [sum(intervals) for id,intervals in intervals_list]

print("Turn Around Time mean =", "median =", stats.median(turnaround_times), "\tmean =", stats.mean(turnaround_times), "seconds \twith
standard deviation", str(stats.pstdev(turnaround_times)))

#find outliers
upper_outliers = []
lower_outliers = []
q1 = at_df.quantile(q=.25)
q3 = at_df.quantile(q=.75)
iqr = q3 - q1
upper = q3 + 1.5*iqr
lower = q1 - 1.5*iqr
for id,index in zip([id for id,intervals in intervals_list],range(len(intervals_list))):
  for column in at_df.columns:
    if at_df[column].iloc[index] > upper[column]:
      upper_outliers.append((id,str(column),at_df[column].iloc[index]))
    if at_df[column].iloc[index] < lower[column]:
      lower_outliers.append((id,str(column),at_df[column].iloc[index]))

for outlier in upper_outliers:
  print("found upper outlier with site id " ,outlier[0]," at time interval ", outlier[1], " with time interval ", outlier[2])
for outlier in lower_outliers:
  print("found lower outlier with site id " ,outlier[0]," at time interval ", outlier[1], " with time interval ", outlier[2])
```

```
boxplot = at_df.boxplot(column=list(at_df.columns))
```

Conclusions/action items:

Write instructions on how to use the code. Possibly output to another spreadsheet and possibly do statistics over days of the week

Research on Mohs (Copied from notebook dated for 9/15/2020)

CHRISTOPHER PUDZISZ - Dec 09, 2020, 8:43 AM CST

Title: Individual Mohs Research

Date: 9/15/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Gain a greater understanding of Mohs to apply to this project

Content:

What is Mohs:

- IEEE Citation: "What is Mohs surgery?," *American Academy of Dermatology*. [Online]. Available: https://www.aad.org/public/diseases/skin-cancer/types/common/melanoma/mohs-surgery. [Accessed: 15-Sep-2020].
- A treatment used for skin cancer that makes it visible to the surgeon whether the cancer has truly stopped.
    - High rate of success
    - Minimal surgery in comparison to other methods
        - Minimal skin removed

Other notes:

- IEEE Citation: "Mohs Surgery," *The Skin Cancer Foundation*, 17-Sep-2020. [Online]. Available: https://www.skincancer.org/treatment-resources/mohs-surgery/. [Accessed: 15-Sep-2020].
- Analyzed by pathologist in a lab (Most likely prepped by pathologist's assistant)
- Done with local anesthesia
- Cost less than some other treatment methods
- Low chance of skin being misshapen afterwards

Conclusions/action items:

The conclusion this research has lead to is that we should be prepared to handle multiple sites from a single patient, or a site being tested many times. Overall, it is also expected that many technicians/physicians may work on the same sample. Other than this, information has been gathered about the process of Mohs and treatment.

Ethical Concern Ideas 10/2/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:20 PM CST

Title: Ethical Concern Brainstorming

Date: 10/2/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Brainstorm possible ethical concerns that may occur during the course of this project so that it can be fixed or accounted for.

Content:

Ideas:

- Lack of sanitation / Samples being ruined due to transfer of bacteria
- Possible chance of data leak if data is stored on online computer
- Possible buildup of bacteria on a stationary scanner if not wiped down
- Turn around time could cause lab to rush samples in order to improve processing time

Possible Solutions:

- Constant sanitization of scanner to prevent bacteria buildup or spread
- Minimal touching of scanner if possible?
- Lab will have to manage their reactions to the TAT and their expectations accordingly, hopefully using the data in a constructive manner
- Will have to be discussed with group further...

Conclusions/action items:

There are a few ethical concerns or problems with a scanner in the lab, although most of them can be easily handled through constant sanitization. Overall, in terms of ethics the project is looking good and it appears that no problems will occur.

Research on HIPAA Compliance 10/30/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:29 PM CST

Title: HIPAA Compliance Research

Date: 10/30/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Find out how HIPAA compliance can be maintained through our project

Content:

The most likely option for data storage and analysis will be google sheets. As such research has been done on the HIPAA compliance of google.

IEEE Citation: HIPAA Compliance with Google Workspace and Cloud Identity. (n.d.). Retrieved October 30, 2020, from https://support.google.com/a/answer/3407054?hl=en

According to Google, they have received many types of certifications for security and data management, including HIPAA compliance for select accounts. The requirement for these select accounts is that they sign a Business Associative Agreement with Google and that the account is an administrative account (not a student or employee account). Google provides a document that must be signed and approved for this BAA. Once this is done, the Google account will be completely HIPAA compliant and able to accept patient data assuming the client is comfortable with such a thing.

Conclusions/action items:

To conclude, as long as the BAA is signed and approved by Google, the account can become HIPAA compliant. This means assuming there is no risk of data leak elsewhere, through using other programs, this is one of the most optimal ways of maintaining the safety of patient information while processing the data online.

CHRISTOPHER PUDZISZ - Dec 08, 2020, 1:13 PM CST

HIPAA Compliance with Google Workspace and Cloud Identity

Ensuring that our customers' data is safe, secure and always available to them is one of our top priorities. To demonstrate our compliance with security standards in the industry, Google has sought and received security certifications such as ISO 27001 certification and SOC 2 and SOC 3 Type II audits. For customers who are subject to the requirements of the Health Insurance Portability and Accountability Act (HIPAA), Google Workspace and Cloud Identity can also support HIPAA compliance.

HIPAA_Compliance_Google.pdf(100.4 KB) - download

Original Time Card System (Competition) 9/11/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:20 PM CST

Title: Analysis of Original Time Card System

Date: 9/11/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Analyze the flaws of the time card system to find out what needs to be improved

Content:

According to the first client meeting the current flaws are:

- Time card system relies on time cards, which are currently in limited stock and usually unavailable during the pandemic
- It is very easy to mess up a time stamp by misaligning it, thus ruining the whole time card
- There is a constant charge or need for payment to buy more and more time cards
- The system is overall very clunky
- Limited number of slots on a time card for processing a site

Possible fixes with an electronic system:

- Ideally it is a one time payment when purchasing equipment
- Once equipment is setup and ready, there is no need to wait for new time cards or equipment to record data
- Ideally there is automatic data processing
    - If it is automatic then there should be a large or infinite number of slots for data
    - Shouldn't be clunky if using technology to record data

Conclusions/action items:

Overall, moving to an electronic system over a manual system should help the lab in a variety of ways. The current time card system has a few fundamental flaws that cannot be ignored. It would be nice if the new system is a one time purchase so the lab can properly justify the $200 budget.

EPIC System 9/12/2020

CHRISTOPHER PUDZISZ - Dec 09, 2020, 8:41 AM CST

Title: EPIC System Competition Research

Date: 9/12/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Get an idea of what the future EPIC system our client will eventually upgrade to will include

Content:

- EPIC cannot really be considered competition from an objective standpoint as it is unknown exactly what our client will be presented with by them, and for what price.
- IEEE Citation: "Software," *Epic*. [Online]. Available: https://www.epic.com/software. [Accessed: 12-Sep-2020].
- However, we can get some general concepts from other EPIC systems that may be a good indicator of what to adopt:
    - HIPAA compliance
    - Secure patient data
    - Barcodes mean nothing outside of EPIC system (as far as we currently know)
    - Provides graph analysis of data that is easy to follow
    - Uses custom apps
    - Meets almost all universal standards for safety of patient information and other requirements for different hospitals

Conclusions/action items:

It was difficult to find very specific information from EPIC directly about the software that they offer, as it pretty much all inclusive. As a result, I grabbed the most important aspects of their system that could apply to our project. I feel that some of this criteria is achievable within a semester, however, some things such as a custom app may not be possible or secure.

Brainstorming ideas (Copied from handwritten notebook dated for 9/11/2020)

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:20 PM CST

Title: Initial Design Brainstorming

Date: 9/11/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Begin to brainstorm or generate ideas on what we could build for the TAT project. (Doesn't need to be perfect, but idea must be generated)

Content:

Replacement Scanning Systems:

- Handheld barcode scanner (like the ones used at grocery stores)
- Handheld QR code scanner
- Improved timestamp electronic reusable cards
- Purely electronic timestamp cards with a computer as the main input

Creation of digital records and analysis system:

- Use excel for automatic barcode recording
    - Examples:
        - Create custom code for excel that puts every new time it is timestamped in a new column
        - https://stackoverflow.com/questions/27108954/excel-barcode-scanning-macro
            - I don't know enough about coding, code may have unknown effect
        - IEEE Citation: Mobile Data Collection - Scan-IT to Office. [Online] Available: <https://appsource.microsoft.com/en-us/product/office/WA104381026?tab=Overview> [Accessed 30 October 2020].
        - Microsoft Data Collection - Scan-IT to Office
            - Microsoft scanning app (clunky and unknown integration)

Conclusions/action items:

Four ideas have been generated, although their viability has not been accounted for yet. These ideas will be presented to the group when we evaluate our ideas. Code for excel sheets already exists and it is an offline option, although this removes the ability for us to access the data online.

Google sheet calculation ideas 10/9/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 1:26 PM CST

Title: Google Sheet Calculations Research For Useful Functions (Individual Research)

Date: 10/9/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Get a grasp on useful functions such as averages and how to do them in google sheets

Content:

Context Notes: The team has decided to move forward with the SMART design through use of a tablet which should automatically upload the scan to google sheets. From there, functions can be used to generate averages or other data.

Useful Functions:

- Average (): Allows an average to be generated from a data set so that the average of a specific station can be found.
  - First the differences between scan in times needs to be calculated.
- Google sheets has a feature that can color a square of the sheet green or red based on its data value which may be possible using the average.
  - Benefit of this is that data becomes much easier to read and identify if a trial was successful in terms of TAT or not.
  - Drawback is that it would be hard to do if there are any incorrect data points or miss-scans unless they are manually corrected.
- May be able to script the generations of new sheets daily or weekly as well as the compilation of averages for these sheets.
- There is a function DSTDEV to return the standard deviation of a data set which may be useful for analyzing outliers in the data.

Conclusions/action items:

It is currently unknown how well these ideas will mix with the SMART design or if any problems will arise, but it is believed that these could be useful in data analysis for comparison to the previous design (time cards). Overall, these functions really need a lot of data to work with (weeks worth) in order to compile proper data to identify outliers.

Further Ideas on Google Sheets (Macros and Scripts) 10/23/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:21 PM CST

Title: Google Sheets Research into Scripts and Macros

Date: 10/23/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Look further into data processing in Google Sheets and a way to automate it

Content:

Ideas on how to automate making graphs:

- Google has apps script which allows for the editing of data in google sheets in a very rigid way (Doesn't appear to be able to account for wrong data points or mis-entries)
    - What this can do is generate graphs (assuming one knows how to code) and may be able to generate additional data that is required
    - Downside is that it is very rigid and would need to be activated manually each time as there is no apparent way to automate it completely this way
- Other idea is a program like AutoHotKey or something similar
    - This program can repeat clicks on screen or typing actions at set time intervals or a specific time
    - The benefit to this is that it could automate scripting or similar data compilation
    - The negative is that keystrokes or inputs must be recorded exactly and will repeat the same every time with no room for change

Conclusions/action items:

The conclusion to this is that currently, these solutions do not quite match our criteria for this project but may become a part of the solution. These applications are useful for rigid actions that could take place assuming nobody from the lab needs to touch the computers.

Show and Tell Response Interpretation 11/2/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 5:01 PM CST

Title: Interpretation and Brainstorming based off of Show and Tell Responses

Date: 11/2/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Take the useful information from our show and tell responses to come up with a possible solution to our problems

Content:

- Problem: HIPAA Compliance is the site barcode is attached to patient info
    - Show and tell ideas:
        - Use a middle-man program to provide alternate numbers before it reaches google sheets
            - Pros: Can be implemented with our current system
            - Cons: Client is questioning of this as there is still risk of data leak if it is not truly randomized
        - Ask our client if Google being HIPAA compliant is enough to maintain patient safety
            - Pros: Don't have to change existing system
            - Cons: Data is still online and may be accessed somehow which would breach patient safety
        - Use a different cloud program
            - Pros: We may be able to better secure patient information
            - Cons: We would have to revamp the entire current system in order to adapt it to the new platform and also find a way to use scripts to interpret data on the new platform

Final idea out of these suggestions:

- We will stick with Google HIPAA compliance, assuming our client agrees to a BAA with Google. This provides the easiest method of data manipulation to provide the lab with the comparisons that they desire while also maintaining patient information safety.

Conclusions/action items:

Overall, we had already discussed most of these ideas with our client earlier. As a result, Google HIPAA compliance was the most appealing option since it is the easiest to implement in the lab safely.

Basic Outline of To-Do List/ Gantt Chart 11/6/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 1:59 PM CST

Title: Very Basic Outline of the Plan for the Semester / Gantt Chart Outline

Date: 11/6/2020

Content by: Chris, TJ Turinske, Madison (For Content in Google Doc) / Chris (For Content in this entry)

Present: Chris, TJ Turinske, Madison

Goals: Create a basic outline and goal times for the remaining steps of the project

Content:

A basic outline of the remaining steps for the project for the semester was created as a method to make sure the project was on track for completion and success. Some major events that have been included:

- Obtaining the scanner
- Creating a survey for the lab for comparison to their old system
- Development of test data and using fake data to test code
- Further error testing of code
- Presenting summary information to client
- Final Poster deadlines by part
- Final Deliverables

Link to Google Doc for viewing: https://docs.google.com/document/d/1Fbi52WnT2W1rgXTnF-cVBlYdlxIfh9RBtCxsGOzvzvQ/edit?usp=sharing

Conclusions/action items:

Attached is the Google doc that the entire document was created in. Whilst it isn't perfect, this is the general guideline that the project should follow for optimal progress and an even distribution of workload. Overall, it helps to grasp the amount of progress needed to finish the project in the given time.

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:52 PM CST

To-Do_List__Rough_Gantt_Chart.pdf(43.1 KB) - download

Brainstorm for Satisfaction Survey 11/13/2020 - 11/19/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:21 PM CST

Title: Survey Brainstorming Ideas

Date: 11/13/2020 - 11/19/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Create a survey for the lab to score the new system and its usability in the lab

Content:

For Everyone Accessing the Survey:

- How much did the system inconvenience your workflow due to the amount of time needed to use it?
    - Rate: 1 (Created lots of delays) - 5 (No Impact to work flow)
- How complicated was it to learn the system?
    - Rate: 1 (Took multiple days of trial and error with mis-inputs) - 5 (Learnable to a usable and understandable extent in under 1 day)
- How congested was the scanning station?
    - Rate: 1 (Multiple people constantly lined up due to wait time) - 5 (Station was always or very close to always open)
- Was there any technical problems when scanning?
    - Rate: 1 (Lots of scanning problems / Wouldn't scan) - 5 (No problems)
- If there was a problem please list it below: _____

For those accessing sheet information:

- How readable and interpretable was the raw data presented in the spreadsheet?
    - Rate: 1 (Hard to find data that you are looking for) - 5 (Can easily find necessary data and information)
- How readable and interpretable were the data graphs and analysis presented in the spreadsheet?
    - Rate: 1 (Hard to understand the meaning behind the data) - 5 (Can easily understand the data)
- How hard was it to enter data in the sheets (Names, etc)?
    - Rate: 1 (Hard to find columns or places to enter data correctly) - 5 (Data columns match up exactly with barcode numbers making it easy to enter technician/other's names)

An updated link with edits from group member, Madison, for viewing
is: https://docs.google.com/document/d/1xR8kQyj859jVtBRp9HxiV600ePhFxexeOGfsUG7pbMA/edit?usp=sharing

Conclusions/action items:

Overall, this is a strong start to a survey in that it covers all the major criteria that will be needed for comparison. What needs to be fixed is the phrasing and how exactly to compare it to the old system. The rating criteria could also be edited to make it more formal and understandable.

How much did the system inconvenience your workflow due to the amount of time needed to use it?
Rate: 1 (Created lots of delays) - 5 (No impact to work flow)

How complicated was it to learn the system?
Rate: 1 (Took multiple days of trial and error with mis-inputs) - 5 (Learnable to a usable and understandable extent in under 1 day)

How congested was the scanning station?
Rate: 1 (Multiple people constantly lined up due to wait time) - 5 (Station was always or very close to always open)

Was there any technical problems when scanning?
Rate: 1 (Lots of scanning problems / Wouldn't scan) - 5 (No problems)
If there was a problem please list it below

How would you compare this system with the last?
Rate: 1 (other system more) - 5 (new system)

For those accessing sheet information:

How readable and interpretable was the raw data presented in the spreadsheet?
Rate: 1 (Hard to find data that you are looking for) - 5 (Can easily find necessary data and information)

How readable and interpretable were the data graphs and analysis presented in the spreadsheet?
Rate: 1 (Hard to understand the meaning behind the data) - 5 (Can easily understand the data)

How hard was it to enter data in the sheets (Names, etc)?
Rate: 1 (Hard to find columns or places to enter data correctly) - 5 (Data columns match up exactly with barcode numbers making it easy to enter technician/other's names)

If you had to change anything what would it be?

Brainstorming_Satisfaction_Survey_BME.pdf(33.8 KB) - download

Satisfaction Survey Work (11/20/2020 - 11/26/2020)

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:21 PM CST

Title: Work on system survey work for client use

Date: 11/20/2020 - 11/26/2020

Content by: Chris Pudzisz, TJ Turniske, Madison (For Google Survey), Chris Pudzisz (For this entry)

Present: Chris Pudzisz, TJ Turniske, Madison

Goals: Turn brainstorming ideas into survey usable by lab staff for valid feedback

Content:

Madison added some ideas to my brainstorming and transferred it over to the google survey to format it. Then I formalized all the questions and ratings, as well as adding some more ideas of my own and reevaluating the criteria I had presented. After that TJ looked over the survey and fixed it so it specifically addressed the old time card system and the new system we are implementing.

Conclusions/action items:

Overall the survey went very well and we received feedback from the client that indicated that our system was an improvement over the old one. In terms of the creation of the survey, the questions now formally address all the required comparisons concisely for easier interpretation.

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:54 PM CST

v._2_-_Moh_s_Time_Tracking_Satisfaction_Survey_-_Google_Forms.pdf(92.9 KB) - download

Satisfaction Survey Results 12/3/2020 - 12/4/2020

CHRISTOPHER PUDZISZ - Dec 08, 2020, 4:22 PM CST

Title: Final results from survey to lab

Date: 12/3/2020 - 12/4/2020

Content by: Chris Pudzisz

Present: Chris Pudzisz

Goals: Analyze or interpret results of satisfaction survey from client

Content:

Overall, our survey data was very promising given the circumstances of our project (Unable to enter the lab or setup a local system as we lack access to the lab). Our system was more successful in every category of the survey, although it was not perfect. What this means is that improvements can be made, one of which was providing more scanners so that one can go to each lab technician and physician. This is something that will have to be expanded upon in future semesters or when the system gets integrated into EPIC due to the timing of how late we were able to fully implement our system in the lab.

Exact data is linked in a google sheet below:

https://docs.google.com/spreadsheets/d/1PVy4J6LGEj2L4hpI0gYKx49BqiTGVMObitO7EAqmG2M/edit?usp=sharing

Conclusions/action items:

The survey was very helpful in comparing our new scanner system to their old time card system. We found out both the advantages ours has and the weaknesses that can be fixed in the future.

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:57 PM CST

Screen_Shot_2020-12-09_at_1.56.08_PM.png(43.9 KB) - download

CHRISTOPHER PUDZISZ - Dec 09, 2020, 1:57 PM CST

Screen_Shot_2020-12-09_at_1.56.19_PM.png(171.4 KB) - download

2014/11/03-Entry guidelines

John Puccinelli - Sep 05, 2016, 1:18 PM CDT

Use this as a guide for every entry

- Every text entry of your notebook should have the **bold titles** below.
- Every page/entry should be **named starting with the date** of the entry's first creation/activity, subsequent material from future dates can be added later.

You can create a copy of the blank template by first opening the desired folder, clicking on "New", selecting "Copy Existing Page...", and then select "2014/11/03-Template")

Title: Descriptive title (i.e. Client Meeting)

Date: 9/5/2016

Content by: The one person who wrote the content

Present: Names of those present if more than just you (not necessary for individual work)

Goals: Establish clear goals for all text entries (meetings, individual work, etc.).

Content:

Contains clear and organized notes (also includes any references used)

Conclusions/action items:

Recap only the most significant findings and/or action items resulting from the entry.

2014/11/03-Template

ADELINE DRIER - Nov 25, 2020, 1:50 PM CST

Title:

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items: