

BME Design-Fall 2023 - Matt Hudson Complete Notebook

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Team contact Information

MEGHAN KAMINSKI - Dec 10, 2023, 5:48 PM CST

Last Name	First Name	Role	E-mail	Phone	Office Room/Building
Settell	Megan	Advisor	settell@wisc.edu		
Martin	Beth	Client	beth.martin@wisc.edu		
Hudson	Matt	Leader	mrhudson2@wisc.edu	612-516-0067	
Kaminski	Meghan	Communicator	mfkaminski@wisc.edu	630-549-4521	
Bailey	Colin	BSAC	cgbailey@wisc.edu	262-646-0863	
Sagues	Sara	BWIG	ssagues@wisc.edu	(512) 696-8710	
Pies	Daniel	BPAG	dpies@wisc.edu	812-639-6242	



Project description

SARA SAGUES (ssagues@wisc.edu) - Oct 11, 2023, 1:09 PM CDT

Course Number: BME 200/300

Project Name: Alert Device for Walker

Short Name: ADW

Project description/problem statement:

Older adults want to remain independent. Those who use a walker device often feel confined or do not want to admit when it is not as easy anymore and possibly lose independence. An alert system associated with their walker could provide warnings and reminders that could improve safety for older adults.

About the client:

Dr. Beth A Martin - Pharmacy Practice & Translational Research Division at UW Madison



9/14/2023 Intro Client Meeting/ PDS planning

Matt Hudson - Oct 06, 2023, 8:45 PM CDT

Title: Intro Client Meetin / PDS planning

Date: 9/14/2023

Content by: Group

Present: Group

Goals: Create a list a questions for the client to understand the scope of the project

Content:

-see attachment

Conclusions/action items:

Talk to advisor about planning out the semester, start creating a PDS and conducting research

Matt Hudson - Oct 06, 2023, 8:45 PM CDT



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Question_Bank_for_Dr.Martin.pdf (39.5 kB)



9/21/23 Second client meeting

MEGHAN KAMINSKI - Oct 11, 2023, 5:34 PM CDT

Title: Second client meeting

Date: 9/21/23

Content by: Meghan

Present: Whole team

Goals: To talk with Dr. Martin about updates and moving forward in the design process.

Content:

- Discussed the progress so far in the process
- Discussed our initial three designs
- Got feedback from Dr. Martin about which design she liked best.
- Planned the next meeting time
- Talked about the preliminary presentation
- Talked about resources to retrieve a walker that is usable for the project

Conclusions/action items: Use Dr. Martins resources and advice with moving forward in the design process. Set up the focus group with Dr. Fields to collect data and opinions from potential users and caregivers of potential users. Continue to keep Dr. Martin updated through meetings and the communicator.



11/30/23- Third client meeting

MEGHAN KAMINSKI - Dec 10, 2023, 5:46 PM CST

Title: Meeting with client

Date: 11/30/2023

Content by: Group

Present: Group

Goals: Update Dr. Martin on progress this far

Content:

- Updated Dr. Martin on progress
- Discussed drawbacks of the progress
- Discussed potential future work
- Invited Dr. Martin to poster presentation

Conclusions/action items:

Continue to complete fabrication as best as possible before the poster session.



11/30/23- Meeting with Dr. Fields

MEGHAN KAMINSKI - Dec 10, 2023, 5:42 PM CST



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Meeting_notes_11_30_23- Dr. Fields_.docx (7.63 kB)

MEGHAN KAMINSKI - Dec 10, 2023, 5:44 PM CST

Title: Meeting with Dr. Fields

Date: 11/30/2023

Content by: Group

Present: Group

Goals: Get a better understanding of testing ideas applicable to the project

Content: Compiled a list of testing ideas that would be applicable to the correct audience

-see attachment

Conclusions/action items:

Begin making the survey for the testing ideas generated in the meeting



9/8/23 Intro/First Advisor Meeting

MEGHAN KAMINSKI - Oct 11, 2023, 5:40 PM CDT

Title: Introduction Advisor Meeting

Date: 9/15/23

Content by: Meghan

Present: Whole Team

Goals: Introductions of the team and advisor, establish a time to meet weekly, and begin discussing first due dates

Content:

- Introductions from the team
- Introductions from Dr. Megan Settell
- Established a team meeting time of 12:05
- Established team roles
- Discussed first big due dates

Conclusions/action items: Use this knowledge to apply to our meeting going forward. Continue to show up to meetings and contribute to the team. Begin the initial work for the project.



9/15/23 Second Advisor Meeting

MEGHAN KAMINSKI - Oct 11, 2023, 6:18 PM CDT

Title: Second Advisor Meeting

Date: 9/22/23

Content by: Meghan

Present: Whole Team

Goals: Discuss the first client meeting and discuss future paper requirements

Content:

- Recapped the first client meeting
- Discussed the PDS due in one week
- Discussed the rigor for the class
- Discussed the team roles in more details

Conclusions/action items: Use the knowledge from Dr. Megan Settell for the PDS. Use the information from Dr. Settell and Dr. Martin for the first design ideas.



9/22/23 Third Advisor Meeting

MEGHAN KAMINSKI - Oct 11, 2023, 6:23 PM CDT

Title: Third Advisor Meeting

Date: 9/22/23

Content by: Meghan

Present: Whole Team

Goals: Review any questions about the PDS and discuss the design matrix requirements

Content:

- Asked questions about the requirements of the PDS
- Received a bit of feedback on the PDS
- Talked about the design matrix requirements
- Talked about the timeline of the semester and the pace it moves at
- Began to brainstorm initial ideas of designs

Conclusions/action items: Use the knowledge from Dr. Settell and apply it to the design matrix. Make last edits to the PDS before turning in. Individual team members should fulfill their weekly jobs.



9/29/23 Fourth Advisor Meeting

MEGHAN KAMINSKI - Oct 11, 2023, 6:13 PM CDT

Title: Fourth Advisor Meeting

Date: 9/29/23

Content by: Meghan

Present: Whole Team

Goals: Discuss requirements for preliminary presentation, go over the design matrix, and go over the preliminary designs

Content:

- Discussed the design matrix
- Narrowed down the design matrix into three categories instead of six.
- Discussed the requirements for the preliminary presentation
- Discussed the strongest preliminary design
- Talked about the future weeks with the design process
- Talked about the future weeks with paper requirements of the course

Conclusions/action items: Use the information from the meeting and apply it towards the preliminary presentation. Continue to complete research that will aid our chosen design. Begin working on the future paper requirements, such as progress report and notebook checks.



10/20/2023 - Fifth Advisor Meeting

Matt Hudson - Oct 27, 2023, 12:44 PM CDT

Title: Advisor Meeting

Date: 10/20/2023

Content by: Everyone

Present: Everyone

Goals:

Content:

-see attachment

Conclusions/action items:

-prepare to order materials

Matt Hudson - Oct 27, 2023, 12:44 PM CDT

5-minute meeting to discuss, keeping on track

Update on all team

- Did more updates for their report with the writing portion of the project
- Prepared domain and prototype
- Reviewed all materials for endorsement

Show and Tell

- Update on building to show for 2 weeks
- Don't need more funding for items and will just be physical parts
- All open fundamental parts

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Advisor_Notes_10_20.docx (6.78 kB)



10/27/2023 - Sixth Advisor Meeting

Matt Hudson - Oct 27, 2023, 12:45 PM CDT

Title: Advisor Meeting

Date: 10/20/2023

Content by: Everyone

Present: Everyone

Goals:

Content:

-see attachment

Conclusions/action items:

-prepare to order materials

Matt Hudson - Oct 27, 2023, 12:45 PM CDT

Advisor Meeting (1) minutes

- To find out what having two seats
- Plan to order and fill
- Showed up
- had job to get done
- No formal order necessary

Open Meeting (1) min

- discussed why we work on what part
- Goals - open
- David and Meghan - ordered
- Matt and Sam - 10/20

Going to meet with the other members to see what to discuss

- The order
- initial understanding of materials needed
- To get as far as possible for order and fill
- To get the things off the order work

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Advisor_and_Team_Meeting_10_27.pdf (25 kB)



11/3/23- Seventh Advisor Meeting

MEGHAN KAMINSKI - Dec 07, 2023, 4:28 PM CST

Title: Advisor Meeting

Date: 11/3/23

Content by: everyone

Present: everyone

Goals: Discuss the current stage of fabrication

Content: Talked about the limitations of the products, got information of professors with coding experience, talked about show and tell

Conclusions/action items: Use the information from the meeting to apply it to research and changes of the design as we work through fabrication



11/10/23 Eight Advisor Meeting

MEGHAN KAMINSKI - Dec 07, 2023, 4:36 PM CST

Title: Advisor Meeting

Date: 11/10/23

Content by: everyone

Present: everyone

Goals: Talk about the progress of fabrication

Content: Talked about the progress in the code, told our limitations thus far, and explained the struggles with meeting at efficient times.

Conclusions/action items: Continue to work on the coding, work on integrating the systems together, and create ideas for new solenoids



11/20/23 Ninth Advisor Meeting

MEGHAN KAMINSKI - Dec 07, 2023, 4:18 PM CST

- Questions for 11/20:
1. Testing/feasibility on PDS concerns
 2. Look over PDS
 - Formatting
 - Missing content
 - Discuss critical implications
 - Potential environmental analysis
 3. Thoughts on testing
 - Scope and of items
 - # number of items that can be tested
 - Number of iterations per test
 - Talk with client regarding in exploration types of testing
 4. How do we expect our strategic marketing partners from preliminary report
 5. Update on what we can do about paper?

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Meeting_Notes_11_20_1_.docx (6.94 kB)

MEGHAN KAMINSKI - Dec 07, 2023, 4:22 PM CST

Title: Advisor Meeting

Date: 11/2023

Content by: everyone

Present: everyone

Goals: Discuss edits to the PDS, ask poster questions, and discuss testing

Content: see attachment

Conclusions/action items: Use the information from advisor to apply to testing and other formal documents



12/1/23 Tenth Advisor Meeting

MEGHAN KAMINSKI - Dec 07, 2023, 4:09 PM CST



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Advisor_meeting_12_1_23.docx (6.88 kB)

MEGHAN KAMINSKI - Dec 07, 2023, 4:11 PM CST

Title: Advisor Meeting

Date: 12/1/23

Content by: everyone

Present: everyone

Goals: Talk about the final steps in the fabrication process and ask about printing

Content: see document attached

Conclusions/action items: Print the poster, finish the code, and finish fabrication



12/5/23 Eleventh Advisor Meeting

MEGHAN KAMINSKI - Dec 07, 2023, 4:14 PM CST

Title: Advisor Meeting

Date: 12/5/23

Content by: Meghan

Present: Colin and Matt

Goals: Discuss plans for testing and issues about printing

Content: Finalized a plan for testing, received feedback of the finished code, and reviewed requirements of the poster.

Conclusions/action items: Test the design according to the testing plan, finish the poster, start working on the final report



9/29/2023 Design Matrix

Matt Hudson - Oct 06, 2023, 9:01 PM CDT

Title: Design Matrix

Date: 9/29/2023

Content by: Group

Present: Group

Goals: Create a way to evaluate potential design ideas

Content:

-see attachment

Conclusions/action items:

-create a preliminary presentation

Matt Hudson - Oct 06, 2023, 9:02 PM CDT

	Design 1	Design 2	Design 3	Design 4
Criteria 1	High	Medium	Low	Very Low
Criteria 2	Low	High	Medium	Very High
Criteria 3	Medium	Very Low	High	Low
Criteria 4	Very High	Low	Very High	Medium
Criteria 5	Low	High	Medium	Very Low

	Design 1	Design 2	Design 3	Design 4
Criteria 1	High	Medium	Low	Very Low
Criteria 2	Low	High	Medium	Very High
Criteria 3	Medium	Very Low	High	Low
Criteria 4	Very High	Low	Very High	Medium
Criteria 5	Low	High	Medium	Very Low

	Design 1	Design 2	Design 3	Design 4
Criteria 1	High	Medium	Low	Very Low
Criteria 2	Low	High	Medium	Very High
Criteria 3	Medium	Very Low	High	Low
Criteria 4	Very High	Low	Very High	Medium
Criteria 5	Low	High	Medium	Very Low

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Design_Matrix_2023.xlsx (6.43 kB)



9/14/2023 - Progress Report #1

Matt Hudson - Oct 11, 2023, 8:06 PM CDT

Title: Progress Report #1

Date: 9/14/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

Matt Hudson - Oct 11, 2023, 7:59 PM CDT



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Progress_Report_1 - 2023.docx (13.2 kB)



9/21/2023 - Progress Report #2

Matt Hudson - Oct 11, 2023, 8:06 PM CDT

Title: Progress Report #2

Date: 9/21/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

Matt Hudson - Oct 11, 2023, 8:00 PM CDT



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Progress_Report_2_-_2023.docx (13.1 kB)



9/28/2023 - Progress Report #3

Matt Hudson - Oct 11, 2023, 8:06 PM CDT

Title: Progress Report #3

Date: 9/28/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

Matt Hudson - Oct 11, 2023, 8:02 PM CDT



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Progress_Report_3_-_2023.docx (78.8 kB)



10/05/2023 - Progress Report #4

Matt Hudson - Oct 11, 2023, 8:05 PM CDT

Title: Progress Report #4

Date: 10/05/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

Matt Hudson - Oct 11, 2023, 8:04 PM CDT



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Progress_Report_4 - 2023.docx (78.6 kB)



10/12/2023 - Progress Report #5

Matt Hudson - Oct 11, 2023, 8:05 PM CDT

Title: Progress Report #5

Date: 10/12/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

Matt Hudson - Oct 11, 2023, 8:08 PM CDT



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Progress_Report_5_-_2023.docx (78.3 kB)



10/19/2023 - Progress Report #6

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:02 PM CST

Title: Progress Report #6

Date: 10/19/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:02 PM CST



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10/26/2023 - Progress Report #7

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:04 PM CST

Title: Progress Report #7

Date: 10/26/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:04 PM CST



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11/2/2023 - Progress Report #8

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:05 PM CST

Title: Progress Report #8

Date: 11/2/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:05 PM CST



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Progress_Report_8_-_2023.pdf (575 kB)



11/9/2023 - Progress Report #9

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:06 PM CST

Title: Progress Report #9

Date: 11/9/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:06 PM CST



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11/16/2023 - Progress Report #10

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:07 PM CST

Title: Progress Report #10

Date: 11/16/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

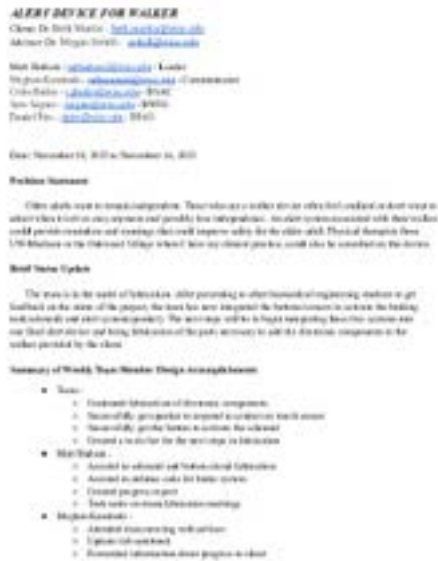
Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:07 PM CST



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Progress_Report_10_-_2023.pdf (575 kB)



11/30/2023 - Progress Report #11

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:08 PM CST

Title: Progress Report #11

Date: 10/30/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:09 PM CST



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Progress_Report_11_-_2023.pdf (312 kB)



12/7/2023 - Progress Report #12

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:09 PM CST

Title: Progress Report #12

Date: 12/7/2023

Content by: Group

Present: Group

Goals: Cover weekly goals and accomplishments

Content:

-see attachment

Conclusions/action items:

Continue to record on a weekly basis

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:10 PM CST



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Progress_Report_12_-_2023.pdf (313 kB)



Up-To-Date Expense Sheet

Matt Hudson - Oct 06, 2023, 8:52 PM CDT

Title: Expenses

Date: 10/6/2023

Content by: Group

Present: Group

Goals: Record Expenses for the project

Content:

-see attachment

Conclusions/action items:

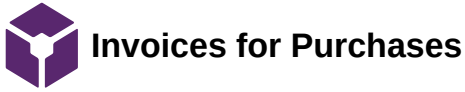
Keep track of expenses going forward.

Daniel Pies - Dec 07, 2023, 3:55 PM CST



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BPAG_Expense_Spreadsheet_1_.xlsx (41.7 kB)



Daniel Pies - Dec 07, 2023, 4:09 PM CST

Title: Invoices for Purchases

Date: 12/7/23

Content by: Group

Present: Group

Goals: Report all invoices/receipts from purchases

Content:

-see attachment

Daniel Pies - Dec 07, 2023, 4:02 PM CST



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Arduino_Microcontroller_-_Order_113-8918342-9685012.pdf (105 kB)



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Arduino_Shop_Invoice.pdf (162 kB)



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Breadboards_-_DK_INVOICE_100691864.pdf (84 kB)



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Resistor_Kit_-_Order_113-9078805-7801811.pdf (107 kB)

Daniel Pies - Dec 07, 2023, 4:02 PM CST



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Solenoid_- Order_113-0482317-0220243.pdf (106 kB)

Daniel Pies - Dec 07, 2023, 4:02 PM CST



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Speaker_- DK_INVOICE_100691866.pdf (84.2 kB)



11/02/2023: Fabrication meeting details

Title: Fabrication meeting**Date:** 11/01/2023**Content by:** Whole group**Present:** Whole group**Goals:** To start fabricating individual parts of the device, the solenoid, the speaker, the button, and the touch sensor**Content:****Speaker:**

```
int piezoPin = 8;

void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:
  /*Tone needs 2 arguments, but can take three
  1) Pin#
  2) Frequency - this is in hertz (cycles per second) which determines the pitch of the noise made
  3) Duration - how long the tone plays
  */
  tone(piezoPin, 1000, 500);
  delay(2500);
}
```

- Digital pin 8 is the input that is grounded
- 2 second delay between beeps

- 1000 represents the frequency that is played
- Next step is to create a if and else statement that produces a cut off point for the speaker

Reference used:

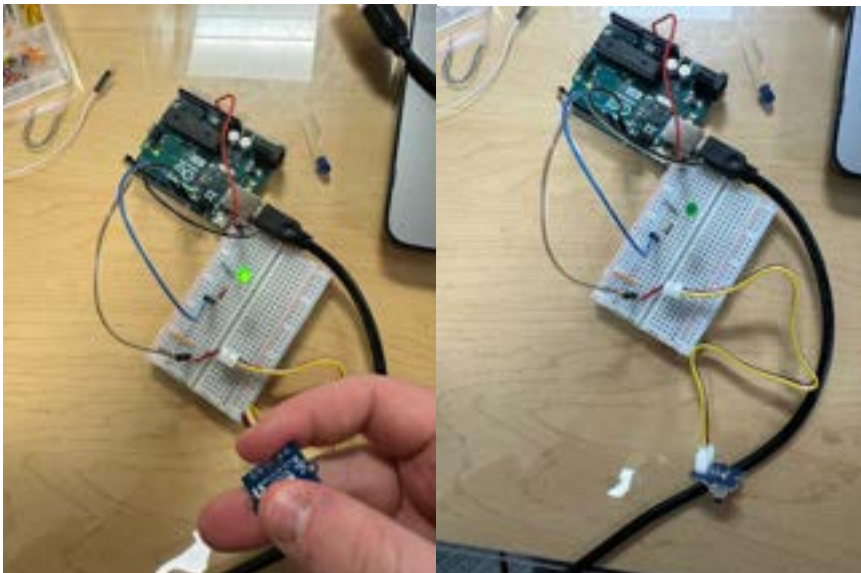
<https://www.programmingelectronics.com/an-easy-way-to-make-noise-with-arduino-using-tone/>

Button:

Starting code -

```
void setup() {  
  pinMode(12, OUTPUT);  
  pinMode(2, INPUT);  
}  
  
void loop() {  
  if(digitalRead(2) == HIGH) { //if the button is pushed  
    digitalWrite(12,HIGH); //LED on  
  }  
  else{ // if button is not pushed  
    digitalWrite(12,LOW); //LED off  
  }  
}
```

Images of circuit -



Input pin is 2, output pin is 12, 5V source from computer to arduino

Brown wire → pin 2

Blue wire → pin 12

Black wire → GND

Red wire → 5V input

Solenoid:

- Starting Code:

```
const int SOLENOID = 8;
```

```
void setup() {
```

```
  // put your setup code here, to run once:
```

```
  pinMode(SOLENOID,OUTPUT);
```

```
}
```

```
void loop() {
```

```
  // put your main code here, to run repeatedly:
```

```
  digitalWrite(SOLENOID,HIGH);
```

```
  delay(1000);
```

```
  digitalWrite(SOLENOID,LOW);
```

```
  delay(1000);
```

```
}
```

- Link to sample schematic for solenoid
- Reference: [Control a Solenoid with an Arduino \(Tutorial\) - YouTube](#)
- Need to order diode and power transistor
- TIP120 (Power transistor pack - \$8.99)
 - [Link](#)
- 1N4001 (Diode pack - \$5.99)
 - [Link](#)

Touch Sensor

Reference links: <https://arduinogetstarted.com/tutorials/arduino-touch-sensor>

<https://www.arduino.cc/reference/en/language/functions/time/micros/>

Using case where if input state is "LOW" then record the time using the function `time = micros()`

Once `time = micros() + 1.5e7` & input still "LOW" (& brakes not engaged)

Then turn on speaker

Quick code to test if touch sensor works:

```
const int SENSOR_PIN = 7;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:
int lastState = LOW; // the previous state from the input pin
int currentState;    // the current reading from the input pin

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  // initialize the Arduino's pin as aninput
  pinMode(SENSOR_PIN, INPUT);
}

void loop() {
  // read the state of the the input pin:
  currentState = digitalRead(SENSOR_PIN);

  if(lastState == LOW && currentState == HIGH)
    Serial.println("The sensor is touched");
  else if(lastState == HIGH && currentState == LOW)
    Serial.println("The sensor is is released");

  // save the the last state
  lastState = currentState;
}
```

Conclusions/action items:

Keep troubleshooting with the parts until all of them work, and show them off at the show and tell.



11/8/2023: Fabrication Meeting

Title: Fabrication Meeting #2 notes**Date:** 11/08/2023**Content by:** Whole group**Present:** Colin, Daniel, Matt, Sara**Goals:** To continue integrating the systems of the device.**Content:**

Speaker & touch sensor :

Button & Solenoid:

Current code:

```
int SOLENOID = 8;
```

```
int button = 12;
```

```
int buttonRead = 0;
```

```
void setup() {
```

```
  pinMode(button, INPUT);
```

```
  pinMode(SOLENOID, OUTPUT);
```

```
  digitalWrite(SOLENOID, LOW);
```

```
}
```

```
void loop() {
```

```
  buttonRead = digitalRead(button);
```

```
  if (buttonRead == HIGH) {
```

```
    digitalWrite(SOLENOID,HIGH);
```

```
  }
```

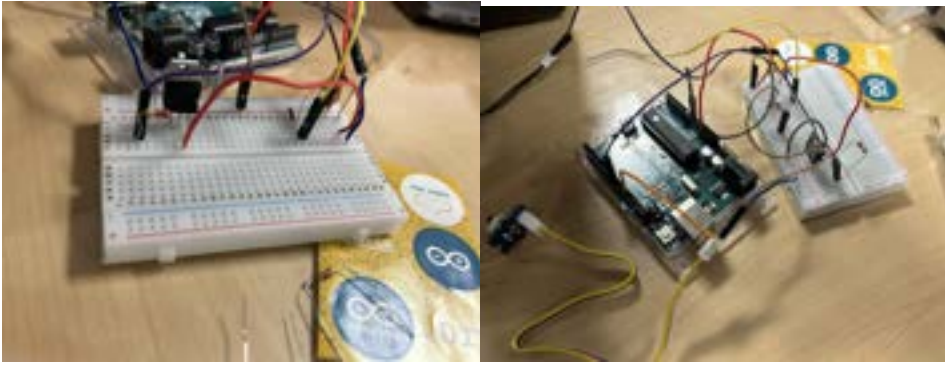
```
  else{
```

```
    digitalWrite(SOLENOID,LOW);
```

```
  }
```

```
}
```

- Button when pressed triggers solenoid to engage



Touch Sensor and Speaker

New integrated code

```
const int SENSOR_PIN = 12;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:

int lastState = LOW; // the previous state from the input pin
int currentState;   // the current reading from the input pin
int newState;       // the new reading after 15 sec
int piezoPin = 8;

void setup() {
// initialize serial communication at 9600 bits per second:
Serial.begin(9600);

// initialize the Arduino's pin as aninput
pinMode(SENSOR_PIN, INPUT);

}

void loop() {
// read the state of the the input pin:
currentState = digitalRead(SENSOR_PIN);

if(lastState == LOW && currentState == HIGH) {
  Serial.println("The sensor is touched");
}

else if(lastState == HIGH && currentState == LOW) {
  Serial.println("The sensor is released");
}
```



```
delay(15000); //waits 15 seconds

newState = digitalRead(SENSOR_PIN);

if(newState == LOW) {

  Serial.println("now beep");

  tone(piezoPin, 1000, 500);

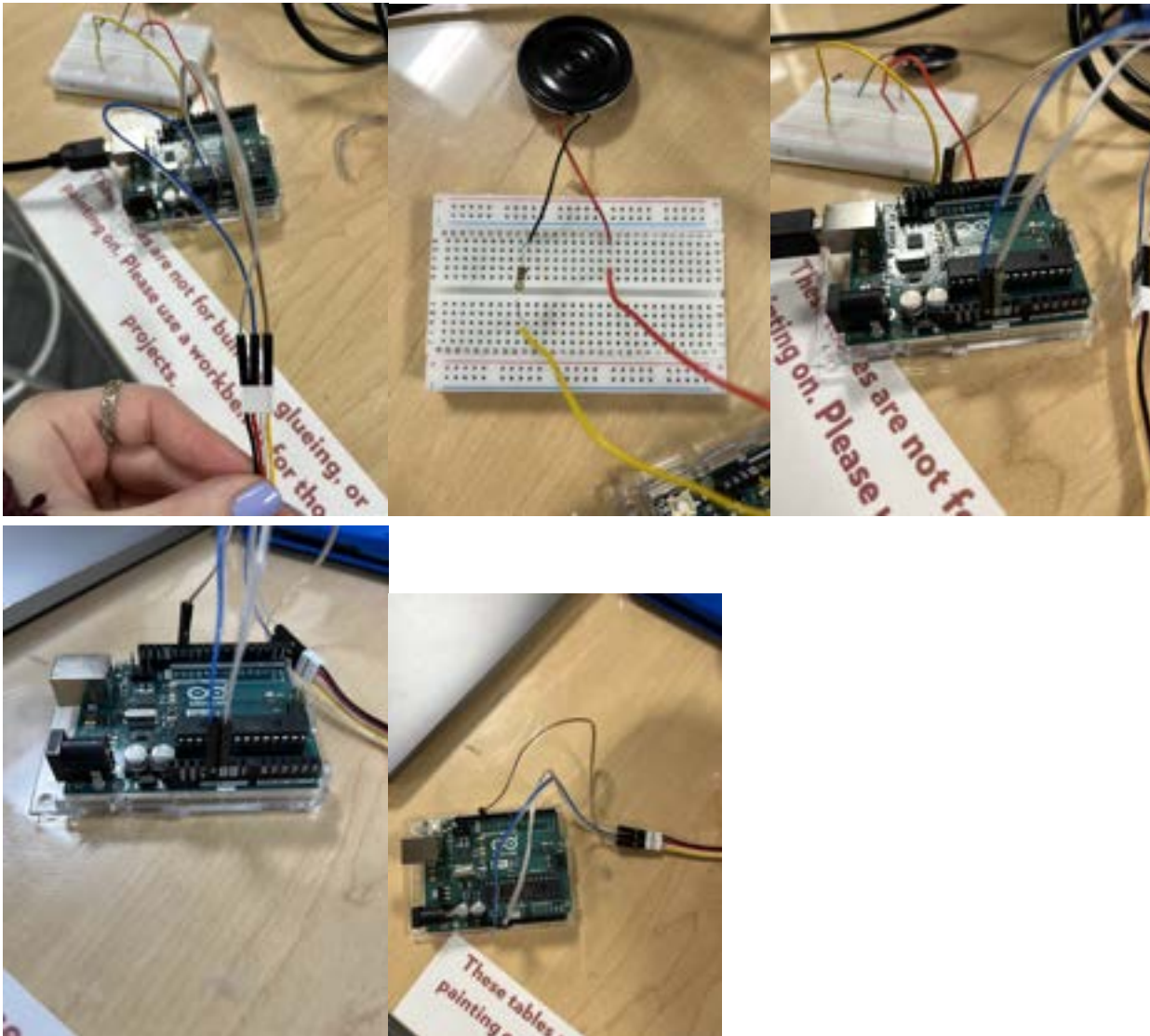
  delay(2500);

}}

// save the the last state

lastState = currentState;

}
```



To-Do List:

- Set up meeting with advisor
 - Explain current status of system
 - Ask what she wants by the end of the semester

- Find storage space for materials
 - Talk to Dr. Settell
- Remove brakes from current walker
- Code to combine the two button systems
 - Touch and speaker to solenoid and button
 - Button triggers solenoid
 - touch sensor untouched causes beep then solenoid
 - Involve combining circuits and cod

	Button (Brakes) On	Button (Brakes) Off
Touch Detected	Brakes Engaged	No Brakes Engaged
Touch Not Detected	Brakes Engaged	Beep & Causes Engage

Conclusions/action items:

-Continue fabrication process, detach current brake system, more integration.



11/17/2023: Fabrication Meeting 3

Matt Hudson - Dec 07, 2023, 4:05 PM CST

Title: Fabrication Meeting 3

Date: 11/17/2023

Content by: Everyone

Present: Everyone

Goals: Continue Fabricating Project

Content:

-see attachment

Conclusions/action items:

continue to meet as a group and get further with project

Matt Hudson - Dec 07, 2023, 4:05 PM CST

```
CODE FOR SIGNALING/DUNING
in SIGNALING = 1
in subunit = 1E
in subunit = 1E

end loop()
println("INPUT")
println("SIGNALING OUTPUT")
println("SIGNALING LOW")
}

end loop()
subunitFeed = digitalRead(subunit)
if (subunitFeed == HIGH)
  digitalWrite(SIGNALING, HIGH)
else
  digitalWrite(SIGNALING, LOW)
}

CODE FOR SIGNALING/DUNING
// This code is for the signaling and duning of the
// system. It is used to control the
// system.

// Define the pins for the signaling and duning
// system.
const int SIGNALING_PIN = 10;
const int SUBUNIT_PIN = 11;

// Define the pins for the signaling and duning
// system.
const int SIGNALING_PIN = 10;
const int SUBUNIT_PIN = 11;

// Define the pins for the signaling and duning
// system.
const int SIGNALING_PIN = 10;
const int SUBUNIT_PIN = 11;

// Define the pins for the signaling and duning
// system.
const int SIGNALING_PIN = 10;
const int SUBUNIT_PIN = 11;
```

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Fabrication_Meeting_3_-_11_17_2023.pdf (1.66 MB)



11/21/2023: Fabrication Meeting 4

Matt Hudson - Dec 07, 2023, 4:07 PM CST

Title: Fabrication Meeting 4

Date: 11/21/2023

Content by: Everyone

Present: Everyone

Goals: Work on Code with Dr.Nimunkar before thanksgiving break

Content:

-see attachment

Conclusions/action items:

use feedback to try and update the code, let Dr.Settell know progress after meeting

Matt Hudson - Dec 07, 2023, 4:07 PM CST

```

// Main Program
// The code to keep with this and readable
// The a constant variable to keep time
// What is used to stop the function when a read button is pressed
// What button is being pressed with a read button being pressed
// Using while function
// At end of while loop use "remainder = remainder - 1"

// The code
int WIDTH = 100;
int HEIGHT = 10;
int buttonPin = 2;
int ledPin = 13; // the pin that the led is on
int ledState = HIGH; // the current reading from the input pin
// Set a variable // the state reading after 10 ms
int pinMode = 0;
int ledState = HIGH;
int remainder = 0;

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  // initialize the ledPin as an output:
  pinMode(ledPin, OUTPUT);
  pinMode(buttonPin, INPUT);
  digitalWrite(buttonPin, LOW);
}

void loop() {
  digitalWrite(ledPin, ledState);
  while (remainder > 0) {
    // Read a digital value from the pin
    remainder = digitalRead(buttonPin);
    if (digitalRead(buttonPin) == HIGH) {
      digitalWrite(ledPin, LOW);
      remainder = 0;
    }
  }
  // If a read button == HIGH then == LOW else remainder == LOW
  digitalWrite(ledPin, HIGH);
  remainder = 0;
}
// If a read button == LOW then == HIGH else remainder == HIGH
digitalWrite(ledPin, LOW);
remainder = 0;

```

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Fabrication_Meeting_4_-_11_21_2023.pdf (67.3 kB)



12/4/2023: Fabrication Meeting 5

Matt Hudson - Dec 07, 2023, 4:08 PM CST

Title: Fabrication Meeting 5

Date: 12/4/2023

Content by: Everyone

Present: Everyone

Goals: Meet with Dr.Coventry to try and finish code

Content:

-see attachment

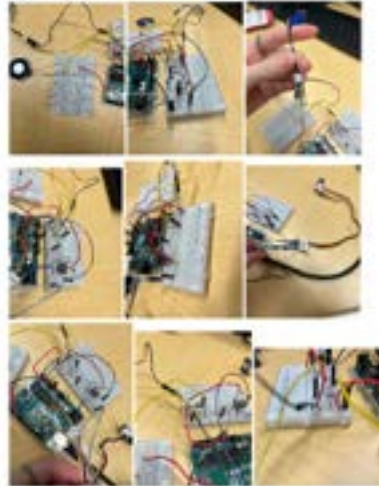
Conclusions/action items:

figure out code to turn off speaker and work on testing and final deliverables

Matt Hudson - Dec 07, 2023, 4:08 PM CST

Meeting with Dr. Coventry
• using Transistor to heat ECU
• using electrical function to test (see outside of meeting - Engineering)

Some selected photos



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Fabrication_Meeting_5_12_4_2023.pdf (3.86 MB)



12/10/2023: Videos of device

SARA SAGUES (ssagues@wisc.edu) - Dec 10, 2023, 7:30 PM CST

Title: Videos of Device

Date: 12/10/2023

Content by: Whole group

Present: Whole group

Goals: To document the device working.

Content:

See attached videos

Conclusions/action items:

It worked!

SARA SAGUES (ssagues@wisc.edu) - Dec 10, 2023, 7:32 PM CST



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Solenoid_Delay.MOV (8.92 MB)

SARA SAGUES (ssagues@wisc.edu) - Dec 10, 2023, 7:32 PM CST



[Download](#)

Solenoid_with_Button.MOV (12.2 MB)



12/3/23 - Testing Protocol

Colin Bailey - Dec 07, 2023, 4:33 PM CST

Title: Testing Protocol

Date: 12/3/23

Content by: All

Present: All

Goals: Create testing protocol to use to determine effectiveness of new walker system

Content:

See attached PDF below

Conclusions/action items:

Created a testing protocol that will collect trials from walker and analyze them using the statistical program R. Data must enable conclusions to be drawn from collected data to determine success of the walker.

Colin Bailey - Dec 07, 2023, 4:19 PM CST



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Testing_Protocol.pdf (106 kB)



12/3/23 - Data and Graphs

Colin Bailey - Dec 07, 2023, 4:32 PM CST

Title: Raw Data and Graphs

Date: 12/3/23

Content by: All

Present: All

Goals: Analyze collected data

Content:

See PDF below

Conclusions/action items:

Used statistical analysis to find p-values and use them to draw conclusions about prototype. Create graphs that show each p-value for each case tested.

Colin Bailey - Dec 07, 2023, 4:23 PM CST

Raw Data

Challenge 1
 Success - Colored correct items to be sorted

0	0	0	0	0
0	0	0	0	0

Time: 10:10

Challenge 2
 Success - Colored correct items to be sorted

0	0	0	0	0
0	0	0	0	0

Time: 10:10

Challenge 3
 Success - Colored correct items to be sorted

0	0	0	0	0
0	0	0	0	0

Time: 10:10

Challenge 4
 Success - Colored correct items to be sorted

0	0	0	0	0
0	0	0	0	0

Time: 10:10

[Download](#)

Testing_Experimentation_.pdf (235 kB)



12/3/23 - Statistical Analysis in R

Title: Statistical Analysis in R

Date: 12/3/23

Content by: All

Present: All

Goals: Run binomial test for each case and create graphs of data.

Content:

BME 300/200 Tests

2023-12-03

```
binom.test(8,10,0.8, alternative = "less")
```

```
##
## Exact binomial test
##
## data: 8 and 10
## number of successes = 8, number of trials = 10, p-value = 0.6242
## alternative hypothesis: true probability of success is less than 0.8
## 95 percent confidence interval:
##  0.0000000 0.9632286
## sample estimates:
## probability of success
##                0.8
```

```
binom.test(10,10,0.8, alternative = "less")
```

```
##
## Exact binomial test
##
## data: 10 and 10
## number of successes = 10, number of trials = 10, p-value = 1
## alternative hypothesis: true probability of success is less than 0.8
## 95 percent confidence interval:
##  0 1
## sample estimates:
## probability of success
##                1
```

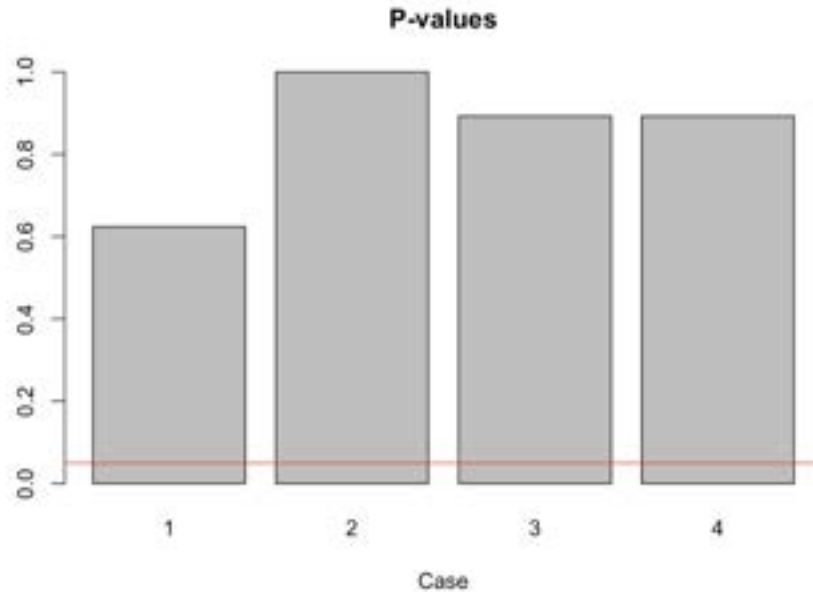
```
binom.test(9,10,0.8, alternative = "less")
```

```
##
## Exact binomial test
##
## data: 9 and 10
## number of successes = 9, number of trials = 10, p-value = 0.8926
## alternative hypothesis: true probability of success is less than 0.8
## 95 percent confidence interval:
##  0.0000000 0.9948838
## sample estimates:
## probability of success
##                0.9
```

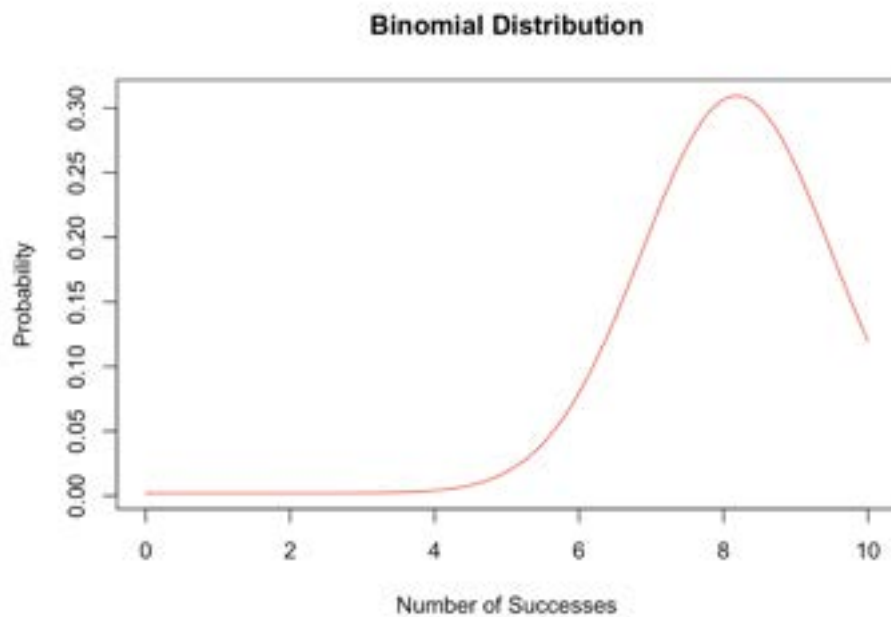
```
binom.test(9,10,0.8, alternative = "less")
```

```
##
## Exact binomial test
##
## data: 9 and 10
## number of successes = 9, number of trials = 10, p-value = 0.8926
## alternative hypothesis: true probability of success is less than 0.8
## 95 percent confidence interval:
##  0.0000000 0.9948838
## sample estimates:
## probability of success
##                0.9
```

```
pvalues = c(0.6242, 1, 0.8926, 0.8926)
barplot(pvalues, main="P-values", xlab = "Case", names.arg = c(1,2,3,4));abline(0.05,0, col="red")
```



```
curve(0.3074*(2.718281828459045)^((-x+8.180)^2/-1.858^2) + 0.002100, xlim = c(0,10), col="red", xlab = "Number of S
uccesses", ylab = "Probability", main = "Binomial Distribution")
```



Conclusions/action items:

Conducted a binomial test for each case to determine p-value and graphed all the p-values on one chart. Finally graphed the binomial distribution which were later shaded in to create each individual p-value graph.



9/15/2023 PDS

SARA SAGUES (ssagues@wisc.edu) - Oct 11, 2023, 1:16 PM CDT

Title: PDS

Date: 10/11/23

Content by: Everyone

Present: Everyone

Goals: To create a document with all the criteria for the device.

Content:

see pdf below

Conclusions/action items:

Continue to update throughout semester.

SARA SAGUES (ssagues@wisc.edu) - Oct 11, 2023, 1:16 PM CDT



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PDS - _Alert_Device_for_Walker_1_.pdf (115 kB)



10/6/2023 Preliminary Presentation PDF

Matt Hudson - Oct 06, 2023, 9:05 PM CDT

Title: Preliminary Presentation PDF

Date: 10/6/2023

Content by: Group

Present: Group

Goals: Create an outline for design plans to share with peers and advisors

Content:

-see attachment

Conclusions/action items:

Begin ordering deliverables and finalizing design

Matt Hudson - Oct 06, 2023, 9:05 PM CDT



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Preliminary_Presentation.pptx (9.66 MB)



10/19/23 Preliminary Report

SARA SAGUES (ssagues@wisc.edu) - Oct 19, 2023, 8:53 PM CDT

Title: Preliminary Report

Date: 10/19/23

Content by: Whole group

Present: Whole group

Goals: To collect the group's designs into a report.

Content:

see pdf below

Conclusions/action items:

Build prototype

SARA SAGUES (ssagues@wisc.edu) - Oct 19, 2023, 8:54 PM CDT



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Preliminary_Report_-_Alert_Device_for_Walker_2_.pdf (2.82 MB)



12/7/2023 Final Poster

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 4:00 PM CST

Title: Final Poster

Date: 12/7/2023

Content by: Whole group

Present: Whole group

Goals: To create a final poster to present data from the entire semester.

Content:

see pdf attached

Conclusions/action items:

Present 12/7/2023.

SARA SAGUES (ssagues@wisc.edu) - Dec 07, 2023, 3:59 PM CST



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Final_Poster_1_.pdf (2.21 MB)



12/15/2023 Final Report

SARA SAGUES (ssagues@wisc.edu) - Dec 15, 2023, 1:48 PM CST

Title: Final Report

Date: 12/15/23

Content by: Whole group

Present: Whole group

Goals: To collect the whole semester's ideas and fabrication and testing into a final report.

Content:

see pdf below

Conclusions/action items:

Done!

SARA SAGUES (ssagues@wisc.edu) - Dec 15, 2023, 1:49 PM CST



[Download](#)

WARNS_Alert_Device_for_Walker_Final_Report.pdf (8.7 MB)



9/21/2023 - Physical Problems Associated with Walkers

Matt Hudson - Oct 11, 2023, 9:13 PM CDT

Title: Physical Problems Associated with Walkers

Date: 9/21/2023

Content by: Matt

Present: Matt

Goals: Understand how walkers affect users for design considerations

Content:

Summary:

- The study explores walker use and falls in assisted-living settings.
- Assisted living facilities cater to elderly residents.
- Researchers investigate walker usage and its effects.
- Physical functioning and health outcomes are examined.
- Falls and walker use are distinct factors.
- Surprisingly, falls aren't strongly tied to health declines.
- Regular walker use, however, correlates with lower well-being.
- Walker users may face mobility and independence challenges.
- Careful consideration of mobility aids is needed.
- Interventions promoting mobility are encouraged.
- Functional independence is vital for residents' well-being.
- A holistic approach is crucial for health promotion.
- Further research is needed for a deeper understanding

IEEE citation: "Walker use, but not falls, is associated with lower physical ...," NCBI, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2684088/> (accessed Oct. 12, 2023).

Conclusions/action items:

Continue to do research as we come up with potential design ideas



10/4/2023 - Choosing a Walker

Title: Choosing a Walker

Date: 10/4/2023

Content by: Matt

Present: Matt

Goals: Understand how patients should chose a walker

Content:

Types of Walkers:

- Understand the types of walkers available
- standing, rolling(2,3,4 wheels), knee scooter
- choose based on personals physcial mobility

Height Adjustment:

- look for 15% elbow bend and upright standing position
- make sure to keep COG close to walker
- people tend to be too hunched if walker is too far away

Wheels and Brakes:

Accessories:

- storage pouches
- trays.
- foldable seats
- food tray

Proper Use:

- step into the walker
- watch the ground for objects
- do not wear heels

Medical Guidance:

- consult with a healthcare professional for advice on the most suitable walker
- continue to check in with healthcare provider incase of changes or injuries

IEEE Citation: "TIPS for choosing and using walkers," Mayo Clinic, <https://www.mayoclinic.org/healthy-lifestyle/healthy-aging/in-depth/walker/art-20546805> (accessed Oct. 11, 2023).

Conclusions/action items:

- take into consideration all these factors when modifying the device and don't make changes that would hinder the patient in any way



9/21/2022 - Self Locking Walker Concept

Matt Hudson - Oct 11, 2023, 9:14 PM CDT

Title: Self Locking Walker Concept

Date: 9/21/2023

Content by: Matt

Present: Matt

Goals: Find current walker designs as inspiration for design matrix and project

Content:

Summary:

- Introduction of a novel walker design concept.
- Incorporation of a self-locking mechanism for improved stability.
- Enhanced safety and convenience for users.
- Potential benefits for various user populations, including the elderly and individuals with limited mobility.
- Exploration of practical applications and potential commercialization.
- Likely discussion of engineering and technical details related to the self-locking mechanism.

Locking System Notes:

- Unique feature: Achieving self-locking functionality through a single mechanical approach.
- Mechanical Lever System: The self-locking mechanism likely employs a mechanical lever system. This system may consist of one or more levers or arms that are connected to different parts of the walker's frame.
- User-Activated Locking: The locking mechanism is typically user-activated, meaning that the user can engage or disengage it as needed. This control can be important for user convenience.
- Engagement During Weight Bearing: The self-locking feature is designed to engage automatically when the user's weight is applied to the walker. This ensures that the walker remains stable when in use, especially when the user leans on it for support.
- Release Mechanism: To fold or collapse the walker, there is typically a release mechanism that allows the user to disengage the self-locking feature. This release may involve a button, lever, or other user-friendly control.

IEEE Citation: An innovative concept for a walker with a self-locking mechanism using ..., <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6571846/> (accessed Oct. 12, 2023).

Conclusions/action items:

This article provides insight into a current design on the market that focuses on the safety components of the walker and based on our meeting with Dr. Martin this should be one of the forefronts for our project this semester. The information in this article could be applied to our first attempt at prototyping and modifying a current walker the client will provide.



9/28/2023 - Finger Print using Arduino

Matt Hudson - Oct 11, 2023, 8:57 PM CDT

Title: Fingerprint using Arduino

Date: 9/28/2023

Content by: Matt

Present: Matt

Goals: find a solution to improve locks on Walkers

Content:

<https://github.com/adafruit/Adafruit-Fingerprint-Sensor-Library>

Content:

- **Compatibility:** The library is designed to work with Adafruit's fingerprint sensor modules, which are often based on the GT-521Fxx series of fingerprint sensors. It is specifically designed for use with Arduino boards.
- **Features:** The library provides functions and methods to communicate with the fingerprint sensor, allowing you to perform tasks such as enrolling fingerprints, searching for stored fingerprints, and verifying fingerprints against stored templates.
- **Example Code:** Adafruit typically provides example code and tutorials to help you get started with using the library and the fingerprint sensor in your projects. These examples demonstrate how to perform common tasks like fingerprint enrollment and verification.
- **Arduino Integration:** The library is compatible with the Arduino platform, making it accessible to a wide range of hobbyists and developers who are familiar with Arduino programming.
- **Community Support:** Since Adafruit is a popular manufacturer of electronic components and modules, you can often find community support and discussions related to their products, including this library, on forums, social media, and other online platforms.

Conclusions/action items:



11/2/2023 - Solenoid Circuits To Potentially Use for Project

Title: Solenoid Circuits To Potentially Use for Project

Date: 11/2/2023

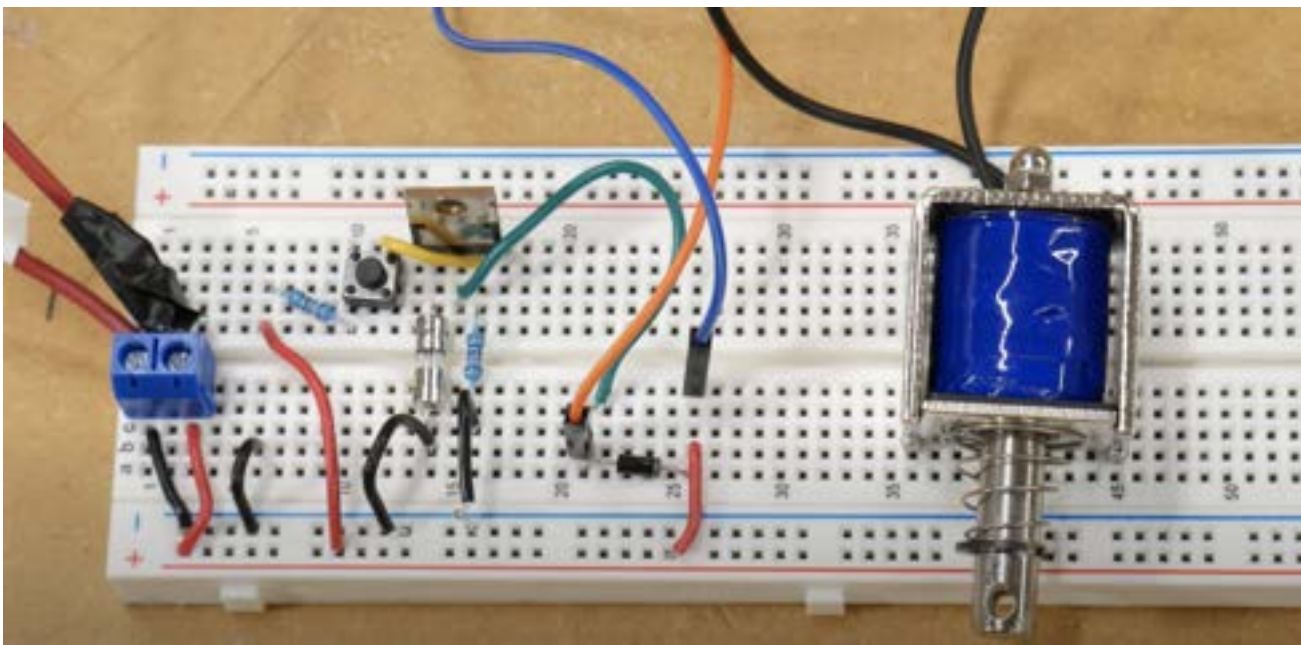
Content by: Matt

Present: Matt and Dan

Goals: Research Solenoid and Arduino Circuits

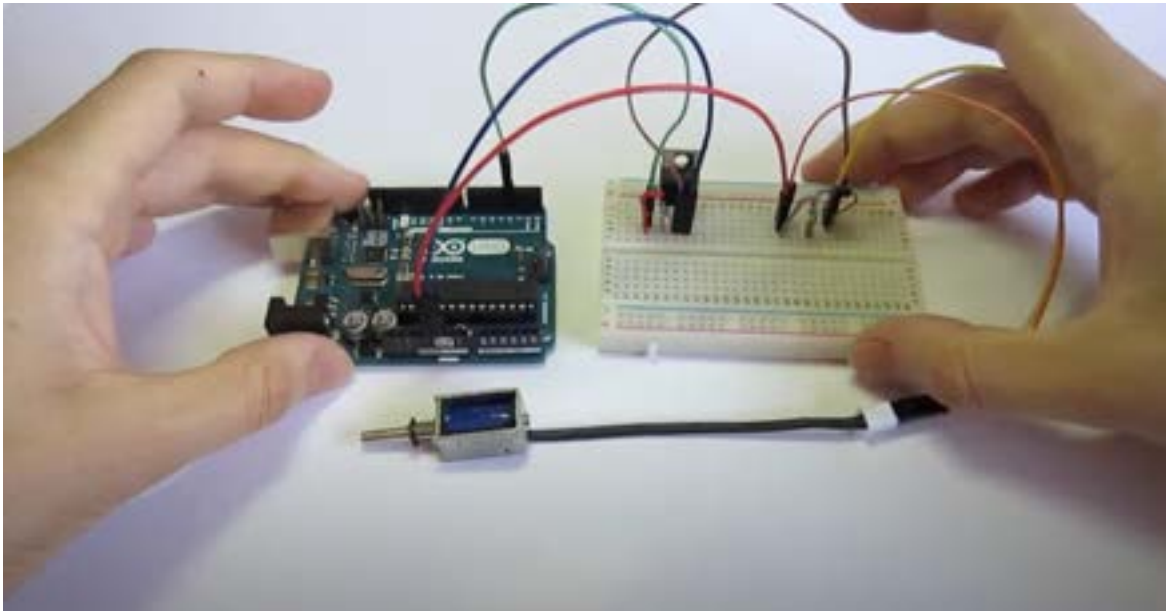
Content:

- 1st video referenced to build lock system on device: <https://www.youtube.com/watch?v=nwVRMU9grSI&t=704>
- complex circuit, makes claim that too much current could harm the solenoid if the button is pressed for too long

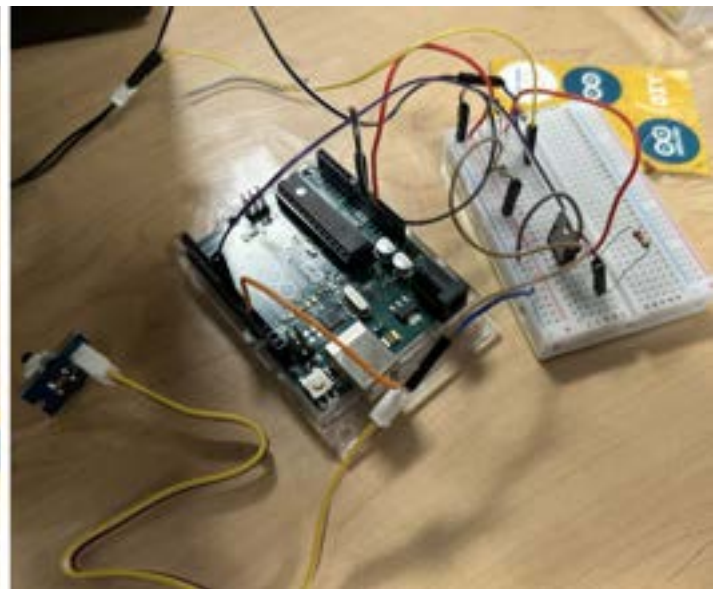
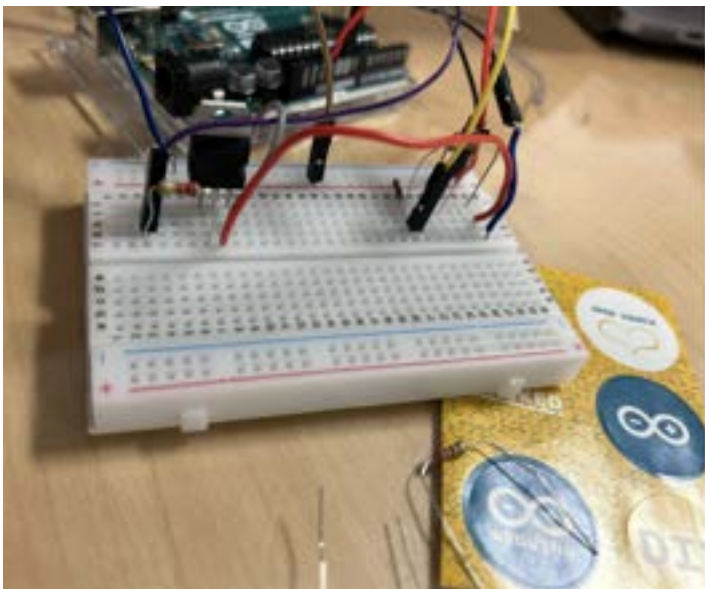


- 2nd video references to build lock system on device: <https://www.youtube.com/watch?v=RfrDtAEQ95c&t=54s>

-easier circuit to follow, made certain a transistor and diode would be required to make the circuit work



-after referencing both of these we were able to add our own button to the circuit



Conclusions/action items:

-connect to speaker



11/10/2023 - Tong Lecture

Matt Hudson - Nov 10, 2023, 12:47 PM CST

Title: Tong Lecture

Date: 11/10/2023

Content by: Matt

Present: Matt

Goals: Learn about BME's in the real world

Content:

- This is YOUR story, despite what you hear from this story make it relate to you
- went to Pitt then UW when ECB was built worked on mini spheres, late night mixing polymers
- find your people, work hard but have fun
- works at exact sciences
- make quality relationships, find what drives you
- do things that scare you, if you don't feel scared it's too easy
- laugh until you cry, cry until you laugh
- think about the highs and lows that define you
- lean into the practice at UW because this is the time you can learn from when you fail
- there's a lot more resources than you think

Conclusions/action items:

Keep pushing yourself and finding ways to grow.



11/30/2023 - Dr.Fields meeting Notes

Matt Hudson - Nov 30, 2023, 9:28 PM CST

Title: Dr.Fields and Dr.Martin Meeting Notes

Date: 11/30/2023

Content by: Matt

Present: All group members

Goals: Plan testing portion of project and get feedback from someone who works with the patients using our device

Content:

Usability testing:

- Survey style questions?
- MyUW → qualtrics
- Use peers as a sample size
- Add additional question on if it would be used after surgery
- Think about time and resources
- If you don't want to use peers:
 - Case study for person
 - Would they use the device
 - Show some sort of video on how it works
- If system doesn't work revert to just using the break to test
- Acceptability and appropriateness testings
 - "Do you think this is worth testing"
 - "Would this be worth using and going further with"

Dr.Martin/team meeting:

- Individual component testing
- Survey idea update:
 - What would people pay and compare it to the standard price of walker
 - run ideas by Dr.Settell

Conclusions/action items:

Plan to create testing survey and finish prototype.



9/28/2023 - Design Sketches for Lock and Sensors

Matt Hudson - Oct 11, 2023, 8:58 PM CDT

Title: Design Sketches for Lock and Sensors

Date: 9/28/2023

Content by: Matt

Present: Matt

Goals: Come up with Ideas for Design Matrix

Content:

See PDF

Conclusions/action items:

Come up with Design Matrix with the rest of the team

Matt Hudson - Sep 29, 2023, 10:52 AM CDT



[Download](#)

Note_Sep_27_2023.pdf (831 kB) Sketches of Designs



10/5/2023 - Client Provided Walker Dimensions

Matt Hudson - Oct 11, 2023, 8:59 PM CDT

Title: Client Provided Walker Dimensions

Date: 10/5/2023

Content by: Matt

Present: Matt

Goals: Create a Design displaying dimensions of the walker we are going to modify

Content:

-see attachment

Conclusions/action items

Being looking into using arduino and figuring out deliverables.

Matt Hudson - Oct 06, 2023, 8:34 PM CDT



[Download](#)

walker.png (192 kB) Walker



10/11/2023 - using the adafruit sensor

Matt Hudson - Oct 11, 2023, 6:48 PM CDT

Title: Using the adafruit sensor

Date: 10/1/2023

Content by: Matt

Present: Matt

Goals: Understand how to use fingerprint sensor planned for project

Content:

video: <https://www.youtube.com/watch?v=1diFaa5OsFg&t=25s>

Notes:

- includes using sensor, breadboard, wires and arduino, LED's, resistors
- connect sensor to breadboard, add wires in series connected to voltage, GND, and 2 digital pins on the arduino
- open the enroll sketch in the arduino app on your computer
- in the serial monitor picking any 'ID #' and then scanning for 2 clear images of the sensor will register the fingerprint into the arduino
- several prints can be recorded at once (ie. index, thumb, ring finger) as long as they all have different ID #'s
- open the fingerprint sketch in the examples folder and changing the corresponding pins and LED colors/values in the code will check that the finger registers the device
- now when the correct finger is scanned one LED should light up and when the wrong finger is scanned the other should

Conclusions/action items:

- finalize design with group and work on ordering materials



10/11/2023 - Sound Using Arduino

Title: Sound Using Arduino

Date: 10/11/2023

Content by: Matt

Present: Matt

Goals: Research for sound based on design matrix decisions

Content:

Summary:

-speaker should be have 8 Ohm characteristic

-components necessary for external audio output:

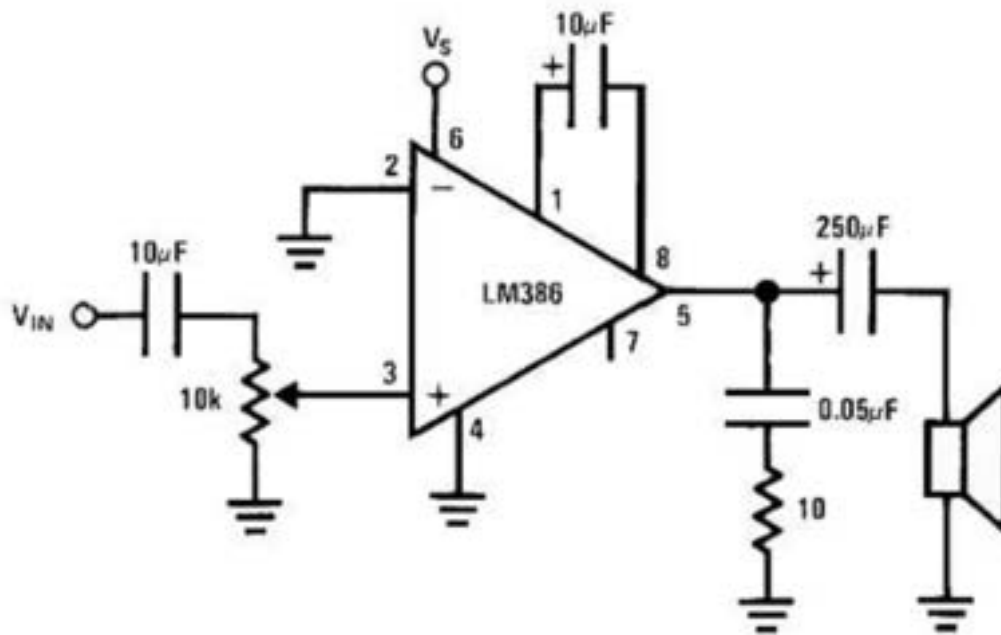
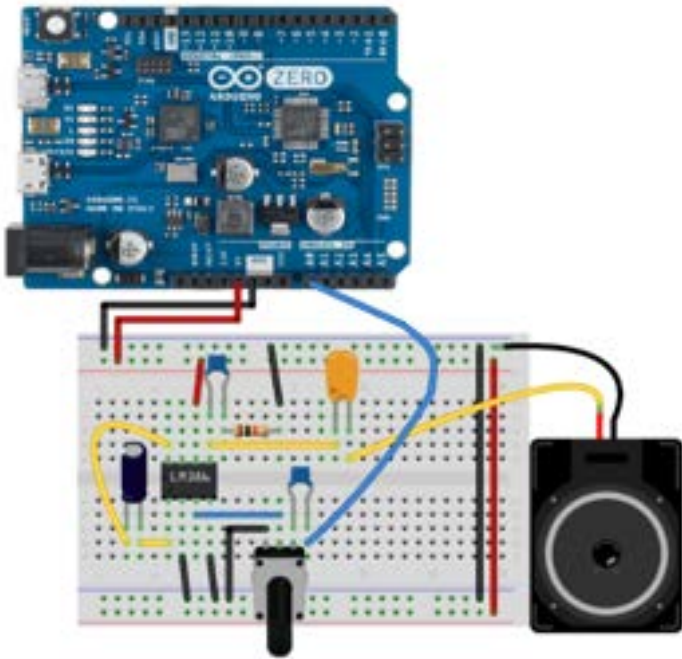
i)LM386 (low audio amp)

ii)10k Ohm potentiometer

iii)10 ohm resistors

iv)multiple capacitors in the microfarad scale

Schematic of Circuit:



- install AudioZero off of the manage libraries tab in the tool bar
- potentiometer can be used to change the volume
- check wires, and code if having problems for troubleshooting, refer to source

IEEE Citation: T. A. Team, "Simple audio player," Arduino Documentation, <https://docs.arduino.cc/tutorials/generic/simple-audio-player> (accessed Oct. 11, 2023).

Conclusions/action items:

Try figuring out how to combine both the fingerprint and speaker onto one arduino? Have to combine the ideas into one cohesive system, may require two microcontrollers, need to discuss with the team.



10/16/2023 - Finalized Design and Material Draft

Matt Hudson - Nov 09, 2023, 2:44 PM CST

Title: Finalized Design and Materials Draft

Date: 10/16/2023

Content by: Matt

Present: Matt

Goals: Finalize design as a team after preliminary presentations

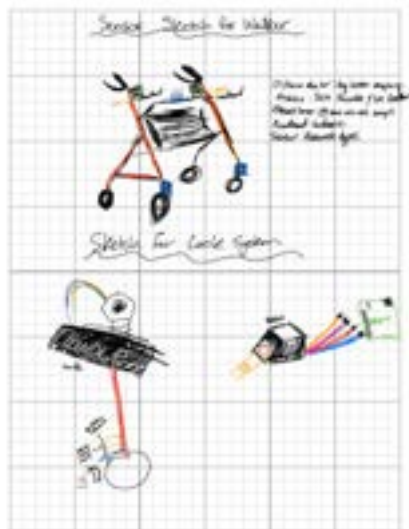
Content:

-see attached file

Conclusions/action items:

Meet as a group to finalize material list and create expense sheet

Matt Hudson - Nov 09, 2023, 2:45 PM CST



[Download](#)

Materials_and_Design_sketch.pdf (2.75 MB)



10/20/2023 - Material Notes

Matt Hudson - Dec 11, 2023, 1:17 PM CST

Title: Material Notes

Date: 10/20/2023

Content by: Matt

Present: All group members

Goals: Final discussion on materials and project before fabrication

Content:

-see attachment

Conclusions/action items:

Order materials, compile links

Matt Hudson - Dec 11, 2023, 1:17 PM CST



[Download](#)

Material_Notes_10_20.pdf (26.9 kB)



10/21/2023 - Links used for material order and expense sheet

Title: Links for material order

Date: 10/21/2023

Content by: Matt

Present: All group via zoom

Goals: Order materials to begin fabrication

Content:

solenoid: <https://www.amazon.com/Adafruit-Mini-Push-Pull-Solenoid-ADA2776/dp/B0722JK1L1>

resistors: https://www.amazon.com/Sparkfun-500-4W-Resistor-Kit/dp/B008MH9714/ref=sr_1_3?

[crid=16FF02DINIGXX&keywords=resistors+sparkfun&qid=1697999022&s=industrial&sprefix=resistors+sparkfun%2Cindustrial%2C70&sr=1-3](https://www.amazon.com/Sparkfun-500-4W-Resistor-Kit/dp/B008MH9714/ref=sr_1_3?crid=16FF02DINIGXX&keywords=resistors+sparkfun&qid=1697999022&s=industrial&sprefix=resistors+sparkfun%2Cindustrial%2C70&sr=1-3)

electrical tape: https://www.amazon.com/Ancor-Marine-Products-Electrical-Assorted/dp/B01CZ30AY0/ref=asc_df_B01CZ30AY0/?tag=hyprod-

[20&linkCode=df0&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p579883507167&psc=1&tag=&ref=&adgrpid=64958377347&hvpon=&hvptwo=&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvqmt=&hvdev=c&hvdvcmdl=&f579883507167](https://www.amazon.com/Ancor-Marine-Products-Electrical-Assorted/dp/B01CZ30AY0/ref=asc_df_B01CZ30AY0/?tag=hyprod-20&linkCode=df0&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p579883507167&psc=1&tag=&ref=&adgrpid=64958377347&hvpon=&hvptwo=&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvqmt=&hvdev=c&hvdvcmdl=&f579883507167)

Arduino: https://www.amazon.com/Arduino-A000066-ARDUINO-UNO-R3/dp/B008GRTSV6/ref=asc_df_B008GRTSV6/?tag=hyprod-

[20&linkCode=df0&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p457497319401&psc=1&tag=&ref=&adgrpid=67183599252&hvpon=&hvptwo=&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvqmt=&hvdev=c&hvdvcmdl=&f457497319401](https://www.amazon.com/Arduino-A000066-ARDUINO-UNO-R3/dp/B008GRTSV6/ref=asc_df_B008GRTSV6/?tag=hyprod-20&linkCode=df0&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p457497319401&psc=1&tag=&ref=&adgrpid=67183599252&hvpon=&hvptwo=&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvqmt=&hvdev=c&hvdvcmdl=&f457497319401)

- The team created the material expenses sheet together over zoom during this week

- These links are for the materials that I was responsible for finding to add to the expenses sheet and does not include everything that the team ordered for fabrication, specifications of each part in a google drive that is shared with the entire team.

- After meeting the previous to discuss what to plan for in the zoom meeting we then did our own work to find the parts

Conclusions/action items:

prepare for show and tell.



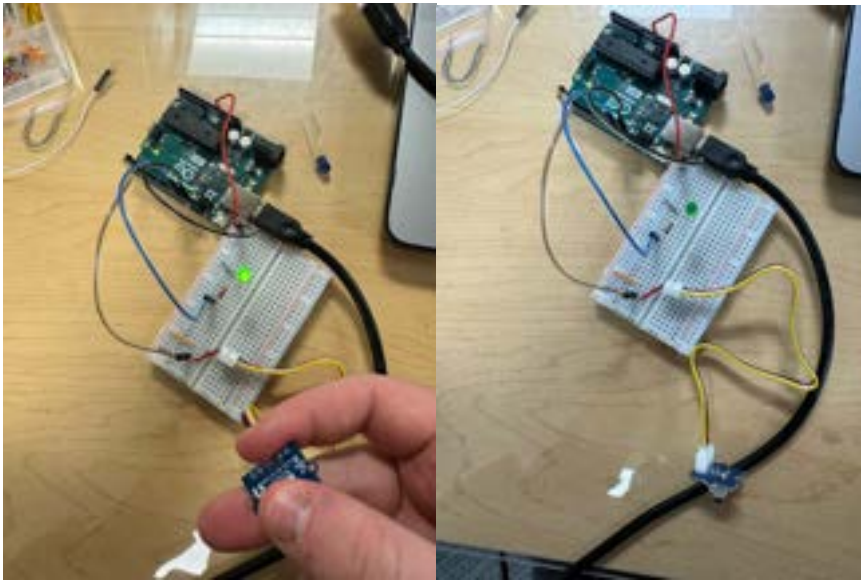
11/1/2023 - Beginning with Fabrication

Title:**Date:** 11/1/2023**Content by:** Matt**Present:** Daniel, Colin, Meghan, Matt**Goals:** Work on Fabrication**Content:** (refers to every portion of the project I was responsible for the week)**Button:**

Starting code -

```
void setup() {  
  pinMode(12, OUTPUT);  
  pinMode(2, INPUT);  
}  
  
void loop() {  
  if(digitalRead(2) == HIGH) { //if the button is pushed  
    digitalWrite(12,HIGH); //LED on  
  }  
  else{ // if button is not pushed  
    digitalWrite(12,LOW); //LED off  
  }  
}
```

Images of circuit -



Input pin is 2, output pin is 12, 5V source from computer to arduino

Brown wire → pin 2

Blue wire → pin 12

Black wire → GND

Red wire → 5V input

Solenoid:

- Starting Code:

```
const int SOLENOID = 8;
```

```
void setup() {
```

```
  // put your setup code here, to run once:
```

```
  pinMode(SOLENOID,OUTPUT);
```

```
}
```

```
void loop() {
```

```
  // put your main code here, to run repeatedly:
```

```
  digitalWrite(SOLENOID,HIGH);
```

```
  delay(1000);
```

```
  digitalWrite(SOLENOID,LOW);
```

```
  delay(1000);
```

```
}
```

- Link to sample schematic for solenoid
- Reference: [Control a Solenoid with an Arduino \(Tutorial\) - YouTube](#)

- Need to order diode and power transistor
- TIP120 (Power transistor pack - \$8.99)
 - [Link](#)
- 1N4001 (Diode pack - \$5.99)
 - [Link](#)

Touch Sensor

Reference links: <https://arduinogetstarted.com/tutorials/arduino-touch-sensor>

<https://www.arduino.cc/reference/en/language/functions/time/micros/>

Using case where if input state is "LOW" then record the time using the function `time = micros()`

Once `time = micros() + 1.5e7` & input still "LOW" (& brakes not engaged)

Then turn on speaker

Quick code to test if touch sensor works:

```
const int SENSOR_PIN = 7;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:
int lastState = LOW; // the previous state from the input pin
int currentState;   // the current reading from the input pin

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  // initialize the Arduino's pin as an input
  pinMode(SENSOR_PIN, INPUT);
}

void loop() {
  // read the state of the the input pin:
  currentState = digitalRead(SENSOR_PIN);

  if(lastState == LOW && currentState == HIGH)
    Serial.println("The sensor is touched");
```



```
else if(lastState == HIGH && currentState == LOW)
    Serial.println("The sensor is is released");

// save the the last state
lastState = currentState;
}
```

Conclusions/action items:

try to connect the solenoid and button into one circuit



11/8/2023 - Fabrciation Work for the week

Title: Fabrication Work (week 2)

Date: 11/8/2023

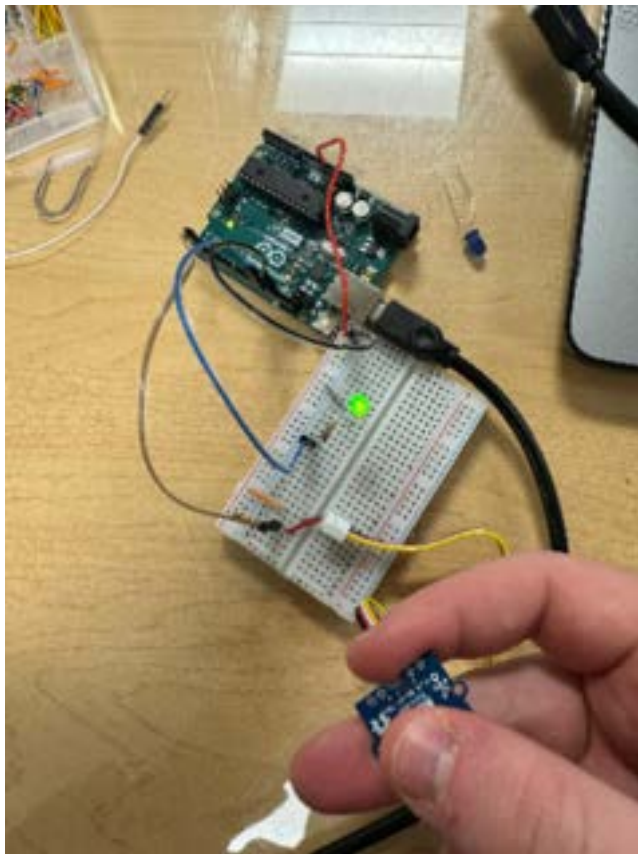
Content by: Matt

Present: Matt, Colin, Daniel, Sara

Goals: Get button and sensor to work with solenoid and speaker

Content:

- Myself and Daniel worked on the solenoid aspect of the project this week and were able to successful get the button to work again with the LED

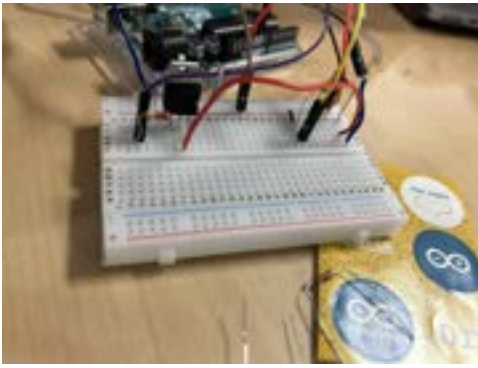


- Our next step was to try and get the solenoid to work after ordering parts that we did not account for during our initial materials order

-Diode and transistors were ordered and arrived over the weekend, these could then be used to create the circuit for a solenoid

-The two of us references this videos circuit and code to see if we could successful get the solenoid to engage and disengage on a 2 second time interval:<https://www.youtube.com/watch?v=RfrDtAEQ95c&t=51s>

-After getting both of these components to work, Daniel and I worked to combine our button and solenoid together which is shown in the image below



The code to get the button and solenoid to work together are:

```
int SOLENOID = 8;

int button = 12;

int buttonRead = 0;

void setup() {

  pinMode(button, INPUT);

  pinMode(SOLENOID, OUTPUT);

  digitalWrite(SOLENOID, LOW);

}

void loop() {

  buttonRead = digitalRead(button);

  if (buttonRead == HIGH) {

    digitalWrite(SOLENOID,HIGH);

  }

  else{

    digitalWrite(SOLENOID,LOW);

  }

}
```

- This allows us to engage the solenoid by pressing the button
- During this time Sara and Colin were able to get the sensor to work with the speaker

Conclusions/action items:

- combine the speaker and solenoid into one giant alert system, plan for attaching system to walker



11/17/2023 - Fabrication meeting notes 3

Title: Fabrication Meeting notes 3

Date: 11/17/2023

Content by: Matt

Present: everyone

Goals: continue fabrication electrical portion of the project

Content:

Meeting was from 12-3pm

Code from the work done in meeting:

```
int SOLENOID = 7;
int button = 12;
int buttonRead = 0;
int lastState = LOW; // the previous state from the input pin
int currentState; // the current reading from the input pin
//int newState; // the new reading after 15 sec
int piezoPin = 8;
const int SENSOR_PIN = 13;

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  // initialize the Arduino's pin as aninput
  pinMode(SENSOR_PIN, INPUT);
  pinMode(button, INPUT);
  pinMode(SOLENOID, OUTPUT);
  digitalWrite(SOLENOID, LOW);
}

void loop() {
  buttonRead = digitalRead(button);
  currentState = digitalRead(SENSOR_PIN);
  if (buttonRead == HIGH && lastState == HIGH && currentState == HIGH) {
    digitalWrite(SOLENOID,HIGH);
  }
  else if (buttonRead == HIGH && lastState == LOW && currentState == LOW) {
    digitalWrite(SOLENOID,HIGH);
  }
}
```

```
}  
else if (buttonRead == LOW && lastState == HIGH && currentState == HIGH) {  
    digitalWrite(SOLENOID,LOW);  
}  
else if (buttonRead == LOW && lastState == LOW && currentState == HIGH) {  
    Serial.println("The sensor is touched"); //print statement  
}  
else if (buttonRead == LOW && lastState == HIGH && currentState == LOW) {  
    Serial.println("The sensor is released"); //print statement  
    delay(15000); //wait 15 seconds  
    currentState = digitalRead(SENSOR_PIN); //read again  
    if(currentState == LOW) { //if still not touched  
        Serial.println("now beep");  
        tone(piezoPin, 1000, 500); //speaker beeps  
        digitalWrite(SOLENOID,HIGH);  
    }  
    //save the the last state  
    lastState = currentState;  
}
```

- current problem with the code is that everything works until the else if function with the delay occurs, then the entire system shuts down
- the solenoid is inaccurate, sometimes it opens and immediately closed when u press the button, rather than staying open while the button is pressed

Conclusions/action items:



11/21/2023 - Fabrication Meeting 4

Matt Hudson - Nov 30, 2023, 9:30 PM CST

Title: Fabrication Meeting 4

Date: 11/21/2023

Content by: Matt and Sara

Present: Matt and Sara

Goals: improve code with help of Dr.Nimunkar

Content:

see attachment

Conclusions/action items:

still touch up the code, reach out to Dr. Coventry

Matt Hudson - Nov 30, 2023, 9:30 PM CST

```

More Notes
• The user to keep with them and readable
• The a counter variable to keep time
• What is used to stop the motor after the motor has stopped and keep
• What is used to keep counting with a counter during timer operations
• Using while function
• At end of while loop use counter = counter + 1

The code
setMotorSpeed = 5;
setMotor = 0;
setMotorSpeed = 0;
setMotorSpeed = 1000; // The previous state that the program
setMotorSpeed; // The motor is running from the program
// setMotorSpeed // The user setting after 10 ms
setMotor = 0;
count = MOTOR_SPEED * 10;
setMotor = 0;

void setup() {
// initialize serial communication at 9600 bits per second:
Serial.begin(9600);
// initialize the pin(s) you're using:
pinMode(MOTOR_PIN, OUTPUT);
pinMode(SIGNAL_PIN, OUTPUT);
digitalWrite(MOTOR_PIN, LOW);
}

void loop() {
Serial.print = digitalWrite(MOTOR_PIN);
while (count > 0) {
//Serial.print = digitalWrite(MOTOR_PIN);
// digitalWrite(MOTOR_PIN, HIGH);
// digitalWrite(MOTOR_PIN, LOW);
// digitalWrite(SIGNAL_PIN, HIGH);
// digitalWrite(SIGNAL_PIN, LOW);
count = count - 1;
}
//Serial.print = digitalWrite(MOTOR_PIN);
// digitalWrite(MOTOR_PIN, HIGH);
// digitalWrite(SIGNAL_PIN, HIGH);
// digitalWrite(SIGNAL_PIN, LOW);
// digitalWrite(MOTOR_PIN, LOW);
// digitalWrite(SIGNAL_PIN, LOW);
// digitalWrite(MOTOR_PIN, HIGH);
// digitalWrite(SIGNAL_PIN, HIGH);
// digitalWrite(MOTOR_PIN, LOW);
// digitalWrite(SIGNAL_PIN, LOW);
}
}

```

[Download](#)

Fabrication_Meeting_4_-_11_21_2023.pdf (37.1 kB)



12/4/2023 - Dr. Coventry Meeting

Title: Dr. Coventry Meeting

Date: 12/4/2023

Content by: Matt

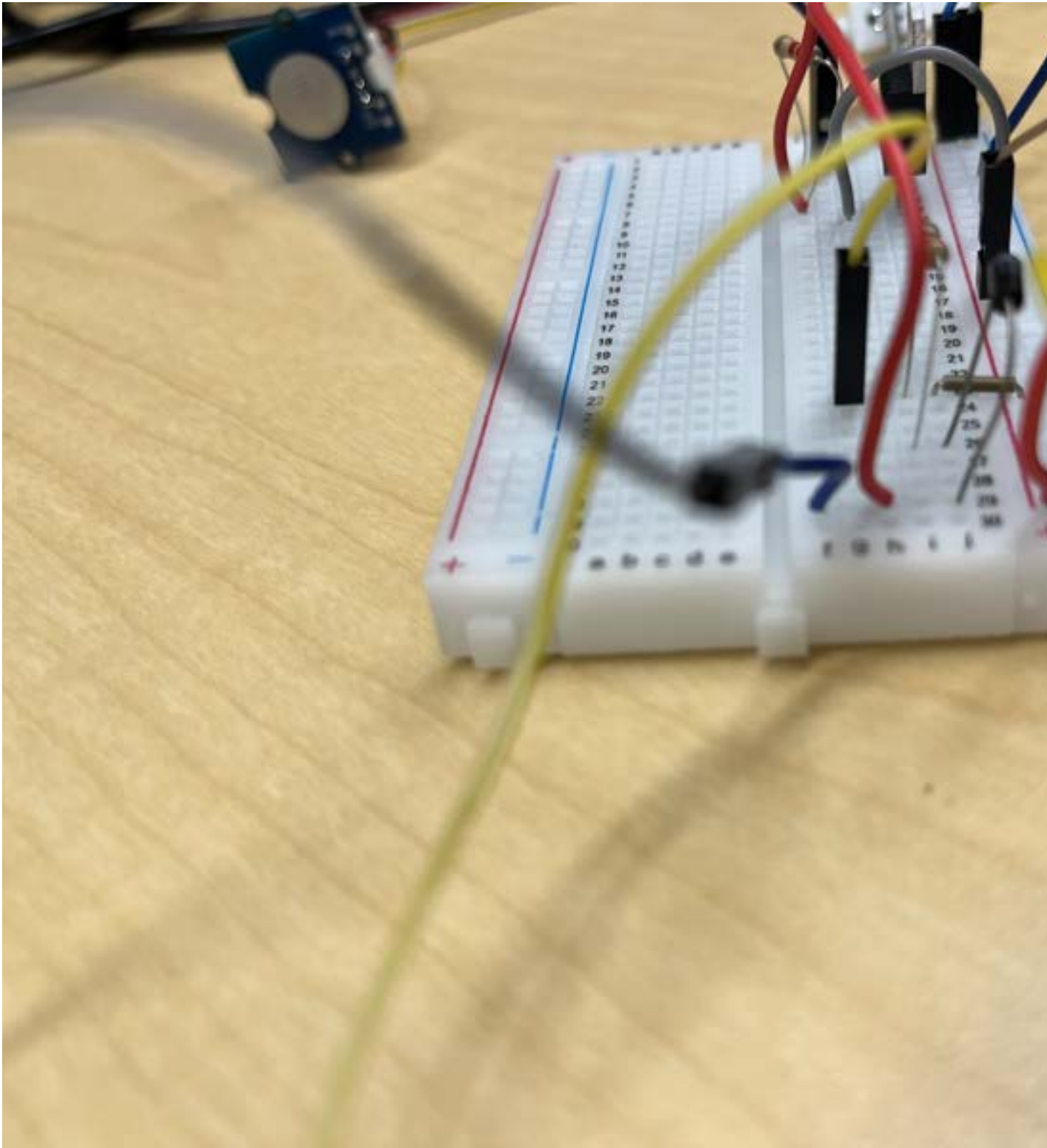
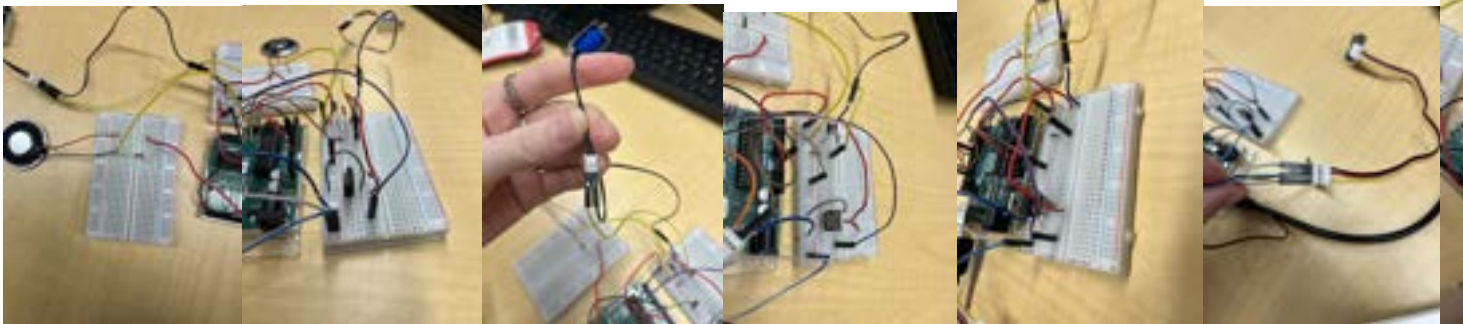
Present: Group

Goals: Try and update code so solenoid and speaker work at the same time

Content:

Dr.Coventry, met with the group to help fix the code and the following code is the most up to date version:

More detailed photos:



New code:

[code]

```
int SOLENOID = 7;

int button = 12;

int buttonRead = 0;

int lastState = LOW; // the previous state from the input pin
int currentState; // the current reading from the input pin
//int newState; // the new reading after 15 sec

int piezoPin = 8;

const int SENSOR_PIN = 13;

#include "Timemark.h"

Timemark myclock(15000);

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);

  // initialize the Arduino's pin as an input
  pinMode(SENSOR_PIN, INPUT);
  pinMode(button, INPUT);
  pinMode(SOLENOID, OUTPUT);
  digitalWrite(SOLENOID, LOW);
  myclock.start();
}

void loop() {
  buttonRead = digitalRead(button);
  currentState = digitalRead(SENSOR_PIN);
  if (buttonRead == HIGH && lastState == HIGH && currentState == HIGH) {
    digitalWrite(SOLENOID, HIGH);
    myclock.start();
    myclock.expired() == false;
  }
  else if (buttonRead == HIGH && lastState == LOW && currentState == LOW) {
    digitalWrite(SOLENOID, HIGH);
    myclock.start();
    myclock.expired() == false;
  }
  else if (buttonRead == LOW && lastState == HIGH && currentState == HIGH) {
    digitalWrite(SOLENOID, LOW);
    myclock.start();
    myclock.expired() == false;
  }
  if (myclock.expired());
  myclock.stop();
  Serial.println("now beep");
```

```
tone(piezoPin, 1000, 5000);  
digitalWrite(SOLENOID, HIGH);  
lastState = currentState;  
}
```

Conclusions/action items:

Try and get speaker to not be on all the time, now that solenoid and speaker work simultaneously



12/4/2023 - Attaching circuit to walker

Matt Hudson - Dec 11, 2023, 1:27 PM CST

Title: Attaching circuit to walker

Date: 12/4/2023

Content by: Matt

Present: Matt

Goals: Extend circuitry so it can attach to device and sit in circuit box

Content:

- attached wires in series to extend along the frame of the walker
- Dan and Colin met up after and were able to tape down the rest of the walker
- Began planning to test device now that the system works
- see photos below of final work when device was put fully together

Conclusions/action items:

Matt Hudson - Dec 11, 2023, 1:28 PM CST



[Download](#)

F07AFC3F-582D-4F24-A6BD-8A586F366158.HEIC (866 kB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



[Download](#)

IMG_7261.HEIC (3.19 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



[Download](#)

IMG_7262.HEIC (1.93 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



[Download](#)

IMG_7264.HEIC (1.78 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



[Download](#)

IMG_7265.HEIC (1.45 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



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IMG_7266.HEIC (1.54 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



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IMG_7267.HEIC (1.6 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



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IMG_7268.HEIC (1.78 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



[Download](#)

IMG_7269.HEIC (1.29 MB)

Matt Hudson - Dec 11, 2023, 1:28 PM CST



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IMG_7270.HEIC (2.04 MB)



12/5/2023 - Testing and Final Code

Matt Hudson - Dec 05, 2023, 7:31 PM CST

Title: Testing and Final Code

Date: 12/5/2023

Content by: Matt and Colin

Present: Matt and Colin

Goals: Gather data through testing the walker

Content:

-see attachment

Conclusions/action items:

create final report and poster

Matt Hudson - Dec 05, 2023, 10:37 PM CST

Contingency Table:
 We would like a contingency table for each condition that the testing conditions have (there are four).
 The following are the four conditions:

Condition 1: *Photo is on, both sensors is off - Walker is locked because the user pushed the button (pushing the button). The two sensors detect the walker is being used which prevents the operator from stepping.

Condition 2: *Photo is on, both sensors is off - Walker is locked from user input, no sound from the sensor.

Condition 3: *Photo is off, both sensors is on - Walker detects that it is in use so it doesn't lock out the user. The sensors are off as the walker is not in use, so it doesn't lock out the user.

Condition 4: *Photo is off, both sensors is off - Walker detects that it is not in use and locks out the user. It locks out the user by locking the door so the user is not locked.

Conclusion:
 - We will have a probability of success for each condition.
 - We will have a probability of failure.

Assumptions:

- Only one indicator for each condition.
- Each test has the same probability of success (50%).
- Each test is mutually exclusive or independent of the other (50%).

Contingency Table:
 Contingency table for each condition:
 - 10 tests (50% success condition)
 - Determine what is classified as a failure and what is classified as a success.

Go to: P | Success | Failure

P	S	F	S	F
S	S	F	S	F

sample probability of success = $P(\text{Photo is on} \cap \text{Photo is off}) = 0.50 \times 0.50$

[Download](#)

Testing_.pdf (173 kB)



9/17/2023 - Leadership

Matt Hudson - Oct 11, 2023, 8:16 PM CDT

Title: Leadership

Date: 9/17/2023

Content by: Matt

Present: Matt

Goals: Be an effective teamleader

Content:

-leadership is not a dictatorship

-influences how a group attains goals

-leader is not a manager

-traits: drive, honesty, creativity, flexibility

-find an effective leadership style

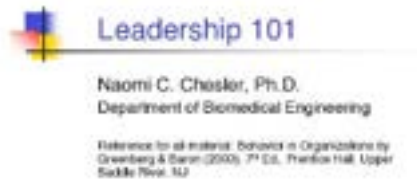
-leading is based on behavior

-build trust with group

Conclusions/action items:

Watch other team leader videos.

Matt Hudson - Oct 11, 2023, 8:16 PM CDT



[Download](#)

Chesler_leadership.pdf (437 kB)



9/17/2023 - Diverse Teams

Matt Hudson - Oct 11, 2023, 8:22 PM CDT

Title: Diverse Teams

Date: 9/17/2023

Content by: Matt

Present: Matt

Goals: Be an effective Team Leader

Content:

- make sure to take into account everyones input
- don't evaluate ideas too early, every idea is a good idea
- wacky ideas help build creativity
- create problem statements together
- brainstorm over and over
- more ideas is better

link:https://bmedesign.engr.wisc.edu/course/topics/communication/diverse_teams

Conclusions/action items:

watch other team leader videos



9/17/2023 - Teamwork

Matt Hudson - Oct 11, 2023, 8:28 PM CDT

Title: Teamwork

Date: 9/17/2023

Content by: Matt

Present: Matt

Goals: Be an effective team leader

Content:

- teamwork is essential in all aspects of life
- several historical examples of how working together is better than individual brilliance
- success is connected to teamwork, more teamwork more success, more success more you focus on teamwork
- teamwork in labs and research in academics
- companies use teamwork as an advantage over competitors
- requires good decisions and communicating
- focus on stuff you can actually control
- fixed roles
- set deadlines, expectations and schedules
- make decisions together
- conflict brings on stronger results, more considerations, be respectful
- constructive behavior is better than destructive

Conclusions/action items:

watch final team leader training video

Matt Hudson - Oct 11, 2023, 8:29 PM CDT



[Download](#)

Block_Teamwork.pdf (1.4 MB)



9/17/2023 - Conflict Resolutions

Matt Hudson - Oct 11, 2023, 8:38 PM CDT

Title: Conflict Resolutions

Date: 9/17/2023

Content by: Matt

Present: Matt

Goals: be an effective team leader

Content:

- what is conflict? disagreement, perceived threat, needs/interests, concerns
- stems from limited resources and interest, people see limited solutions
- negotiation: substance needs(stuff of the conflict), procedural needs(ground rules), psychological needs(trust, honesty, safety)
- behavioral response: compete, accommodate, avoid, compromise, collaborate
- focus on active listening
- step 1: understand what's going on
- step 2: establish a negotiation
- step 3: listen to both sides
- step 4: assert needs respectfully
- step 5: problem solve w/ flexibility
- step 6: if you get stuck, reset ground rules
- step 7: build an agreement
- step 8: evaluate solution

Conclusions/action items:

- begin working on semester project!

Matt Hudson - Oct 11, 2023, 8:39 PM CDT



[Download](#)

Webne-Behrman_Conflict_Resolution.pdf (107 kB)



9/19/2023 "How Do Roller Brakes Work? (Adjust, Lock, and Replace Guide)"

MEGHAN KAMINSKI - Sep 20, 2023, 12:42 PM CDT

Title: "How Do Roller Brakes Work? (Adjust, Lock, and Replace Guide)"

Date: 9/19/2023

Content by: Meghan Kaminski

Present: Meghan Kaminski

Goals: To understand how wheels on walkers work regarding the brake system, adjustment, and movement

Content:

- Rollator brakes are essential to stopping while not having full control
- The brakes are used by taking the handle and squeezing the grip to lock them into place
- Once squeezed, the brake pads attached to the back wheels clampdown
- Some brakes may need to be pushed down instead of clamped
- The hand brakes are right below the grips of the walker
- The brake pads are attached via a cable to the handle
- The brakes are independent of each other
- Adjustment of position of rollator brakes is possible
- It is possible to turn using rollator brakes
- To turn right simply press the right brake
- to turn left simply press the left brake

Conclusions/action items: Use the insight learned from the article to continue to think about adaptations that can be made to the brake system or wheels. The brake system tends to cause the most injuries in elderly people. Continuing to target the wheels on walkers will be essential to the first steps of the project.

IEEE Citation:

[1] ASmith, "How Do Rollator Brakes Work? (Adjust, Lock, and Replace Guide)," *Mobility Aids Reviews & Advice*, Feb. 15, 2021.
<https://mobilitymedicalsupply.com/how-do-rollator-brakes-work/> (accessed Sep. 19, 2023).

Link/PDF: [How Do Rollator Brakes Work? \(Adjust, Lock, and Replace Guide\) \(mobilitymedicalsupply.com\)](https://mobilitymedicalsupply.com/how-do-rollator-brakes-work/)



9/19/2023 "Force Plates: What are they and what insights do they provide coaches?"

MEGHAN KAMINSKI - Sep 20, 2023, 12:31 PM CDT

Title: "Force Plates: What are they and what insights do they provide coaches?"

Date: 9/19/2023

Content by: Meghan Kaminski

Present: Meghan Kaminski

Goals: To discover more information about force plates regarding their most common uses in people

Content:

-Force plates are used to use to detect and measure force applied during physical exercise

-Can be used to study posture, power and position

-Used to measure force exerted onto the ground

-Can be used for diagnostic and rehabilitation processes

-strength and jump testing are the most common uses of force plates

- Coaches are suggested to look at two components of the force plate

-Dynamic strength index: the difference between an athletes maximal and explosive strength

-Eccentric Utilization Ratio: an indicator of lower extremity stretch shortening cycle performance

Conclusions/action items: In the first ideas of the project, a pressure plate system was suggested. Looking into the force plate systems will allow the group to decide which direction to proceed with alert system. Taking ideas from the article and applying them to the alert system will be the next steps in the brainstorming process.

IEEE Citation:

[1] W. Ambler, "Force Plates: What are they and what insights do they provide coaches? - Science for Sport," *Science for Sport*, Jan. 25, 2022.

<https://www.scienceforsport.com/force-plates-what-are-they-and-what-insights-do-they-provide-coaches/>

Link/PDF: [Force Plates: What are they and what insights do they provide coaches? | Science for Sport](#)



10/6/23 "Newly patented electronic braking prevent slips on walker"

MEGHAN KAMINSKI - Oct 11, 2023, 12:57 PM CDT

Title: "Newly Patented Electronic Braking Prevents Slips on Walkers"

Date: 10/6/23

Content by: Meghan

Present: Meghan

Goals: The goal of finding this article was to find other competing designs.

Content:

- Research and creation of the device done by Cornell Biomedical Engineering
- Their walker starts in braking state
- The walker has hand sensors and button system
- The button system releases the brakes and allows movement
- The hand sensors are triggered when the user removes their hands from the handles
- The hand sensors set the system back into braking status
- The goal is to prevent unnecessary movement of the walker
- The goal is to improve safety of users

Conclusions/action items: Use this knowledge to apply to preliminary presentations. Additionally, keep this idea in mind when designing our project to prevent overlap and create an original and improved idea.

Link: [Newly patented electronic braking prevents slips on walkers | Cornell Chronicle](#)

Citation:

[1] "Newly patented electronic braking prevents slips on walkers | Cornell Chronicle," *news.cornell.edu*.
<https://news.cornell.edu/stories/2010/06/engineers-invent-smart-walkers-elderly>



11/17/23 - Servo component

MEGHAN KAMINSKI - Nov 17, 2023, 2:41 PM CST

[Amazon.com: ZOSKAY 35kg high Torque Coreless Motor servo Metal Gear Digital and Stainless Steel Gear servo arduino servo for Robotic DIY,RC car \(Control Angle 270°\) : Toys & Games](#)

MEGHAN KAMINSKI - Nov 17, 2023, 2:43 PM CST

Title: Servo Component

Date: 11/17/23

Content by: Meghan

Present: Whole team

Goals: Research new replacements for solenoid

Content: The servo will provide another way of stopping the wheels.

Conclusions/action items: Compile more research to decide if the servo is better than the solenoid



11/17/23- Solenoid

MEGHAN KAMINSKI - Nov 17, 2023, 2:40 PM CST

[Amazon.com: Abletop Push Pull Solenoid DC 12V 35mm Long Stroke Small Electromagnetic Electric Magnet For Automobiles : Industrial & Scientific](#)

MEGHAN KAMINSKI - Nov 17, 2023, 2:44 PM CST

Title: Solenoid

Date: 11/17/23

Content by: Meghan

Present: Whole team

Goals: Find another component that works better than the current solenoid

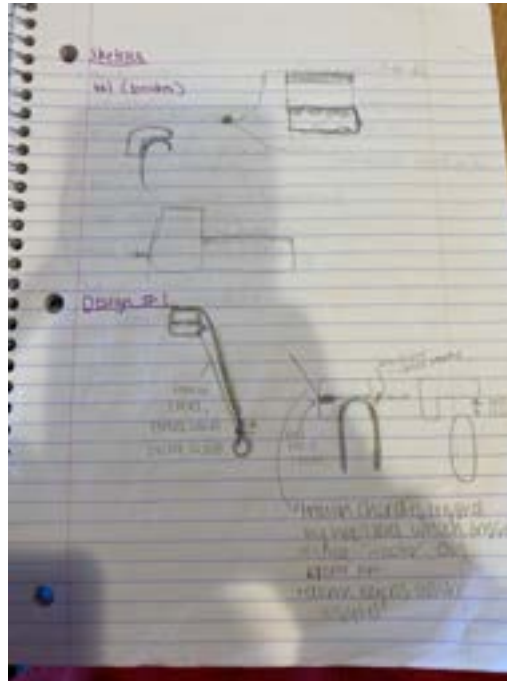
Content: The solenoid above is larger but needs more voltage.

Conclusions/action items: See the effects of using a higher voltage solenoid.



9/28/23- Design idea for lock

MEGHAN KAMINSKI - Oct 11, 2023, 1:38 PM CDT



[Download](#)

design_ideas-_bme200.jpg (2.81 MB)

MEGHAN KAMINSKI - Oct 11, 2023, 1:39 PM CDT

Title: Design Sketches for lock

Date: 9/28/2023

Content by: Meghan

Present: Meghan

Goals: Come up with Ideas for Design Matrix

Content:

See attachment

Conclusions/action items:

Come up with Design Matrix with the rest of the team



10/21/23- Expenses

MEGH

Title: Links for material order

Date: 10/21/2023

Content by: Matt

Present: All group via zoom

Goals: Order materials to begin fabrication

Content:

solenoid: <https://www.amazon.com/Adafruit-Mini-Push-Pull-Solenoid-ADA2776/dp/B0722JK1L1>

resistors: https://www.amazon.com/Sparkfun-500-4W-Resistor-Kit/dp/B008MH9714/ref=sr_1_3?

[crid=16FF02DINIGXX&keywords=resistors+sparkfun&qid=1697999022&s=industrial&sprefix=resistors+sparkfun%2Cindustrial%2C70&sr=1-3](https://www.amazon.com/Sparkfun-500-4W-Resistor-Kit/dp/B008MH9714/ref=sr_1_3?crid=16FF02DINIGXX&keywords=resistors+sparkfun&qid=1697999022&s=industrial&sprefix=resistors+sparkfun%2Cindustrial%2C70&sr=1-3)

electrical tape: https://www.amazon.com/Ancor-Marine-Products-Electrical-Assorted/dp/B01CZ30AY0/ref=asc_df_B01CZ30AY0/?tag=hyprod-20&linkCode=df0&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvppone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p579883507167&psc=1&tag=&ref=&adgrpid=64958377347&hvppone=&hvptwo=&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvqmt=&hvdev=c&hvdvcmdl=&f579883507167

Arduino: https://www.amazon.com/Arduino-A000066-ARDUINO-UNO-R3/dp/B008GRTSV6/ref=asc_df_B008GRTSV6/?tag=hyprod-20&linkCode=df0&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvppone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p457497319401&psc=1&tag=&ref=&adgrpid=67183599252&hvppone=&hvptwo=&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvqmt=&hvdev=c&hvdvcmdl=&f457497319401

- The team created the material expenses sheet together over zoom during this week

- These links are for the materials that I was responsible for finding to add to the expenses sheet and does not include everything that the team ordered for fabrication, specifications of each part in a google drive that is shared with the entire team.

- After meeting the previous to discuss what to plan for in the zoom meeting we then did our own work to find the parts

Conclusions/action items:

prepare for show and tell.



11/1/23- Beginning Fabrication Steps

MEGHAN KAMINSKI - Nov 09, 2023, 6:18 PM CST



[Download](#)

[_Team_Fabrication_Meeting_1_-_11_1_2023.docx \(11.1 MB\)](#)

MEGHAN KAMINSKI - Nov 09, 2023, 6:22 PM CST

John Puccinelli - Nov 03, 2014, 3:20 PM CST

Title: Fabrication meeting one

Date: 11/1/23

Content by: Meghan, Matt, Daniel, Colin

Present: Meghan, Matt, Daniel, Colin

Goals: Get a head start on fabrication

Content: The document above has the contents of the fabrication we completed during the meeting. The first steps were to find videos that showed us how to use the equipment. From there, we were able to make the sound component and button work. We discovered that the solenoid needed a new part, so we ordered one during the meeting.

Conclusions/action items: Use the code from the meeting to build the integration between parts, begin to reach out to other professionals to assist with the coding, and bring materials to show and tell



11/8/23- Fabrication Meeting 2

Title: Fabrication Work (week 2)

Date: 11/8/2023

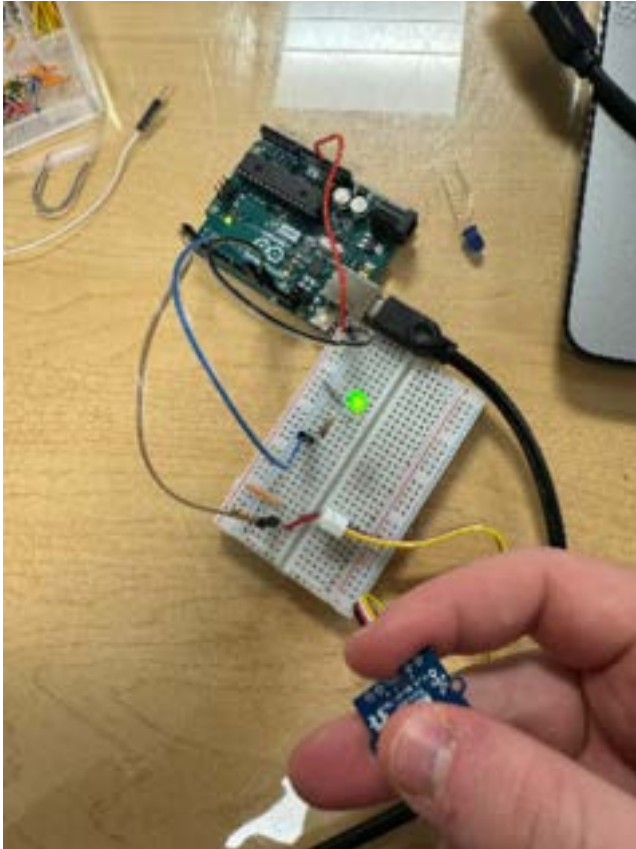
Content by: Matt

Present: Colin, Matt, Daniel, Sara

Goals: Get button and sensor to work with solenoid and speaker

Content:

- Myself and Daniel worked on the solenoid aspect of the project this week and were able to successful get the button to work again with the LED



- Our next step was to try and get the solenoid to work after ordering parts that we did not account for during our initial materials order

-Diode and transistors were ordered and arrived over the weekend, these could then be used to create the circuit for a solenoid

-The two of us references this videos circuit and code to see if we could successful get the solenoid to engage and disengage on a 2 second time interval:<https://www.youtube.com/watch?v=RfrDtAEQ95c&t=51s>

-After getting both of these components to work, Daniel and I worked to combine our button and solenoid together which is shown in the image below



The code to get the button and solenoid to work together are:

```
int SOLENOID = 8;

int button = 12;

int buttonRead = 0;

void setup() {

  pinMode(button, INPUT);

  pinMode(SOLENOID, OUTPUT);

  digitalWrite(SOLENOID, LOW);

}

void loop() {

  buttonRead = digitalRead(button);

  if (buttonRead == HIGH) {

    digitalWrite(SOLENOID,HIGH);

  }

  else{

    digitalWrite(SOLENOID,LOW);

  }

}
```

- This allows us to engage the solenoid by pressing the button
- During this time Sara and Colin were able to get the sensor to work with the speaker

Conclusions/action items:

- combine the speaker and solenoid into one giant alert system, plan for attaching system to walker



11/17/23- Fabrication Meeting 3

MEGHAN KAMINSKI - Nov 17, 2023, 3:41 PM CST

Title: Fabrication Meeting 3

Date: 11/17/23

Content by: Whole team

Present: Whole team

Goals: Make progress with the coding in terms of integration of the components.

Content: The code produced in the fabrication meeting along with pictures of circuit boards.

Conclusions/action items: Contact help to help us proceed with the code.

CODE FOR SOLENOID INDIVIDUALLY:

```
int SOLENOID = 7;
int button = 12;
int buttonRead = 0;

void setup() {
  pinMode(button, INPUT);
  pinMode(SOLENOID, OUTPUT);
  digitalWrite(SOLENOID, LOW);
}

void loop() {
  buttonRead = digitalRead(button);
  if (buttonRead == HIGH) {
    digitalWrite(SOLENOID,HIGH);
  }
  else{
    digitalWrite(SOLENOID,LOW);
  }
}
```

CODE FOR SPEAKER INDIVIDUALLY:

```
const int SENSOR_PIN = 13;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:
int lastState = LOW; // the previous state from the input pin
int currentState;   // the current reading from the input pin
int newState;       // the new reading after 15 sec
int piezoPin = 8;

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);

  // initialize the Arduino's pin as aninput
  pinMode(SENSOR_PIN, INPUT);
}

void loop() {
  // read the state of the the input pin:
  currentState = digitalRead(SENSOR_PIN);
```

```

if(lastState == LOW && currentState == HIGH) { //if last state untouched, current touched
  Serial.println("The sensor is touched"); //print statement
}
else if(lastState == HIGH && currentState == LOW) { //if last state is touched, current state untouched
  Serial.println("The sensor is released"); //print statement
  delay(15000); //wait 15 seconds
  newState = digitalRead(SENSOR_PIN); //read again
if(newState == LOW) { //if still not touched
  Serial.println("now beep");
  tone(piezoPin, 1000, 500); //speaker beeps
  delay(2500); //waits 2.5 seconds
}}
// save the the last state
lastState = currentState;
}

```

COMBINED CODE IDEA(MATT):

```

int SOLENOID = 7;
int button = 12;
int buttonRead = 0;
int lastState = LOW; // the previous state from the input pin
int currentState; // the current reading from the input pin
//int newState; // the new reading after 15 sec
int piezoPin = 8;
const int SENSOR_PIN = 13;

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  // initialize the Arduino's pin as aninput
  pinMode(SENSOR_PIN, INPUT);
  pinMode(button, INPUT);
  pinMode(SOLENOID, OUTPUT);
  digitalWrite(SOLENOID, LOW);
}

void loop() {
  buttonRead = digitalRead(button);
  currentState = digitalRead(SENSOR_PIN);
  if (buttonRead == HIGH && lastState == HIGH && currentState == HIGH) {

```

```
digitalWrite(SOLENOID,HIGH);
}
else if (buttonRead == HIGH && lastState == LOW && currentState == LOW) {
digitalWrite(SOLENOID,HIGH);
}
else if (buttonRead == LOW && lastState == HIGH && currentState == HIGH) {
digitalWrite(SOLENOID,LOW);
}
else if (buttonRead == LOW && lastState == LOW && currentState == HIGH) {
Serial.println("The sensor is touched"); //print statement
}
else if (buttonRead == LOW && lastState == HIGH && currentState == LOW) {
Serial.println("The sensor is released"); //print statement
delay(15000); //wait 15 seconds
currentState = digitalRead(SENSOR_PIN); //read again
if(currentState == LOW) { //if still not touched
Serial.println("now beep");
tone(piezoPin, 1000, 500); //speaker beeps
digitalWrite(SOLENOID,HIGH);
}}
//save the the last state
lastState = currentState;
}
```



IMAGES:

Replacing Delay Function with another function that doesn't stop solenoid function #1- micros() (Sara)

```
const int SENSOR_PIN = 13;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:
int lastState = LOW; // the previous state from the input pin
int currentState;    // the current reading from the input pin
int newState;        // the new reading after 15 sec
int piezoPin = 8;
int SOLENOID = 7;
int button = 12;
int buttonRead = 0;

static unsigned long lastTime = 0;
const long interval = 15000;
//static bool state = 0;
unsigned long now = micros();

void setup() {
// initialize serial communication at 9600 bits per second:
Serial.begin(9600);
// initialize the Arduino's pin as aninput
pinMode(SENSOR_PIN, INPUT);
pinMode(button, INPUT);
pinMode(SOLENOID, OUTPUT);
digitalWrite(SOLENOID, LOW);
}

void loop() {
// read the state of the the input pin:
currentState = digitalRead(SENSOR_PIN);
buttonRead = digitalRead(button);

if (buttonRead == HIGH) {
    digitalWrite(SOLENOID, HIGH);
}
else{
    digitalWrite(SOLENOID, LOW);
}
}
```

```

if(lastState == LOW && currentState == HIGH) { //if last state untouched, current touched
  Serial.println("The sensor is touched"); //print statement
}
else if(lastState == HIGH && currentState == LOW) { //if last state is touched, current state untouched
  Serial.println("The sensor is released"); //print statement
  currentState = digitalRead(SENSOR_PIN); //read again
  lastTime = millis();
if(now == lastTime + 15000 && currentState == LOW) { //if still not touched
  Serial.println("now beep");
  tone(piezoPin, 1000, 500); //speaker beeps
  digitalWrite(SOLENOID, HIGH);
}}
// save the the last state
lastState = currentState;
}

```

Replacing Delay Function with another function that doesn't stop solenoid function #1- using library SimpleTimer (Sara)

```

#include <SimpleTimer.h>

const int SENSOR_PIN = 13;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:
int lastState = LOW; // the previous state from the input pin
int currentState;   // the current reading from the input pin
int newState;       // the new reading after 15 sec
int piezoPin = 8;
int SOLENOID = 7;
int button = 12;
int buttonRead = 0;
SimpleTimer timer(15000);
bool flag = false;

void setup() {
// initialize serial communication at 9600 bits per second:
Serial.begin(9600);
// initialize the Arduino's pin as aninput

```

```
pinMode(SENSOR_PIN, INPUT);
pinMode(button, INPUT);
pinMode(SOLENOID, OUTPUT);
digitalWrite(SOLENOID, LOW);
}

void loop() {
// read the state of the the input pin:
currentState = digitalRead(SENSOR_PIN);
buttonRead = digitalRead(button);

if (buttonRead == HIGH) {
    digitalWrite(SOLENOID,HIGH);
}
else{
    digitalWrite(SOLENOID,LOW);
}

if(lastState == LOW && currentState == HIGH) { //if last state untouched, current touched
    Serial.println("The sensor is touched"); //print statement
}
else if(lastState == HIGH && currentState == LOW) { //if last state is touched, current state untouched
    Serial.println("The sensor is released"); //print statement
    if(timer.isReady() && !flag) {
        currentState = digitalRead(SENSOR_PIN); //read again
        if(currentState == LOW){
            Serial.println("15 seconds have passed and not touched");
            Serial.println("now beep");
            tone(piezoPin, 1000, 500); //speaker beeps
            digitalWrite(SOLENOID,HIGH);
            flag = true;
        }
    }
}
// save the the last state
lastState = currentState;
}
```



11/29/23- Fabrication Meeting 4

MEGHAN KAMINSKI - Nov 30, 2023, 5:51 PM CST

Title: Fabrication Meeting 4

Date: 11/29/23

Content by: Meghan

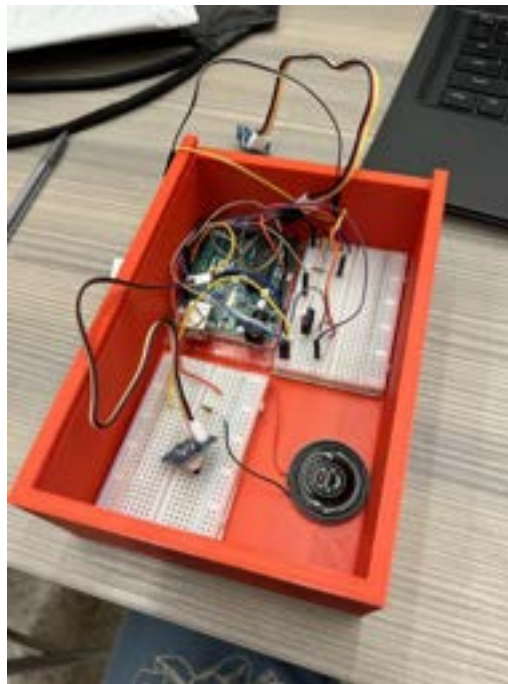
Present: Daniel, Colin, Matt, Meghan

Goals: Decide on how the box will be attached to the wheelchair, fit components inside the box, and take measurements of the box

Content: The box fit the components in very well. The box will be attached via zip ties and holes in the sides and top of the box.

Conclusions/action items: Finish the lid of the box, drill the holes, finish attachments of all components within the box.

MEGHAN KAMINSKI - Nov 29, 2023, 7:41 PM CST



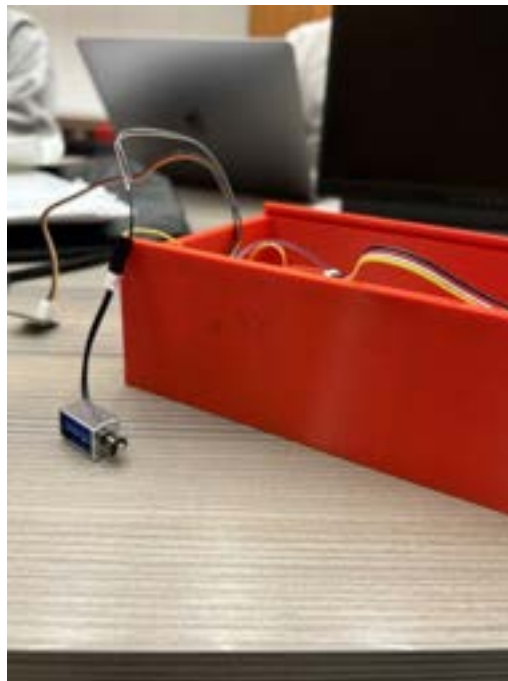
[Download](#)

IMG_7246.jpg (3.69 MB)



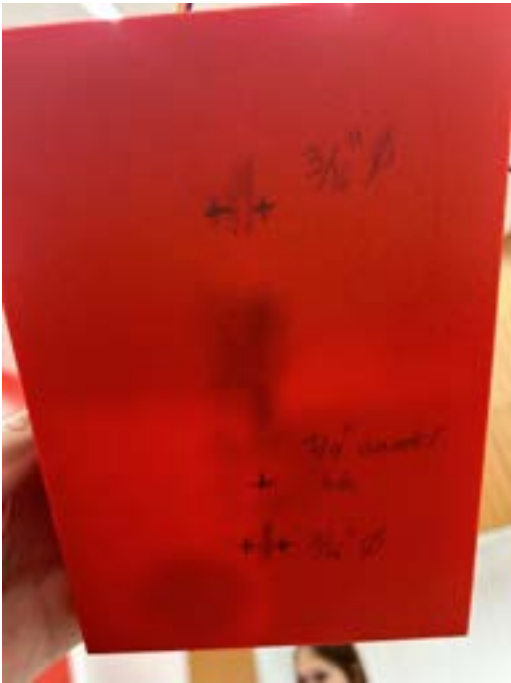
[Download](#)

IMG_7247.jpg (3.03 MB)



[Download](#)

IMG_7248.jpg (2.95 MB)



[Download](#)

IMG_7250.jpg (2.59 MB)



12/4/23- Fabircation with Dr. Coventry

Title: Dr. Coventry Meeting

Date: 12/4/2023

Content by: Matt

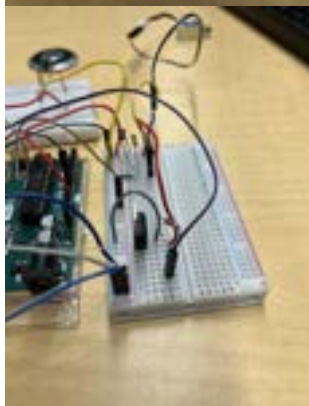
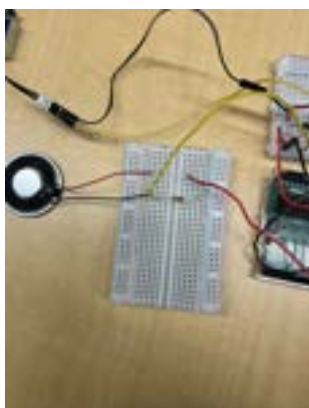
Present: Group

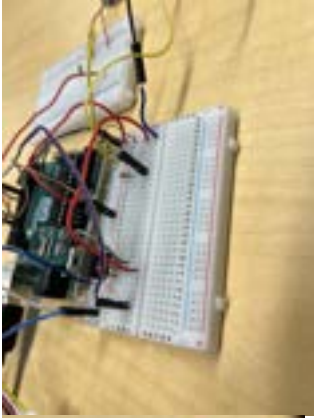
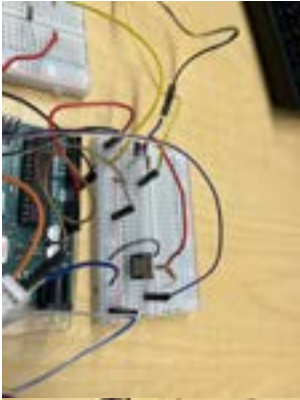
Goals: Try and update code so solenoid and speaker work at the same time

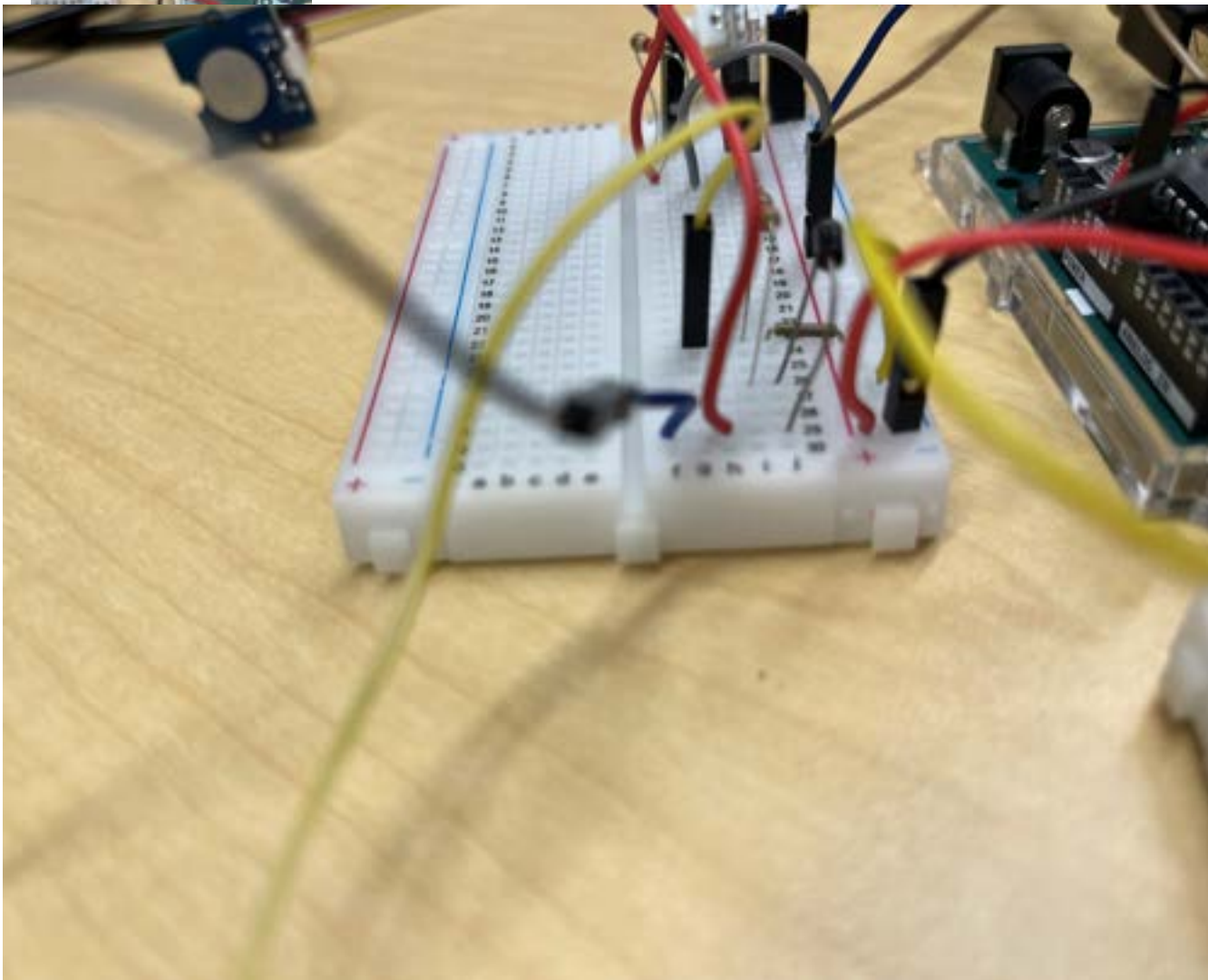
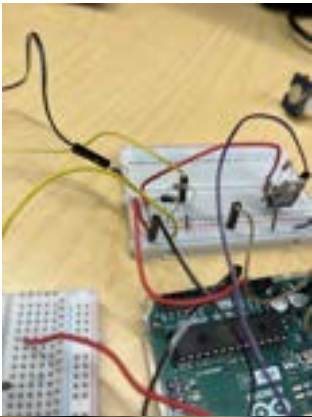
Content:

Dr.Coventry, met with the group to help fix the code and the following code is the most up to date version:

More detailed photos:







New code:

[code]

```
int SOLENOID = 7;
```

```
int button = 12;
```

```
int buttonRead = 0;
```

```
int lastState = LOW; // the previous state from the input pin
```

```
int currentState; // the current reading from the input pin
```

```
//int newState; // the new reading after 15 sec
```

```
int piezoPin = 8;

const int SENSOR_PIN = 13;

#include "Timemark.h"

Timemark myclock(15000);

void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  // initialize the Arduino's pin as aninput
  pinMode(SENSOR_PIN, INPUT);
  pinMode(button, INPUT);
  pinMode(SOLENOID, OUTPUT);
  digitalWrite(SOLENOID, LOW);
  myclock.start();
}

void loop() {
  buttonRead = digitalRead(button);
  currentState = digitalRead(SENSOR_PIN);
  if (buttonRead == HIGH && lastState == HIGH && currentState == HIGH) {
    digitalWrite(SOLENOID, HIGH);
    myclock.start();
    myclock.expired() == false;
  }
  else if (buttonRead == HIGH && lastState == LOW && currentState == LOW) {
    digitalWrite(SOLENOID, HIGH);
    myclock.start();
    myclock.expired() == false;
  }
  else if (buttonRead == LOW && lastState == HIGH && currentState == HIGH) {
    digitalWrite(SOLENOID, LOW);
    myclock.start();
    myclock.expired() == false;
  }
  if (myclock.expired());
```

```
myclock.stop();  
  
Serial.println("now beep");  
  
tone(piezoPin, 1000, 5000);  
  
digitalWrite(SOLENOID, HIGH);  
  
lastState = currentState;  
  
}
```

Conclusions/action items:

Try and get speaker to not be on all the time, now that solenoid and speaker work simultaneously



9/15/23 - "Tips for choosing and using walkers"

Title: Tips for choosing and using walkers**Date:** 9/15/23**Content by:** Colin Bailey**Present:** n/a**Goals:** Gather more information about walkers and more specifically what proper and improper use looks like**Content:**

- Several types of walkers:

1. Standard walker: Typical walker with four rubber tipped legs, user must pick up and move walker with each step.
2. Two-wheeled walker: Has two wheels on the front legs and rubber tips on the back two. Helpful if lifting walker is a struggle. Easier to stand fully upright with this type of walker.
3. Four-wheeled walker: Has wheels on every leg which offers continuous balance and support. Tends to be less stable than other types of walkers but is helpful for people who aren't sturdy with their feet and can't manually pick up a normal walker. Also generally include a seat to rest on.

- Several options for types of grips on your walker

- Proper walker fit entails a comfortable elbow bend, about 15°, while standing upright in the walker. While standing beside the walker with arms relaxed at your side, the top of the walker grip should align with the crease in your wrist.

- Walking with a walker:

1. Put walker one step in front of you, keeping your back straight, don't hunch over
2. Step forward with one foot while keeping other behind legs of walker, keeping the walker as still as possible
3. Push straight down on the grips of the walker to support your weight as you bring your other foot forward.
4. Repeat this process to continue moving forward

-Tips to move carefully include: staying upright as you move, step into the walker instead of keeping it in front of you as you walk, and making sure walker is it properly

Conclusions/action items: This article provides great background on what types of walkers are currently available, how to fit a walker to someone, and how to correctly use a walker. This gives us a great baseline of how walkers should be used, and next we can research how they are commonly misused. Additionally, this is great information to have because it will be relevant when brain storming how to improve the walkers safety features.

IEEE: "TIPS for choosing and using walkers," Mayo Clinic, <https://www.mayoclinic.org/healthy-lifestyle/healthy-aging/in-depth/walker/art-20546805> (accessed Sep. 20, 2023).



9/20/23 - "3 Ways to Prevent Falls With Your Walker"

Colin Bailey - Sep 22, 2023, 12:21 PM CDT

Title: 3 Ways to Prevent Falls With Your Walker

Date: 9/20/23

Content by: Colin Bailey

Present: n/a

Goals: Learn more about why walker falls occur

Content:

- Falls occur while using walkers for various reasons

1. Wrong sized walker: For proper use a walker needs to be fit correctly to one's frame
2. Correctly sized for home/living environment: Walker used must fit through doorways and spaces that are commonly used. Not having to worry about squeezing through spaces is important to prevent falls.
3. Learning how to use walker properly: Retraining how to walk is important to correctly using a walker. Putting the walker too far in front of you can lead to a fall but having it too close to you can put too much pressure on it. Also having poor posture can lead to injuries.

Conclusions/action items:

This article summarized the importance of walker safety and walker selection. Understanding how a user uses a walker correctly and incorrectly can help us discover what additions or modifications should be made.

IEEE:

E. P. Therapy, "Elderly falls - 3 ways to prevent falls - ECRC physical therapy," Elderly falls - 3 Ways to Prevent Falls - ECRC Physical Therapy, <https://ecrc-pt.com/elderly-falls/> (accessed Sep. 20, 2023).



Automatic Breaking Walker

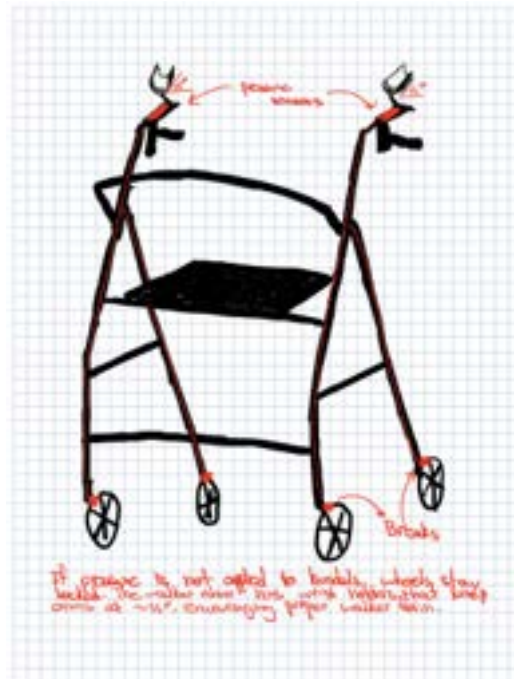
Title: Press Down U Step II Walker**Date:** 10/1/23**Content by:** Colin Bailey**Present:** n/a**Goals:** Learn more about competing walker designs.**Content:**

- Walker where lever or handle must be triggered to release breaks.

**Conclusions/action items:**

This walker has a similar breaking design to one of our design ideas. The breaks on this walker are always on unless triggered to deactivate. The different between this design and our design the mechanism that triggers the deactivation of the breaks. This design uses a lever system where ours uses a pressure sensor.

The Wright Stuff, Inc. | Mobility-Aids.com. "Press Down U Step II Walker : Easy to Use Brakes." Accessed October 11, 2023. <https://www.mobilityaids.com/press-down-u-step-ii-walker.html>.



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Sketches_.pdf (1.69 MB)



10/21/23 Links to components

Title: Ordering Links**Date:** 10/21/2023**Content by:** Colin**Present:** Whole group**Goals:** Find necessary components for fabrication and order them**Content:**Touch sensor: <https://store-usa.arduino.cc/products/grove-touch-sensor?queryID=undefined&selectedStore=us>5V Solenoid: <https://www.sparkfun.com/products/11015>Speaker: https://www.digikey.com/en/products/detail/soberton-inc./SP-3605/6562949?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063fCjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAgtApDzQpgH9iZNTYybw1UmWB6silwiFjBoCUzAQAvD_BwE&gclid=CjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAgtApDzQpgH9iZNTYybw1UmWB6silwiFjBoCUzAQAvD_BwEsolenoid: <https://www.amazon.com/Adafruit-Mini-Push-Pull-Solenoid-ADA2776/dp/B0722JK1L1>resistors: https://www.amazon.com/Sparkfun-500-4W-Resistor-Kit/dp/B008MH97I4/ref=sr_1_3?crd=16FF02DINIGXX&keywords=resistors+sparkfun&qid=1697999022&s=industrial&sprefix=relectrical tape: https://www.amazon.com/Ancor-Marine-Products-Electrical-Assorted/dp/B01CZ30AY0/ref=asc_df_B01CZ30AY0/?tag=hyprod-20&linkCode=df0&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvppone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p579883507167&psc=1&tag=&ref=&adgrpid=64958377347&hvppone=&hvptwo=&hvadid=312177424933&hvpos=&hvnetw=g&hvrnd=1487471366275347598&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p579883507167Arduino: https://www.amazon.com/Arduino-A000066-ARDUINO-UNO-R3/dp/B008GRTSV6/ref=asc_df_B008GRTSV6/?tag=hyprod-20&linkCode=df0&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvppone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p457497319401&psc=1&tag=&ref=&adgrpid=67183599252&hvppone=&hvptwo=&hvadid=309751315916&hvpos=&hvnetw=g&hvrnd=4020840888236527270&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p457497319401**Conclusions/action items:**

Order them



10/22/23 - Expenses

Colin Bailey - Nov 10, 2023, 12:48 PM CST

Date	Description	Amount	Category	Total
10/22/23	Materials for BSAC/Design Ideas and Fabrication	100.00	Materials	100.00
10/22/23	Tools for BSAC/Design Ideas and Fabrication	50.00	Tools	50.00
10/22/23	Supplies for BSAC/Design Ideas and Fabrication	25.00	Supplies	25.00
10/22/23	Travel for BSAC/Design Ideas and Fabrication	75.00	Travel	75.00
10/22/23	Other expenses for BSAC/Design Ideas and Fabrication	150.00	Other	150.00
	Total	300.00		300.00

[Download](#)

Screenshot_2023-11-10_at_12.46.58_PM.png (380 kB) Expense sheet for components purchased.



10/27/23 Advisor Meeting Notes

Colin Bailey - Nov 10, 2023, 12:53 PM CST

Advisor Meeting (10 minutes)

- Talked about solenoid being too small
 - Fine for show and tell
- Show and tell
 - Half pitch half walk
 - No formal attire necessary

Team Meeting (20 min)

- Discussed who will work on what part
 - Colin → speaker
 - Daniel and Meghan → solenoid
 - Matt and Sara → button
- Going to meet wednesday afternoon to do an intro to Arduino
 - Try coding
 - Initial understanding of materials ordered
 - Try to get as far as possible for show and tell
- Try and take the clamps off the current walker



11/1/23 - Fabrication Work #1

Title: Button Code

Date: 11/1/23

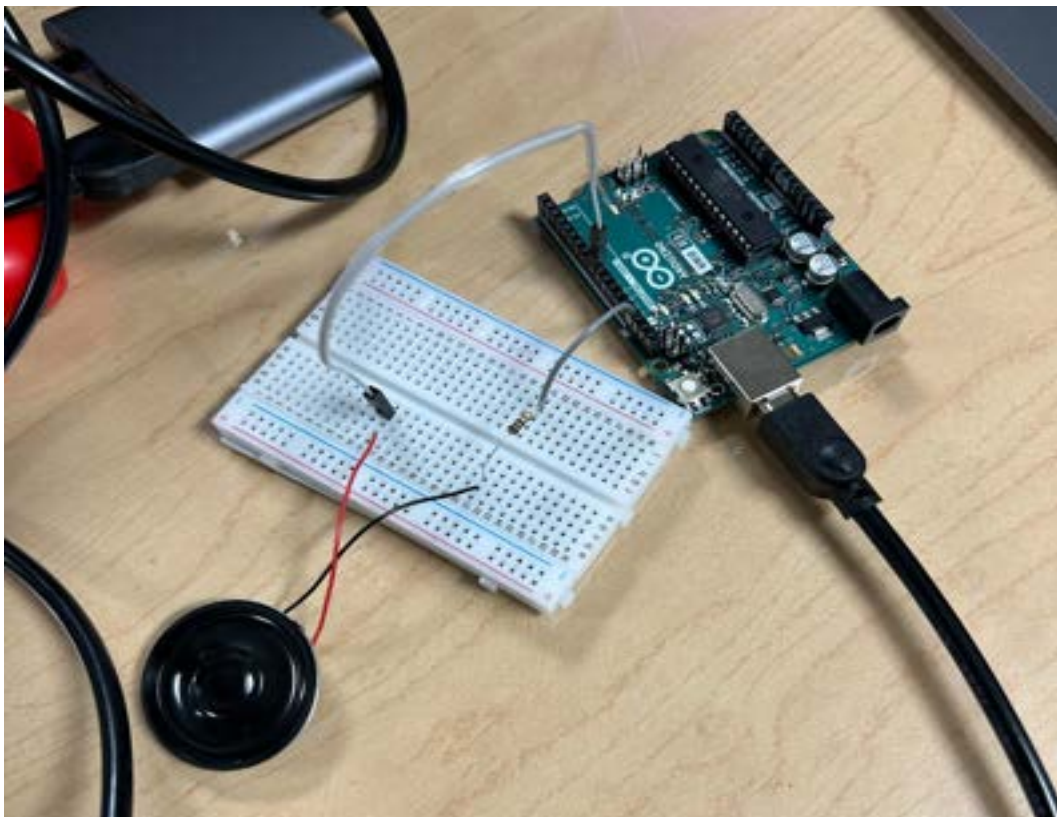
Content by: Colin Bailey

Goals: create button code and circuit

Content:

Created code and circuit for speaker.

```
1  int piezoPin = 8;
2  void setup() {
3    // put your setup code here, to run once:
4
5  }
6
7  void loop() {
8    // put your main code here, to run repeatedly:
9    /*Tone needs 2 arguments, but can take three
10     1) Pin#
11     2) Frequency - this is in hertz (cycles per second) which determines the pitch of the noise made
12     3) Duration - how long the tone plays
13     */
14     tone(piezoPin, 1000, 500);
15     delay(2500);
16
17 }
18
```





11/8/23 Fabrication Work #2

Title: Fabrication Work (week 2)

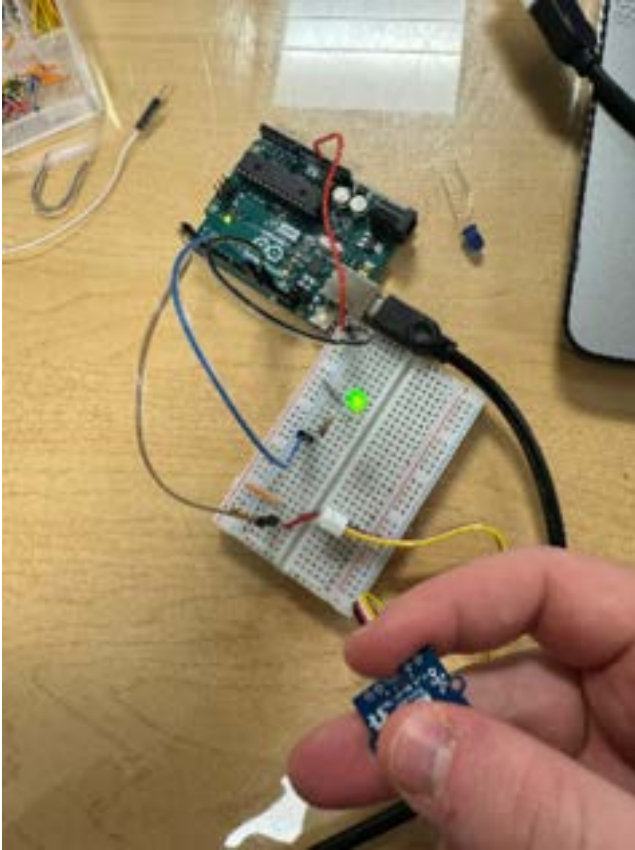
Date: 11/8/2023

Content by: Matt

Present: Colin, Matt, Daniel, Sara

Goals: Get button and sensor to work with solenoid and speaker

Content:



- Our next step was to try and get the solenoid to work after ordering parts that we did not account for during our initial materials order

-Diode and transistors were ordered and arrived over the weekend, these could then be used to create the circuit for a solenoid

-The two of us references this videos circuit and code to see if we could successful get the solenoid to engage and disengage on a 2 second time interval:<https://www.youtube.com/watch?v=RfrDtAEQ95c&t=51s>

-After getting both of these components to work, Daniel and I worked to combine our button and solenoid together which is shown in the image below



The code to get the button and solenoid to work together are:

```
int SOLENOID = 8;
```

```
int button = 12;

int buttonRead = 0;

void setup() {

  pinMode(button, INPUT);

  pinMode(SOLENOID, OUTPUT);

  digitalWrite(SOLENOID, LOW);

}

void loop() {

  buttonRead = digitalRead(button);

  if (buttonRead == HIGH) {

    digitalWrite(SOLENOID,HIGH);

  }

  else{

    digitalWrite(SOLENOID,LOW);

  }

}
```

- This allows us to engage the solenoid by pressing the button
- During this time Sara and Colin were able to get the sensor to work with the speaker

Conclusions/action items:

- combine the speaker and solenoid into one giant alert system, plan for attaching system to walker



11/17/23 - Fabrication Work #3

Colin Bailey - Nov 17, 2023, 2:40 PM CST

Title: Fabrication meeting #3

Date: 11/17/23

Content by: Colin Bailey

Present: All

Goals: Integrate speaker and touch sensor system with button and solenoid system. Begin formulating plan to attach system to walker.

Content:



Walker with breaks removed

- Also researched alternative methods to replace solenoid in future work.

Best alternative while still operating under 5v constraint was an electromagnet. Linked below.

https://www.digikey.com/en/products/detail/adafruit-industries-llc/3874/9603613?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Medium%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20223376311_adg-_ad-_dev-c_ext-_prd-9603613_sig-CjwKCAiAu9ygBhBmEiwAHTx5p2f9vF-egKqL5HnG-J2K5QIB2sDgagmcVl6CaKASzEOXvkgqKj829RoC2j4QAvD_BwE&gad_source=1&gclid=CjwKCAiAu9ygBhBmEiwAHTx5p2f9vF-egKqL5HnG-J2K5QIB2sDgagmcVl6CaKASzEOXvkgqKj829RoC2j4QAvD_BwE

- Team also worked on combining code from all components

Conclusions/faction items:

During this team meeting we continued working on integrating the speaker and touch sensor system with button and solenoid system. Additionally, we removed the current brake system from the walker to make space for our new system.



11/29/23 - Fabrication Work #4

Colin Bailey - Nov 29, 2023, 7:45 PM CST

Title: Fabrication Meeting

Date: 11/29/23

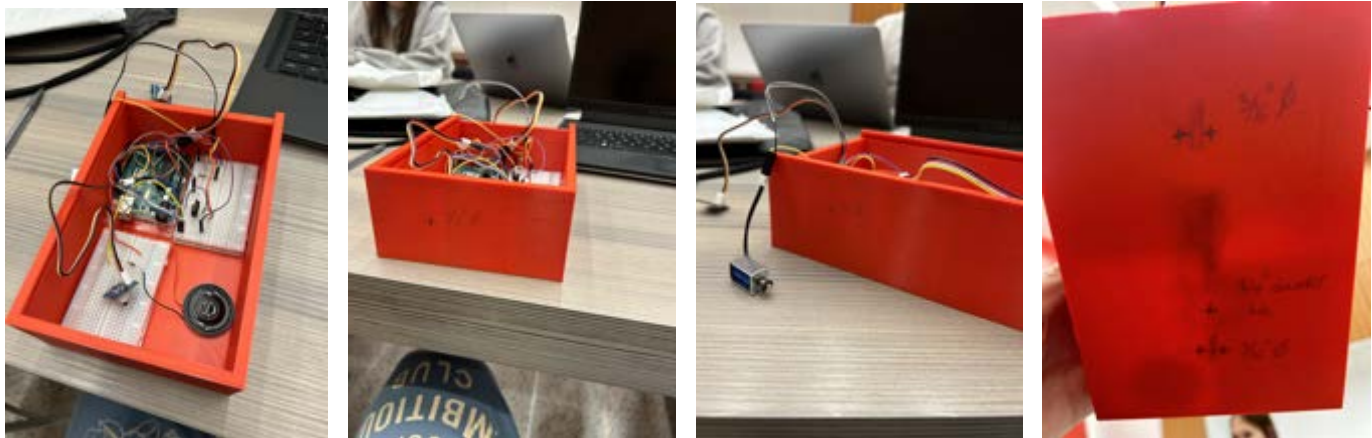
Content by: Colin

Present: Dan, Colin, Matt, Meghan

Goals: Discuss next steps in project and determine how to attach box to walker.

Content:

Images of box with components inside.



Holes will be drilled to attach the box to walker via zip ties. The top of the box still needs to be fabricated.

- discussed what questions to ask client during next meeting
- discussed poster report.

Conclusions/action items:

In this meeting we discussed the remainder of the semester and set tentative deadlines for all future work. We also determined how to attach the box that holds the components to the walker. We still need to finish the code for the components and attach everything to the walker. We started our final poster report and determined what must be done to accomplish our final report by the deadline.



12/6/23 - Fabrication Work #5

Colin Bailey - Dec 06, 2023, 1:14 PM CST

Design and State
 The result must be identified for each condition that the testing conditions have (then we know)

The following are the test conditions:

Condition 1 - (Pusher is on, both sensors is on) - Pusher is locked because the door is closed (by button pushing the sensor). The door sensor detects the sensor is being used which prevents the operator from leaving.

Condition 2 - (Pusher is on, both sensors is off) - Pusher is locked because the door is closed (by button pushing the sensor).

Condition 3 - (Pusher is off, both sensors is on) - Pusher detects that it is not in use and locks automatically. The sensor are still on the sensor can move freely for second possible sensor.

Condition 4 - (Pusher is off, both sensors is off) - Pusher detects that it is not in use and locks automatically. It stays until a time to long the user know the sensor is not locked.

Case 1	Pusher and both sensors on
Case 2	Pusher on and both sensors off
Case 3	Pusher off and both sensors on
Case 4	Pusher off and both sensors off

Assumptions

HE if a probability of success for PT we want the 0 = probability

Assessments

- One one outcome for each test (Yes)
- Each test has the same probability of outcomes (Yes)
- Each test is mutually non-failed or independent of one another (No)

Data Collection

- Collect data for each condition
- If applicable on each condition
- Determine what is classified as a failure and what is classified as a success.

Go into P 1 page P 1-64

[Download](#)

Final_Testing_Doc.pdf (314 kB)

Title: Fabrication Work #5

Date: 12/6/23

Content by: Colin Bailey

Present: All

Goals: Assemble final design, conduct testing, conduct testing analysis

Content:

- Final_Testing_Doc above contains all our testing data and information
- The walker prototype was fully assembled



Conclusions/action items:

Assembled final prototype and finished testing.





Colin Bailey - Oct 11, 2023, 5:34 PM CDT

Design 3: Pressure Sensing Brakes

Pressure Sensing Break Release

- Reason for Design
- Locks engaged when walker not in use
- Pressure sensors embedded in walker grip
- Controlled by an arduino UNO microcontroller



Colin 12

[Download](#)

Screenshot_2023-10-11_at_5.34.22_PM.png (499 kB)

Colin Bailey - Oct 11, 2023, 5:34 PM CDT

Design 3: Evaluation

- Benefits
 - Breaks always activated
 - Ergonomic
- Constraints
 - Coding experience
 - Cost
 - Integration into walker grips



Colin 13

[Download](#)

Screenshot_2023-10-11_at_5.34.27_PM.png (316 kB)



Colin Bailey - Nov 12, 2023, 12:46 PM CST

Title: Tong Lecture

Date: 11/10/23

Content by: Colin Bailey

Present: n/a

Goals: Listen and learn about her journey

Content:

Went to University of Pitt

Started as premed but switched to BME

Went to graduate school at Madison

-helped work on creating microspheres from polymers

Heath equity director at exact sciences

- cancer care for all people

Discusses how life is not linear

Lean into practice, failing is ok

1. Find your people

2. Do things that scare you/make you uncomfortable

3. laugh until you cry, cry until you laugh

4. Everyone is counting on you

Conclusions/action items:

I thought her speech was both interesting and inspiring.



10/01/2023: "Touch sensors: What it is, How it works, Arduino Guide"

SARA SAGUES (ssagues@wisc.edu) - Oct 01, 2023, 2:29 PM CDT

Title: "Touch sensors: What it is, How it works, Arduino Guide"

Date: 10/01/2023

Content by: Sara

Present: Sara

Goals: To understand how touch sensors work to incorporate them into the noise alert system.

IEEE Citation: "Touch sensors: What it is, how it works, Arduino guide," Shawn 2019.

Link: <https://www.seeedstudio.com/blog/2019/12/31/what-is-touch-sensor-and-how-to-use-it-with-arduino/>

Content:

- Multiple types of sensors
- The resistive touch sensor might work better for our case,
 - needs pressure (not as touch and go)
 - works with gloves so material in between might work
 - works in equipment such as touch-pads and game consoles

Conclusions/action items:

Research more of how they work IN devices, would material over them inhibit or is there a better touch sensor?

**10/01/2023: "SP-3605"**

SA

Title: "SP-3605"**Date:** 10/5/23**Content by:** Sara**Present:** Sara**Goals:** To find a speaker that would work in our alarm system and be integrated with Arduino materials.**IEEE Citation:** Digikey, "SP-3605 Soberton Inc" 2023.**Link:** https://www.digikey.com/en/products/detail/soberton-inc./SP-3605/6562949?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063fCjwKCAjwseSoBhBXEiwA9iZtxkfQsR2gFTgTVYpD_sECWXJiGGOIk79HRSAB6Zg4dx4QuUZ1aN9mBoCr0cQAVd_BwE&gclid=CjwKCAjwseSoBhBXEiwA9iZtxkfQsR2gFTgTVYpD_sECWX**Content:**

-picture used in presentation

-might buy in the future

Conclusions/action items:

-conclude which materials to buy and add them to the spreadsheet.



9/15/2023: "Ensuring Safe Use of Four-Wheeled Walkers"

SARA SAGUES (ssagues@wisc.edu) - Sep 15, 2023, 1:51 PM CDT

Title: "Ensuring Safe Use of Four-Wheeled Walkers"

Date: 09/15/2023

Content by: Sara Sagues

Present: Sara

Goals: To understand the safety problems associated with using a walker incorrectly.

IEEE Citation: "Ensuring safe use of four-wheeled walkers," *Saskatchewan Health Authority*, December 18, 2017.

Link: pdf below

Content:

- Patients can get injured by using walker incorrectly
- specifically a four wheel walker is commonly misused by patients sitting in the seat portion and moving around to get places.
- they don't lock the wheels
- easy for the walker to tip over
- caregivers also don't enforce these rules
- guidelines on how to adjust the height for different patients
- guidelines on how to use the brake system

Conclusions/action items:

Look at different walkers: two wheeled, the basic model, with and without seat, etc.

Patient Safety Alert

File Number: 13728-04
December 18, 2017

ENSURING SAFE USE OF FOUR-WHEELED WALKERS

Transporting or resident who is seated on a four-wheeled walker has been identified as an unsafe practice. Four-wheeled walkers are not designed to transport residents/patients or to have them propel themselves while sitting on the seat.

There are some hybrid models specifically designed for transport residents/patients but they are not commonly used in long-term care health authority facilities.

RECOMMENDATIONS

The Ministry of Health recommends the health care health authority and health care organizations have policies and/or work standards to place the amount:

- Walkers/walkers (including four-wheeled and two-wheeled) are used as walking aids only;
- Residents and/or patients are discouraged from propelling the walker while sitting on the seat; and
- Staff never use a walker to transport a patient/resident.

Supporting documents:

1. Essential Use Cases – Four-Wheeled Walker
2. Walkers/Walkers – https://www.health.gov.on.ca/walkers_alert/walkers

Background of the Critical Incident

In November 2017, the Toronto Health Authority (THA) was notified by a distributor of the death of an 85-year-old resident of a long-term care facility who was transported on a four-wheeled walker. It was determined that the resident was transported on a four-wheeled walker while sitting on the seat. The resident was transported on a four-wheeled walker while sitting on the seat.






[Download](#)

PSA-2017-18-04-Safe-Use-of-Four-Wheeled-Walkers.pdf (757 kB)



9/17/2023: "The Kanega Watch Difference"

Title: "The Kanega Watch Difference"

Date: 09/17/2023

Content by: Sara Sagues

Present: Sara

Goals: To look at a competing design that includes fall detection software.

IEEE Citation: "The Kanega Watch Difference," *UnaliWear Inc*, 2020.

Link: [https://www.unaliwear.com/unaliwear-home-mobile-lp-v1/?](https://www.unaliwear.com/unaliwear-home-mobile-lp-v1/?utm_term=fall%20detection%20watch&keyword=fall%20detection%20watch&adgroupid=118965906926&utm_source=Google%20Ads&utm_medium=cpc&utm_campaign=Search_Fall_Detec)

[utm_term=fall%20detection%20watch&keyword=fall%20detection%20watch&adgroupid=118965906926&utm_source=Google%20Ads&utm_medium=cpc&utm_campaign=Search_Fall_Detec](https://www.unaliwear.com/unaliwear-home-mobile-lp-v1/?utm_term=fall%20detection%20watch&keyword=fall%20detection%20watch&adgroupid=118965906926&utm_source=Google%20Ads&utm_medium=cpc&utm_campaign=Search_Fall_Detec)

Content:

- Adaptive learning technology based on data from users
- Calls dispatcher once a fall is detected: connects to either emergency contacts or to emergency services
- Stylish, elderly are embarrassed to wear something that's not discrete
- Reminders about when to take medication also included
- Connects through cellular and wifi (what if there is no wifi or service?)
- Voice controlled

Conclusions/action items:

Dive deeper into their fall detection technology: <https://www.unaliwear.com/realfall/>



9/22/2023: "At What Age Do Most Seniors Enter Assisted Living?"

SARA SAGUES (ssagues@wisc.edu) - Sep 29, 2023, 12:02 PM CDT

Title: "The Kanega Watch Difference"

Date: 09/17/2023

Content by: Sara Sagues

Present: Sara

Goals: To learn about average ages for adults entering independent living.

IEEE Citation: "At What Age Do Most Seniors Enter Assisted Living". Buckner Parkway Place. Jan 23, 2023.

Link: <https://bucknerparkwayplace.org/news-blog/at-what-age-do-most-seniors-enter-assisted-living/>

Content:

-for PDS research

-some places require a certain age to be allowed to live there

-average age for new residents between 75 and 84

-average age overall is 87

Conclusions/action items:

find the difference between this number and the independent living age



11/9/2023: "Arduino Touch Sensor"

SARA SAGUES (ssagues@wisc.edu) - Nov 09, 2023, 3:29 PM CST

Title: "Arduino Touch Sensor"

Date: 11/9/2023

Content by: Sara

Present: Sara

Goals: To learn how to code an arduino touch sensor.

Content:

Link: <https://arduinogetstarted.com/tutorials/arduino-touch-sensor>

Used in Fabrication meeting #1 and #2 to create code for touch sensor, and integrated with speaker.

Conclusions/action items:

-integrate code with brake system



11/16/2023: "Delay() Arduino Reference"

SARA SAGUES (ssagues@wisc.edu) - Nov 16, 2023, 3:58 PM CST

Title: "Delay () Arduino Reference"

Date: 11/16/2023

Content by: Sara

Present: Sara

Goals: To understand the delay function and its limitations to eventually replace it with a better function.

Link: <https://www.arduino.cc/reference/en/language/functions/time/delay/>

Content:

- the delay function pauses the system for a certain number of milliseconds, and then continues
- not ideal for when we want the system to continue to test for if the touch sensor has been touched in the middle
- wouldn't be able to "reset timer"
- how much does that matter if the patient still isn't touching it exactly at the point when the sound goes off

Conclusions/action items:

Research how to get around this problem. Current status still "works" for our purposes but could be better.



11/30/2023: "Switch case statement used with sensor input"

SARA SAGUES (ssagues@wisc.edu) - Nov 30, 2023, 8:15 AM CST

Title: "Switch case statement used with sensor input"

Date: 11/30/2023

Content by: Sara

Present: Sara

Goals: To implement the switch case that Dr. Numinkar suggested to clean up the code.

Link: <https://docs.arduino.cc/built-in-examples/control-structures/SwitchCase>

<https://www.arduino.cc/reference/en/language/structure/control-structure/switchcase/>

Content:

- Separates loops like if and else if loops so they don't compete and confuse each other
- example has four cases assigned 0-4
- enters a case if certain conditions are met (our four conditions)
- "break" used after each case

Conclusions/action items:

Put switch cases into code instead of if loops, and test.



11/30/2023: Meeting notes

SARA SAGUES (ssagues@wisc.edu) - Nov 30, 2023, 8:40 AM CST

Title: Meeting notes

Date: 11/30/2023

Content by: Sara

Present: Whole group+ Dr. Fields and Michael Minus

Goals: To keep track of ideas given to us.

Content:

<https://usabilitygeek.com/usability-metrics-a-guide-to-quantify-system-usability/>

To assess acceptability, we measured primary caregiver perceptions of usability and usefulness. We measured usability using a weekly confidence survey with a single question: "rate your confidence in using CareVirtue on a scale from 1 (not at all confident) to 10 (very confident)" and using the System Usability Scale (SUS), which includes 10 statements (eg, "Learning to use CareVirtue was quick for me") and a 5-point response scale (1=strongly disagree to 5=strongly agree) [29]. We measured usefulness with 3 surveys. First, we used the National Aeronautics and Space Administration-Task Load Index (NASA-TLX) to assess caregiver workload on a 6-item subscale with a 100-point range (1=very low to 5=very high). The purpose of this measure was to understand the relationship between caregiver workload and CareVirtue use.

Second, we used the Behavioral Intention Scale, which included 4 statements (eg, "If it were up to you, to what extent would you want to use CareVirtue?") and 5-point response scale from 1 (not at all) to 5 (a great deal) [30,31]. Third, we used the perceived usefulness survey, which includes 4 statements (eg, "Using CareVirtue would make it easier to perform my caregiving role") and a 5-point response scale (1=strongly disagree to 5=strongly agree) [32].

<https://aging.jmir.org/2022/3/e36975/>

Use qualtrics for survey making.

<https://www.adroll.com/blog/proof-of-concept-what-it-is-and-how-to-do-it-right>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3068522/>

Conclusions/action items:

Make procedure for testing.



09/13/2023: Client Questions

SARA SAGUES (ssagues@wisc.edu) - Sep 14, 2023, 1:11 PM CDT

Title: Client Questions

Date: 09/13/2023

Content by: Sara Sagues

Present: Sara Sagues

Goals: Prepare for a meeting with the client, Dr. Martin.

Content:

1. Do you have any firm deadlines for us on any part of the project?
2. How often would you like to be updated on our progress?
3. Older adults often start to lose the ability to hear as well as they age. Is this an important consideration for the alert system?
4. The project overview talks about giving "reminders and warnings that could improve safety". What should those look like?
5. What is the average age range for those who use walkers?

Conclusions/action items:

Meet with Dr. Martin tomorrow, 9/14 at 3:30pm.



9/28/2023: Design Ideas for Matrix

SARA SAGUES (ssagues@wisc.edu) - Sep 28, 2023, 11:36 AM CDT

Title: Design Ideas for Matrix

Date: 09/28/2023

Content by: Sara

Present: Sara

Goals: To come up with two ideas, one for locking system, one for distance tracker, and sketch them out.

Content:

pictures below

Conclusions/action items:

Make design matrix

SARA SAGUES (ssagues@wisc.edu) - Sep 28, 2023, 11:47 AM CDT



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IMG_8260.heic (2.85 MB)

SARA SAGUES (ssagues@wisc.edu) - Sep 28, 2023, 11:47 AM CDT



[Download](#)

IMG_8261.heic (2.12 MB)



09/29/2023: Design Matrix

SARA SAGUES (ssagues@wisc.edu) - Sep 29, 2023, 12:07 PM CDT

Title: Design Matrix

Date: 09/29/2023

Content by: Sara

Present: Sara

Goals: To decide on a design for the walker components.

Content:

see pdf below

Conclusions/action items:

-update with sketches and more detailed designs

SARA SAGUES (ssagues@wisc.edu) - Sep 29, 2023, 12:37 PM CDT

[Download](#)

Design_Matrix_2023_-_Sheet1.pdf (49 kB)



10/19/2023: Components for Design

SARA SAGUES (ssagues@wisc.edu) - Oct 20, 2023, 1:03 PM CDT

Title: Components for Design

Date: 10/19/23

Content by: Sara

Present: Sara

Goals: To compile a list of components needed to order.

Content:

- Arduino Touch Sensor
- Digikey Speaker
- Arduino UNO microcontroller (already have)
- Arduino breadboard (already have)
- wires (already have)
- resistors (already have)
- adapter (already have)
- computer (already have)

Conclusions/action items:

Order parts and put them in the BPAG sheet.



10/21/2023: Ordering Links

SARA SAG

Title: Ordering Links

Date: 10/21/2023

Content by: Sara

Present: Whole group

Goals: Narrow down what we're ordering and where from.

Content:

Touch sensor: <https://store-usa.arduino.cc/products/grove-touch-sensor?queryID=undefined&selectedStore=us>

5V Solenoid: <https://www.sparkfun.com/products/11015>

Speaker: [https://www.digikey.com/en/products/detail/soberton-inc./SP-3605/6562949?](https://www.digikey.com/en/products/detail/soberton-inc./SP-3605/6562949?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063fCjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAqtApDzQp9H9iZNTYEybw1UmWB6silwiFjBoCuzAQAvD_BwE&gclid=CjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAqtApDz)

[utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063fCjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAqtApDzQp9H9iZNTYEybw1UmWB6silwiFjBoCuzAQAvD_BwE&gclid=CjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAqtApDz](https://www.digikey.com/en/products/detail/soberton-inc./SP-3605/6562949?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063fCjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAqtApDzQp9H9iZNTYEybw1UmWB6silwiFjBoCuzAQAvD_BwE&gclid=CjwKCAjwysipBhBXEiwApJOcu9ENggSaOlufsVNhaibAqtApDz)

Additional: resistors, Arduino UNO, rubber, and PLA

Conclusions/action items:

Order them



12/10/2023: All code ideas

Title: All code ideas**Date:** 12/10/2023**Content by:** Sara**Present:** Sara**Goals:** To compile the code written by myself into one page.**Content:**Replacing Delay Function with another function that doesn't stop solenoid function #1- micros()

```
const int SENSOR_PIN = 13;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:
int lastState = LOW; // the previous state from the input pin
int currentState;    // the current reading from the input pin
int newState;        // the new reading after 15 sec
int piezoPin = 8;
int SOLENOID = 7;
int button = 12;
int buttonRead = 0;

static unsigned long lastTime = 0;
const long interval = 15000;
//static bool state = 0;
unsigned long now = micros();

void setup() {
// initialize serial communication at 9600 bits per second:
Serial.begin(9600);
// initialize the Arduino's pin as aninput
pinMode(SENSOR_PIN, INPUT);
pinMode(button, INPUT);
pinMode(SOLENOID, OUTPUT);
digitalWrite(SOLENOID, LOW);
}

void loop() {
// read the state of the the input pin:
currentState = digitalRead(SENSOR_PIN);
```

```

buttonRead = digitalRead(button);

if (buttonRead == HIGH) {
    digitalWrite(SOLENOID, HIGH);
}
else{
    digitalWrite(SOLENOID, LOW);
}

if(lastState == LOW && currentState == HIGH) { //if last state untouched, current touched
    Serial.println("The sensor is touched"); //print statement
}
else if(lastState == HIGH && currentState == LOW) { //if last state is touched, current state untouched
    Serial.println("The sensor is released"); //print statement
    currentState = digitalRead(SENSOR_PIN); //read again
    lastTime = millis();
if(now == lastTime + 15000 && currentState == LOW) { //if still not touched
    Serial.println("now beep");
    tone(piezoPin, 1000, 500); //speaker beeps
    digitalWrite(SOLENOID, HIGH);
}}
// save the the last state
lastState = currentState;
}

```

Replacing Delay Function with another function that doesn't stop solenoid function #1- using library SimpleTimer

```

#include <SimpleTimer.h>

const int SENSOR_PIN = 13;          // the Arduino's input pin that connects to the sensor's SIGNAL pin

// Variables will change:
int lastState = LOW; // the previous state from the input pin
int currentState;    // the current reading from the input pin
int newState;        // the new reading after 15 sec
int piezoPin = 8;
int SOLENOID = 7;

```



```
int button = 12;

int buttonRead = 0;

SimpleTimer timer(15000);

bool flag = false;

void setup() {
// initialize serial communication at 9600 bits per second:
Serial.begin(9600);
// initialize the Arduino's pin as aninput
pinMode(SENSOR_PIN, INPUT);
pinMode(button, INPUT);
pinMode(SOLENOID, OUTPUT);
digitalWrite(SOLENOID, LOW);
}

void loop() {
// read the state of the the input pin:
currentState = digitalRead(SENSOR_PIN);
buttonRead = digitalRead(button);

if (buttonRead == HIGH) {
    digitalWrite(SOLENOID,HIGH);
}
else{
    digitalWrite(SOLENOID,LOW);
}

if(lastState == LOW && currentState == HIGH) { //if last state untouched, current touched
    Serial.println("The sensor is touched"); //print statement
}
else if(lastState == HIGH && currentState == LOW) { //if last state is touched, current state untouched
    Serial.println("The sensor is released"); //print statement
    if(timer.isReady() && !flag) {
        currentState = digitalRead(SENSOR_PIN); //read again
        if(currentState == LOW){
            Serial.println("15 seconds have passed and not touched");
            Serial.println("now beep");
            tone(piezoPin, 1000, 500); //speaker beeps
            digitalWrite(SOLENOID,HIGH);
            flag = true;
        }
    }
}
```

```
    }  
  }  
}  
  
// save the the last state  
lastState = currentState;  
}
```

Case Switch code:

```
int SOLENOID = 7;  
int button = 12;  
int buttonRead = 0;  
int lastState = LOW; // the previous state from the input pin  
int currentState;    // the current reading from the input pin  
int speaker = 8;  
int SENSOR_PIN = 13;  
int counter = 0;  
int number = 0;  
  
void setup() {  
  // initialize serial communication at 9600 bits per second:  
  Serial.begin(9600);  
  pinMode(SENSOR_PIN, INPUT);  
  pinMode(button, INPUT);  
  pinMode(SOLENOID, OUTPUT);  
  digitalWrite(SOLENOID, LOW);  
}  
  
void loop() {  
  buttonRead = digitalRead(button);  
  
  if(buttonRead == HIGH && lastState == HIGH && currentState == HIGH) {  
    number = 1;  
  }  
  
  if(buttonRead == HIGH && lastState == LOW && currentState == LOW) {  
    number = 2;  
  }  
  
  if(buttonRead == LOW && lastState == HIGH && currentState == HIGH) {  
    number = 3;  
  }  
  
  if(buttonRead == LOW && lastState == LOW && currentState == HIGH) {
```

```
    number = 4;
}
if(buttonRead == LOW && lastState == LOW && currentState == LOW) {
    number = 5;
}

switch (number) {
while (counter < 50) {
    //Serial.println("while loop");
    currentState = digitalRead(SENSOR_PIN);

    case 1:
        digitalWrite(SOLENOID, HIGH);
        counter = 0;
        break;

    case 2:
        digitalWrite(SOLENOID, HIGH);
        counter = 0;
        break;

    case 3:
        digitalWrite(SOLENOID, LOW);
        counter = 0;
        break;

    case 4:
        Serial.println("The sensor is touched"); //print statement
        counter = 0;
        break;

    case 5:
        Serial.println("The sensor is released"); //print statement
        //delay(1000); //wait 15 seconds
        if (counter == 50) {
            Serial.println("if loop");
            currentState = digitalRead(SENSOR_PIN); //read again
            if (currentState == LOW) { //if still not touched
                Serial.println("now beep");
                tone(speaker, 1000, 5000); //speaker beeps
                digitalWrite(SOLENOID, HIGH);
```

```
        lastState = currentState;
    }
}
break;

//save the the last state
//lastState = currentState;
Serial.println(lastState);
counter = counter + 1;
delay(100);
Serial.println(counter);
}
}
}
```

Conclusions/action items:

Rename files in arduino for organization.



Falls and Other Injuries For Eldery

Title: Falls and Fractures in Older Adults: Causes and Prevention**Date:** 9/17/23**Content by:** Daniel Pies**Present:** Daniel Pies**Goals:** Determine which factors present the biggest safety risks for elderly, and how to negate them.**Content:**

- More than 1 in 4 people age 65+ fall each year.
- Frequent causes of slipping/falling
 - Hearing, eyesight, and reflexes
 - Conditions like diabetes, heart disease, or problems with thyroid, nerves, feet or blood vessels affect balance.
 - Sudden rushed movements increase the chance of a fall
 - Cognitive impairments/dementia
 - Loss of muscle mass (sarcopenia)
 - Blood pressure dropping
 - Foot pain (unsuitable footwear)
 - Medication resulting in dizziness or confusion.
- Proposed solutions to these problems:
 - Balance/strength training exercise (yoga, pilates, tai chi)
 - Hearing / vision tests
 - Learn more about side effects of medications
 - Sleep more
 - **Stand up slowly**
 - Using properly sized assistive devices
 - Wheels roll smoothly
 - Weight limits
 - Take extra caution on icy/wet surfaces
 - Keep hands free
 - Choose proper footwear
- What to do in case of a fall:
 - Crawl to sturdy chair
 - Relax and breathe
 - Get help via 911 or trusted neighbors/family

Conclusions/action items:

Falls can come at any time especially when it's least expected. There are many measures that the elderly can take to prevent falls, however, sometimes it happens regardless of precautionary measures. At that point, it is important to know what to do and how to treat the situation.



Causes of Lacking Forearm Strength in Elderly

Title: Falls and Fractures in Older Adults: Causes and Prevention**Date:** 10/11/23**Content by:** Daniel Pies**Present:** Daniel Pies**Goals:** Determine which factors are associated with grip strength decline in older adults and how to combat those factors**Content:**

- Significant factors for women were stress, smoking, and dementia
- For men: marital status, mean arterial pressure, physical activity (at work) and chronic disorders
- Loss of muscle strength leads to negative outcomes like limited daily living activities, falls resulting in injuries, morality.
- Men's grip strength on average decreases faster with age than women's
- For women, risk factors are more lifestyle related (smoking, stress, etc.)
- For men, risk factors are typically more physically related
- Avoid pattern loss of strength with the following:
 - minimize stress in early midlife
 - avoid smoking in early and late midlife
 - Long term-stress should be handled
 - Smoking increases oxidative stress, which affects the muscles negatively
 - Dementia and grip strength are additionally associated
 - Physical activity is a positively associated factor in grip strength deterioration

How can this be applied to our walker project:

Consider the lack of grip strength

Could our design somehow incorporate some mechanism such as a forearm-strengthening device?

Conclusions/action items:

It was found that risk factors in early adulthood were associated with grip strength decline later in life. Interventions for better grip strength should start early in life and should focus on different lifestyle aspects for men and women.

IEEE Citation:

"Factors associated with grip strength decline in older adults," National Library of Medicine, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4400526/> (accessed Oct. 11, 2023).



Camino Walker

Title: Competing Design: Camino Walker**Date:** 9/21/23**Content by:** Daniel Pies**Present:** Daniel Pies**Goals:** Document "Camino: The World's First Smart Walker"**Content:**

Functions of the Camino Walker

- "An intelligent electric-powered mobility device that boosts, brakes, inspires, detects"
- Has "adaptive autoboot" to aid in uphill walking.
- Smart braking system to aid in downhill motion.
- Narrow mode for tight spaces
- Super compact mode
- Seat back
- Basket
- Cup holder
- Phone holder
- Automatic lights
- Embedded cameras for gait-tracking AI technology
- Sit assist: automatically breaks when hands are taken off the grips

Price Point of the Camino

- List Price: \$2,999
- First Mover Deal for \$1,999

Other Relevant Information

- Carbon Fiber and Machined Aluminum Frame
- Lithium Ion Battery
- Charges in 1 hour
- FCC, EMC, and EMI compliant
- Weight limit of 300 lbs
- Fits a 6'4" user comfortably
- Folds down to 21"
- Weighs 19lbs

Conclusions/action items:

This Camino walker claims to be the world's first smart walker and features many features to enhance mobility and safety.

Link:

[Camino : The World's First Smart Walker – Camino Mobility](#)



Pursue research of a ShopUW Distributors for the following items:

Mini Speakers:

[Mini Metal Speaker w/ Wires - 8 ohm 0.5W \(chicagodist.com\)](http://chicagodist.com)



Arduino Buttons / Finger Print Scanners



DigiKey Link to Solderless Breadboards:

[Solderless Breadboards | Electronic Components Distributor DigiKey](#)



11/30/23 Meeting with Dr. Martin

Title: Meeting with Dr. Martin**Date:** 11/30/23**Content by:** Daniel Pies**Present:** All group members present**Goals:** Catch client up to date on fabrication, testing plans, and seek advice/feedback on progress so far.**Content:**

Usability Tests

- Effectiveness
 - Accuracy
 - Achieving goals
- Efficiency
 - Brake/alarm on did it happen when it should),
- Satisfaction (group of users)

Use a 3rd party group to eliminate bias

Create questions based on device and what we want it to do

- Safety measures (qualitative)

Quantitative vs Qualitative

- What skills and resources do we have available
- Qualtrics survey - platform on MyUW
- Find group of peers (preferable older adults) to test & take survey
- Hip-surgery patients???

Focus group with target audience, show video functionality, ask questions/send survey

Provided links:

- [Usability Metrics - A Guide To Quantify The Usability Of Any System - Usability Geek](#)
- <https://www.qualtrics.com>
- [What is Proof of Concept & How Do You Do It Right? | AdRoll](#)
- [Outcomes for Implementation Research: Conceptual Distinctions, Measurement Challenges, and Research Agenda - PMC \(nih.gov\)](#)

“To assess acceptability, we measured primary caregiver perceptions of usability and usefulness. We measured usability using a weekly confidence survey with a single question: “rate your confidence in using CareVirtue on a scale from 1 (not at all confident) to 10 (very confident)” and using the System Usability Scale (SUS), which includes 10 statements (eg, “Learning to use CareVirtue was quick for me”) and a 5-point response scale (1=strongly disagree to 5=strongly agree) [29]. We measured usefulness with 3 surveys. First, we used the National Aeronautics and Space Administration-Task Load Index (NASA-TLX) to assess caregiver workload on a 6-item subscale with a 100-point range (1=very low to 5=very high). The purpose of this measure was to understand the relationship between caregiver

workload and CareVirtue use. Second, we used the Behavioral Intention Scale, which included 4 statements (eg, "If it were up to you, to what extent would you want to use CareVirtue?") and 5-point response scale from 1 (not at all) to 5 (a great deal) [30,31]. Third, we used the perceived usefulness survey, which includes 4 statements (eg, "Using CareVirtue would make it easier to perform my caregiving role") and a 5-point response scale (1=strongly disagree to 5=strongly agree) [32]."

[JMIR Aging - A Web-Based Platform \(CareVirtue\) to Support Caregivers of People Living With Alzheimer Disease and Related Dementias: Mixed Methods Feasibility Study](#)

Conclusions/action items: Continue developing testing plan, potentially using accuracy test or Qualtrics survey.



Sketch Design 1 - 4 Wheel Braking and Forearm Holders

Daniel Pies - Sep 28, 2023, 12:55 PM CDT



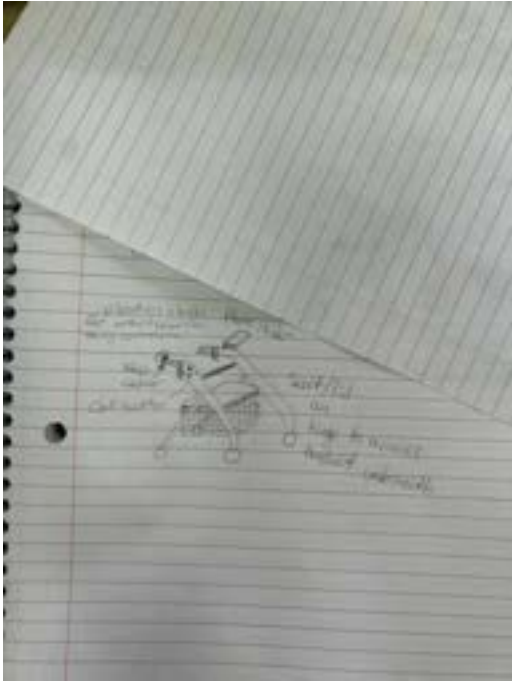
[Download](#)

SketchDesign1_-_4_Wheel_Braking_Forearm_Holders.jpg (991 kB)



Sketch Design 2 - Safety Plan

Daniel Pies - Sep 28, 2023, 12:56 PM CDT



[Download](#)

SketchDesign2- Safety_Plan.jpg (1.07 MB)



Preliminary Presentation

Daniel Pies - Oct 05, 2023, 3:43 PM CDT



[Download](#)

Preliminary_Presentation.pdf (2.03 MB)



Expense Spreadsheet 11/9/23

Daniel Pies - Nov 09, 2023, 2:33 PM CST

Category	Item	Amount	Date	Account
Travel	Hotel	150.00	11/08/23	1000
Travel	Gas	25.00	11/08/23	1000
Travel	Food	10.00	11/08/23	1000
Travel	Taxi	5.00	11/08/23	1000
Travel	Uber	15.00	11/08/23	1000
Travel	Hotel	150.00	11/09/23	1000
Travel	Gas	25.00	11/09/23	1000
Travel	Food	10.00	11/09/23	1000
Travel	Taxi	5.00	11/09/23	1000
Travel	Uber	15.00	11/09/23	1000

[Download](#)

BPAG_Expense_Sheet.pdf (71.2 kB)



Expense Spreadsheet 12/11/23

Daniel Pies - Dec 11, 2023, 1:40 PM CST

[Download](#)

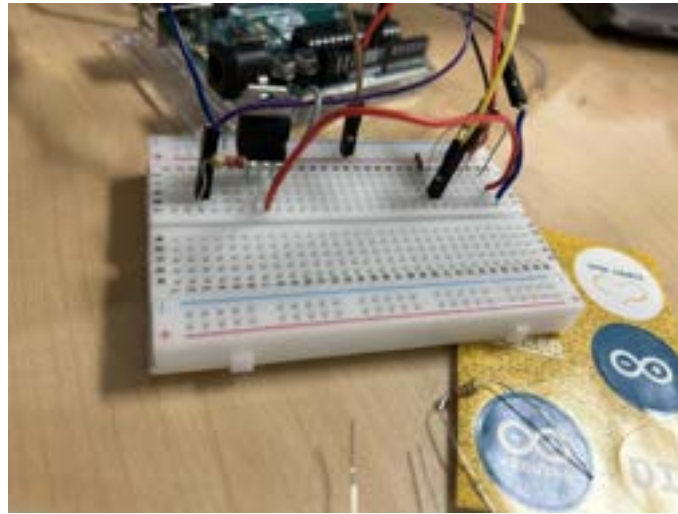
BPAG_Expense_Spreadsheet_-_Sheet1_2_.pdf (53.6 kB)



Circuit 1.0

 **Circuit 11/8/23**

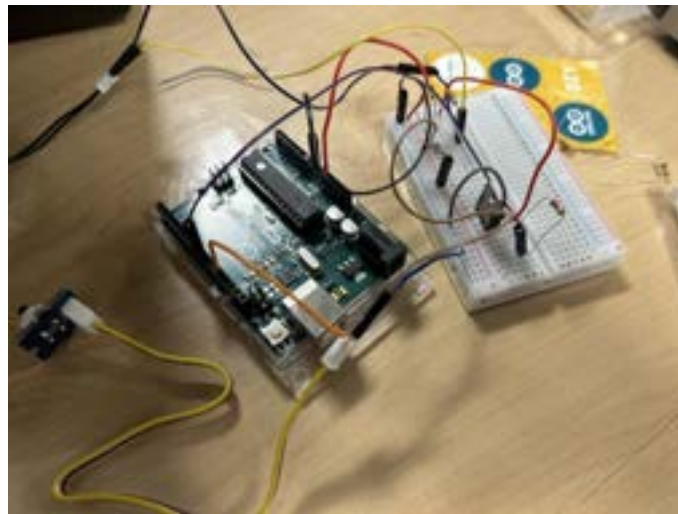
Daniel Pies - Nov 09, 2023, 2:36 PM CST



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IMG_7125.jpeg (3.15 MB)

Daniel Pies - Nov 09, 2023, 2:37 PM CST



[Download](#)

IMG_7124.jpeg (3.66 MB)

**Code 11/8/23**

Daniel Pies - Nov 09, 2023, 2:38 PM CST

```
int SOLENOID = 8;
int button = 12;
int buttonRead = 0;
```

```
void setup() {
  pinMode(button, INPUT);
  pinMode(SOLENOID, OUTPUT);
  digitalWrite(SOLENOID, LOW);
}
```

```
void loop() {
  buttonRead = digitalRead(button);
  if (buttonRead == HIGH) {
    digitalWrite(SOLENOID, HIGH);
  }
  else{
    digitalWrite(SOLENOID, LOW);
  }
}
```



11/10/23 - Tong Lecture

Daniel Pies - Nov 10, 2023, 12:32 PM CST

Title: Tong Lecture

Date: 11/10/23

Content by: Daniel Pies

Present: BME200/300

Goals: Listen & take notes on the motivation of Dr. Ellis

Content:

Attending Pitt when she found BME.

Accepted to UW MBPHD program, wanted to impact patients through tissue engineering.

Worked on polymer microspheres (injectable drug delivery)

Now working at Exact Sciences

She offers the following advice:

- Find your people
- Do the things that scare you
- Laugh until you cry, cry until you laugh
- Practice is important
- It's okay to fail

Health Equity Director

- seek to eradicate cancer across the country
- leads strategy for cancer care for ALL people



Breadboard Box 1.0

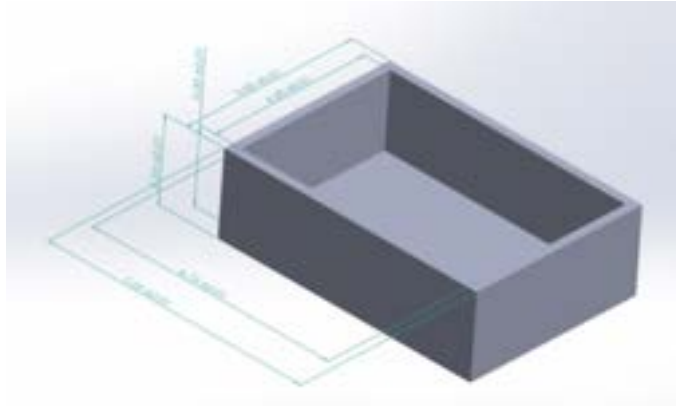
Daniel Pies - Nov 17, 2023, 2:24 PM CST



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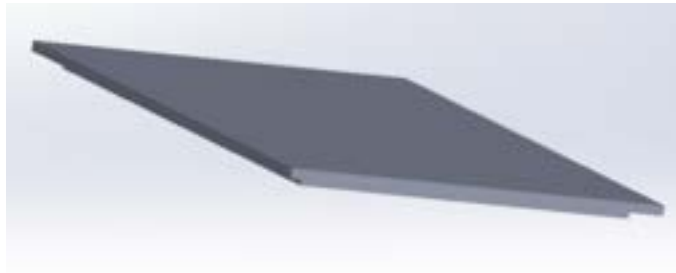
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Breadboard Slide Box

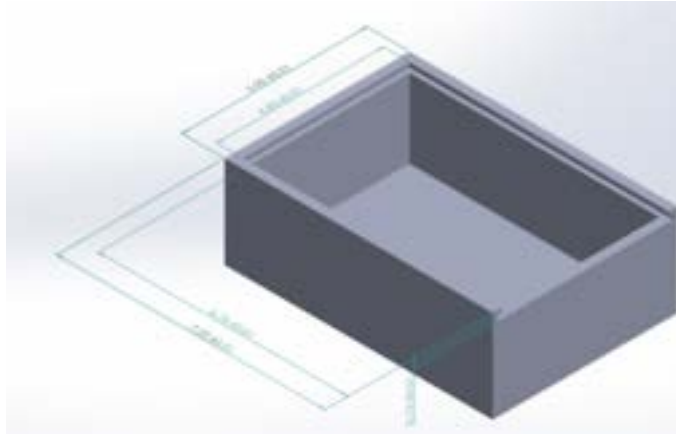
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Breadboard Slide Box Lid

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IMG_7264.JPG (3.16 MB)

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See markings for planned drilling via drill press

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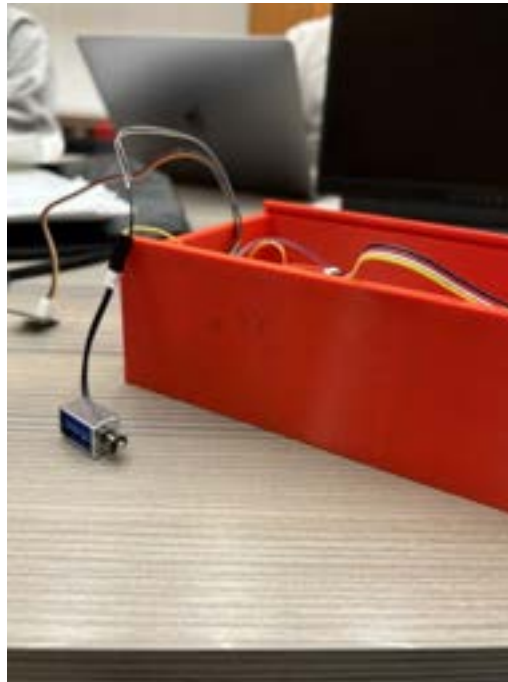
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IMG_7246.JPG (4.35 MB)

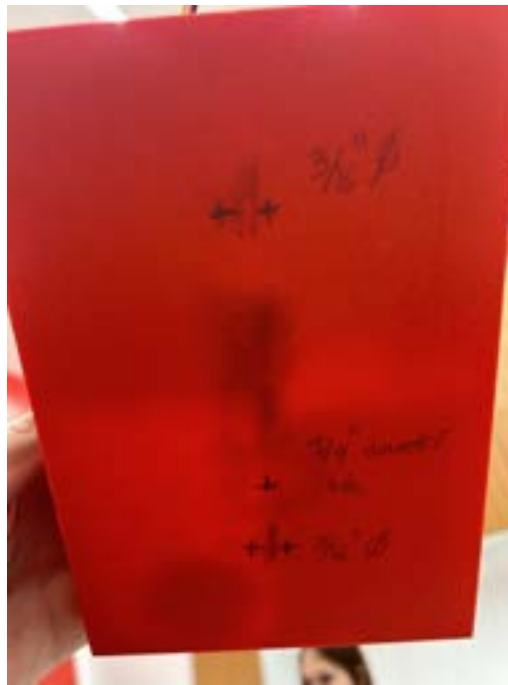
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2014/11/03-Entry guidelines

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.



Title:

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items: