BME Design-Fall 2023 - TANISHKA SHETH
Complete Notebook

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on

Dec 13, 2023 @11:27 PM CST

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Team contact Information

TANISHKA SHETH - Sep 15, 2023, 12:13 PM CDT

Last Name	First Name	Role	E-mail	Phone	Office Room/Building
Block	Walter	Advisor	wfblock@wisc.edu	608-2659686	1137 WI INSTITUTE MEDICAL RESEARCH
Stelford	Mark	Client	mark@oakenacresown.com		
Sheth	Tanishka	Leader	tsheth@wisc.edu	(224)-337-9317	
Park	Selina	Communicator	spark567@wisc.edu	(608)-658-0422	
Finn	Sophia	BSAC	svfinn@wisc.edu	(414)-426-4592	
Agoudemos	Loukia	BWIG	lagoudemos@wisc.edu	(414)-502-5997	
Cruz	Erwin	BPAG			

Project description

TANISHKA SHETH - Sep 15, 2023, 12:07 PM CDT

Course Number:

BME 400

Project Name:

Incubator for Infant Wildlife

Short Name:

Wildlife Incubator

Project description/problem statement:

This project is focused on the creation of a low-cost, durable, easy-to-clean incubator with accurate temperature control to enable wildlife rehabilitators to provide the care needed to save thousands of lives! With the exception of first aid and fluids, incubators are crucial to the rehabilitator's success. All the necessary details to be able to manufacture and offer for sale this item would be of interest as part of this project under the umbrella of Oaken Acres Own, a low-profit limited liability company that is owned by Oaken Acres Wildlife Center. We'd like to be able to share the design of the incubator to key individuals at a national wildlife rehabilitators conference in February 2024 (or earlier) to get feedback as part of the process.

About the client:

Oaken Acres Own, a low-profit limited liability company that is owned by Oaken Acres Wildlife Center. They participate in wildlife rehabilitation

Questions for the Client

TANISHKA SHETH - Oct 11, 2023, 9:01 PM CDT

Title: Questions for the Client

Date: 9/19/23

Content by: All

Present: All

Goals: Get clarification about what the client expects from the design team this semester

Content:

- Wife started a wildlife rehabilitation center 39 years ago on the farm
    - Now there is a seasonal staff that takes care of 1500 orphaned/injured animals every year
    - Birds/animals that cannot regulate their temperature when small
        - Incubator is meant to help this
- L3c company
    - Low profit, limited liability company, mission driven
- Want to provide low cost incubators
- Food products called Newmans Home is similar to Oaken Acres
    - Want proceeds from sales to go fund operations of the wildlife center
    - Want to provide for key wildlife rehabilitation staff
        - Staff works 3 12hr shifts a week
        - Seasonal work
        - There’s not enough work to allow for full time employment
    - Any assembly work for product to be shipped can provide full time year round employment
        - We want to be able to develop something that will allow for this
- $100 is ideal for parts/labor
- No weight limitations
    - Assumed it would be injection mold plastic
- Electronics on the top in existing incubator, no sharp parts
    - Accurate temperature control is REQUIRED
- See through door–required to see the animal within the incubator
- Aesthetics don’t matter–plastic can be any color
- Humidity:
    - 1) get it to 60%
    - 2) very difficult to get to 70% which can be necessary for opossums
        - Base incubator reaches up to 60
        - External humidity source or seal kit to reach higher levels of humidity

Conclusions/action items:

We have more direction now to focus our research. We will focus on components and how to build them on campus.

2023/09/15 Outreach Seminar

SEYOUNG PARK - Sep 15, 2023, 12:28 PM CDT

Title: Outreach Seminar

Date: 9/15/2023

Content by: Seyoung Selina Park

Present: Seyoung, Tanishka, Sophia, Loukia, Erwin

Goals: Understand the requirements for the outreach

Content:

- Submit 1 page professional proposal with a table of materials and costs

Deliverables:

- Presentation

  10 mins intro, define BME and activity

- Activity

  20-40 mins hands-on activity

  must have clear learning objectives (4-5)

- Report

- Teacher/leader evaluation

Activity guide (or mentor plan) due 12/13

Final outreach deliverables due 4/20

Must set up meeting with Tracy once we have our activity guide and presentation drafts completed

Conclusions/action items:

Keep in mind the requirements and due dates for the outreach

2023/09/29 Design Matrix Meeting with Dr. Block

ERWIN CRUZ - Oct 11, 2023, 7:47 PM CDT

Title: Design Matrix Meeting with Dr. Block

Date: 9/29/2023

Content by: Erwin Cruz

Present: Loukia Agoudemos, Erwin Cruz, Sophia Finn, Seyoung Selina Park, Tanishka Sheth

Goals: Receive feedback on Design Matrices and figure out what still needs to be clarified from the client. Also, figure out what needs to be prepared before Preliminary Deliverables are due.

Content:

Clarify from Mark if we are simply trying to keep the incubator at a constant temperature of 95 degrees, or if an option to adjust the set temperature to something else is necessary

Consider adding a flap or vent that can open if the temperature gets too high

- Would also be important for air exchange/humidity

Not from the meeting: https://polygiene.com/biomaster/ - possible addition for antimicrobial stuff to the incubator

Change the verbiage of criteria to make it easy for a layman to understand

Try to get a better idea of what the incubator will look like overall for presentation explanation

Ask Mark how the animal rehabilitation center comes upon animals, so that it can be added to our presentation as “significance”

Ask Mark how significant the lifespan of the product is, if it is not as important we can move our focus away from it.
Follow up with Mark about how large our prototyping budget is.

- If there is no funding, we may have to ask the BME department for funding
- We can hopefully expect for at least a $500 fund for research and development

Clarify the process for how temperature and humidity will be monitored/controlled so that it can be explained in our presentation

If we can get a rough draft done quickly we can send it to Dr. Block for feedback

Conclusions/action items:

Begin work on Preliminary Presentation, and ask Mark necessary questions to obtain more clarity on the project's expectations.

Material expenses

SEYOUNG PARK - Dec 13, 2023, 12:35 PM CST

Title: Expenses

Date: 12/12/2023

Content by: Seyoung Park

Present: N/A

Goals: Reporting expenses throughout the semester

Content:

Item	Description	Manufacturer	Part Number	Date	QTY	Cost Each	Total	Link
Component 1								
Atomization Disc, 5V Module USB Humidifier Atomization Plate Circuit Board	It Is A 108KHz 20mm Micro USB Humidifier With Driver. It Will Keep Work after Power-ON.	tingbowie	B095MZDD1Z	10/30	1	7.99	7.99	link
Component 2								
150 * 28.5mm PTC Heating Plate	Ceramic Electric Heating Plate, with High Temperature Resistance PTC Thermostat Heating Element (12V 220℃) Component Heater	Marhynchus Store	1	10/26	1	8.99	8.99	link
Component 3								
DS18B20 Temperature Sensor Waterproof Stainless Steel Prob	Power supply range: 3.0V to 5.5V Wide temperature Measurement range of -55 ℃ ~ +125 ℃	DIYables	B0BPFYQT8C	10/26	1	9.99	9.99	link
Component 4								
Liquid Level Controller	This liquid level controller has LED indicators, large contact capacity, ultra-wide voltage, and flame-retardant materials. Stable operation, 35MM standard track installation.	Hilitand Store	Hilitand8a1b23u0ys	10/26	1	18.23	18.23	link
Component 5								
MakerFocus 4pcs 3D Printer Fan	Size: 40 mm x 40 mm x 10 mm; Working Voltage: DC 12V; Working Current: 0.08A; Air Flow: 5.75±10% CFM; Power: 0.96w; Cable length: 280mm; Certification: CE,UL,CUL	MakerFocus	B07CH6YC32	10/26	1	10.99	10.99	link
Component 6								

5V Relay Module	5V indicator light LED 1 channel relay module works with arduino boards	DAOKI	B00XT0OSUQ	11/141	7.89	7.89	link

Component 7

DC 12V 2A power supply adapter	AC 120V to DC 12V, 5.5mm*2.1mm plug 12V 2A power supply	CENTROPOWER store	B0C2J2M3GL	11/291	9.99	9.99	link

Component 8

Pop up travel pet kennel	Size: 32.5” * 19.5”* 19.5”	Beatrice home fashion store	SLOPPKOOBLK	12/5	1	17.76	17.76 link

Total: $91.83

Conclusions/action items:

Future expenses should be added.

2023/11/09 Circuit fabrication

SEYOUNG PARK - Nov 14, 2023, 11:41 AM CST

Title: Team meeting for the circuit fabrication

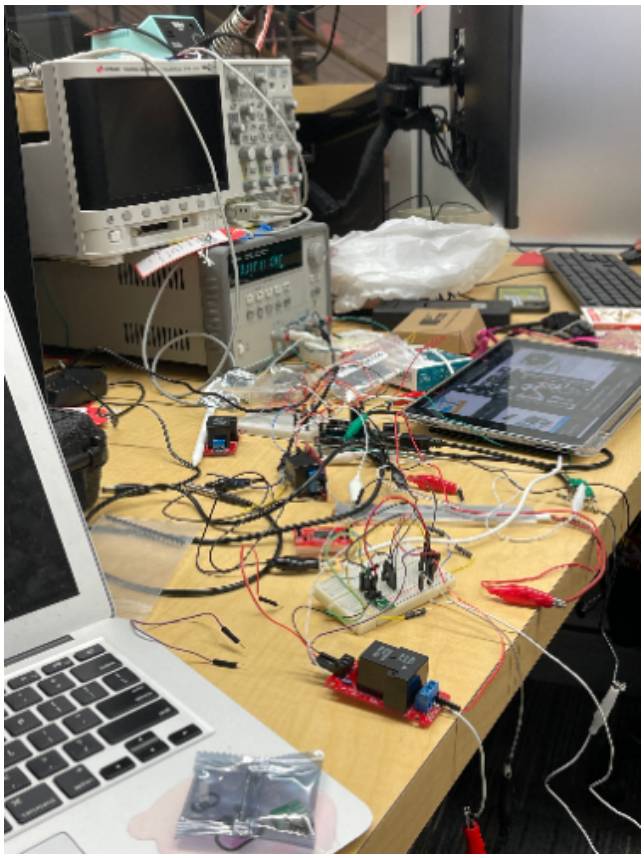
Date: 11/9/2023

Content by: Seyoung Park

Present: Sophia Finn, Seyoung Park, Tanishka Sheth, Erwin Cruz

Goals: Completing the temperature circuit

Content:



The team fabricated the circuit and tested if the temperature sensor and the heating element is working properly.

The Serial Monitor on the Arduino showed the appropriate temperature reading, but the heating pad wasn't heating up and the temperature didn't go up.

The team purchased new part for the AC to DC volt transformer and the power supply adapter.

The humidity sensor didn't work well, so the next goal is to figure out if we are using right library on the Arduino and make sure the sensor is reading the appropriate humidity level.

Conclusions/action items:

The team is planning to finish fabricating both temperature and humidity circuit next week.

2023/11/14 Circuit fabrication

SEYOUNG PARK - Nov 16, 2023, 11:35 AM CST

Title: Team meeting for the circuit fabrication

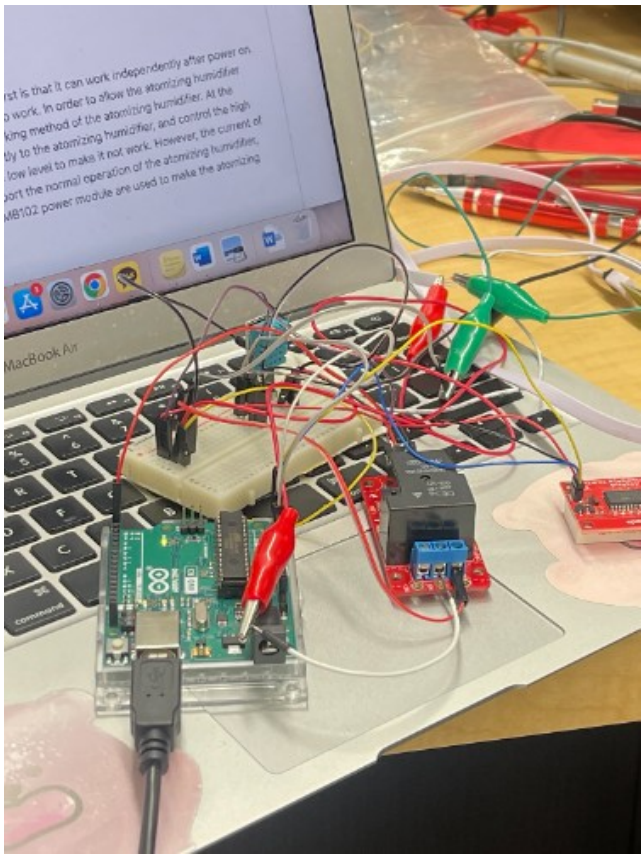
Date: 11/14/2023

Content by: Seyoung Park

Present: Sophia Finn, Seyoung Park, Tanishka Sheth

Goals: Completing the temperature circuit

Content:



The team got new humidity sensor (blue square shape in the picture) and checked the sensor itself is working well.

However, the circuit didn't have any current going on when it was connected to the Beefcake Relay and the display.

The team ended up purchasing new Beefcake Relay, display, and the MB-102 3.3V/5V power module.

For the temperature sensor, everything is working well when connected to the power source of oscilloscope, but didn't work when connected to the power source on the wall.

The only difference between the two settings are the AC to DC volt transformer, so the team will test with different transformer next meeting.

Conclusions/action items:

The team is planning to finish fabricating both temperature and humidity circuit next week.

2023/11/20 Circuit fabrication

SEYOUNG PARK - Dec 13, 2023, 12:46 PM CST

Title: Team meeting for the circuit fabrication

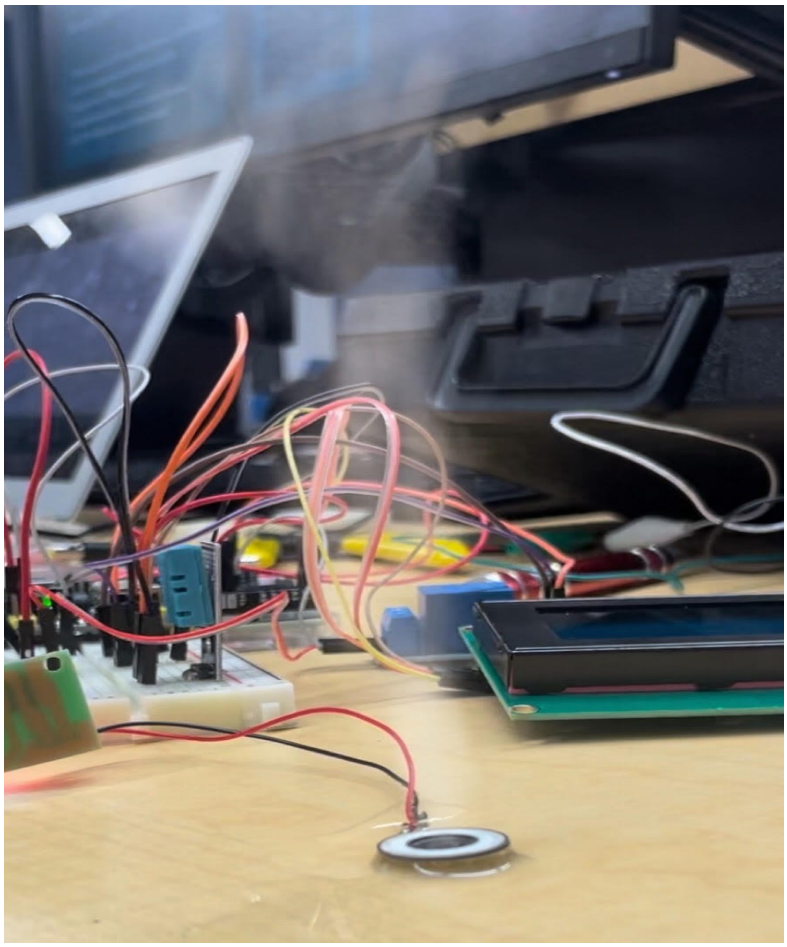
Date: 11/20/2023

Content by: Seyoung Park

Present: Sophia Finn, Seyoung Park, Erwin Cruz

Goals: Completing the humidity feedback circuit with the automizer

Content:



The team completed the humidity feedback circuit including the humidity sensor, automizer working.

The Beefcake Relay wasn't turning on stably, so the team should figure out that problem.

If the Beefcake Relay doesn't work properly, the automizer will not turn on and off when necessary.

The serial monitor was reading humidity and the temperature properly. (The humidity sensor can read both temperature and humidity itself)

Conclusions/action items:

The team finished fabricating the humidity feedback circuit and got the testing data.

2023/11/29 Circuit fabrication

SEYOUNG PARK - Dec 13, 2023, 12:55 PM CST

Title: Team meeting for the circuit fabrication

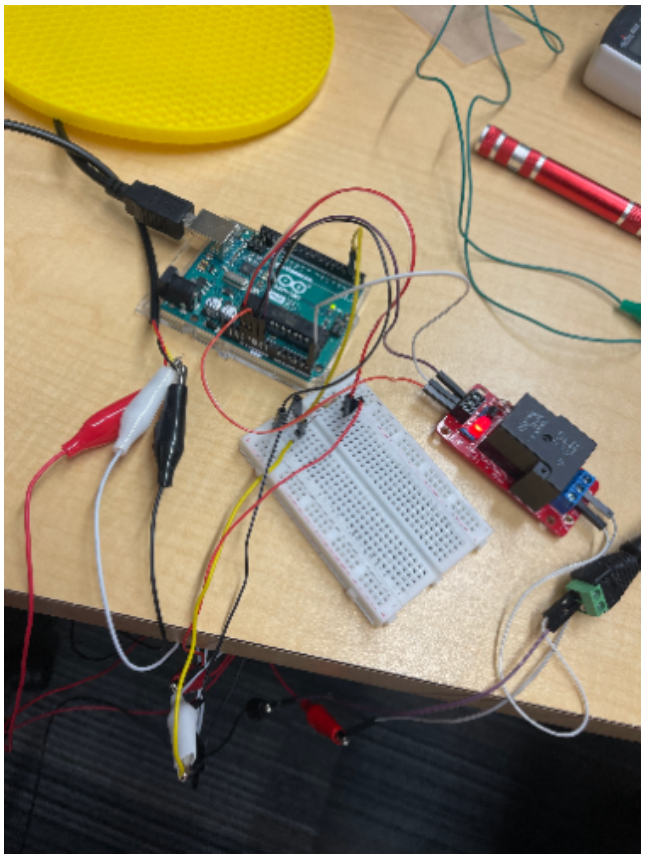
Date: 11/29/2023

Content by: Seyoung Park

Present: Sophia Finn, Seyoung Park, Erwin Cruz, Tanishka Sheth, Loukia Agoudemos

Goals: Completing the temperature feedback circuit

Content:



The team completed the temperature feedback circuit including the temperature sensor, heating element, Beefcake Relay working.

The serial monitor was reading the temperature properly.

When the temperature was below 93ºF, the heating element was on, printing "The heating element is turned on" on the serial monitor.

As the temperature increases and hits 97ºF, the heating element was off, printing "The heating element is turned off" on the serial monitor

Conclusions/action items:

The team finished fabricating the temperature feedback circuit and got the testing data.

2023/12/5 Final fabrication

SEYOUNG PARK - Dec 13, 2023, 1:02 PM CST

Title: Team meeting for the final fabrication

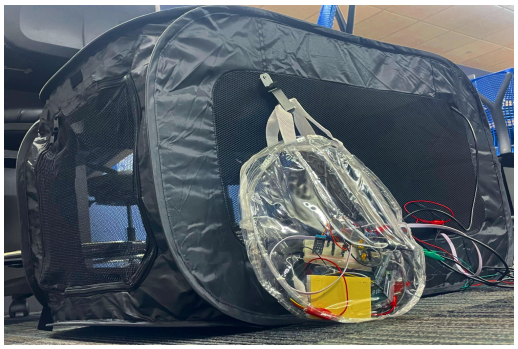
Date: 12/5/2023

Content by: Seyoung Park

Present: Sophia Finn, Seyoung Park, Erwin Cruz, Tanishka Sheth, Loukia Agoudemos

Goals: Completing the final prototype and combining all the circuit elements into the dog cage

Content:



The team put all the circuit elements inside the bag. The circuit elements should be placed outside of the actual incubator so that the animals cannot touch them.

The temperature sensor and the heating element was set inside the dog cage so that it can measure the temperature inside the cage and heat up inside.

In the future, the team should 3D print the incubator or will use the T-Slot 80/20.

The team should figure out the easier way to refill the water for the automizer.

Conclusions/action items:

The picture above is our final prototype every elements combined together.

Humidity circuit testing

SEYOUNG PARK - Dec 13, 2023, 4:16 PM CST

Title: Humidity feeback circuit testing

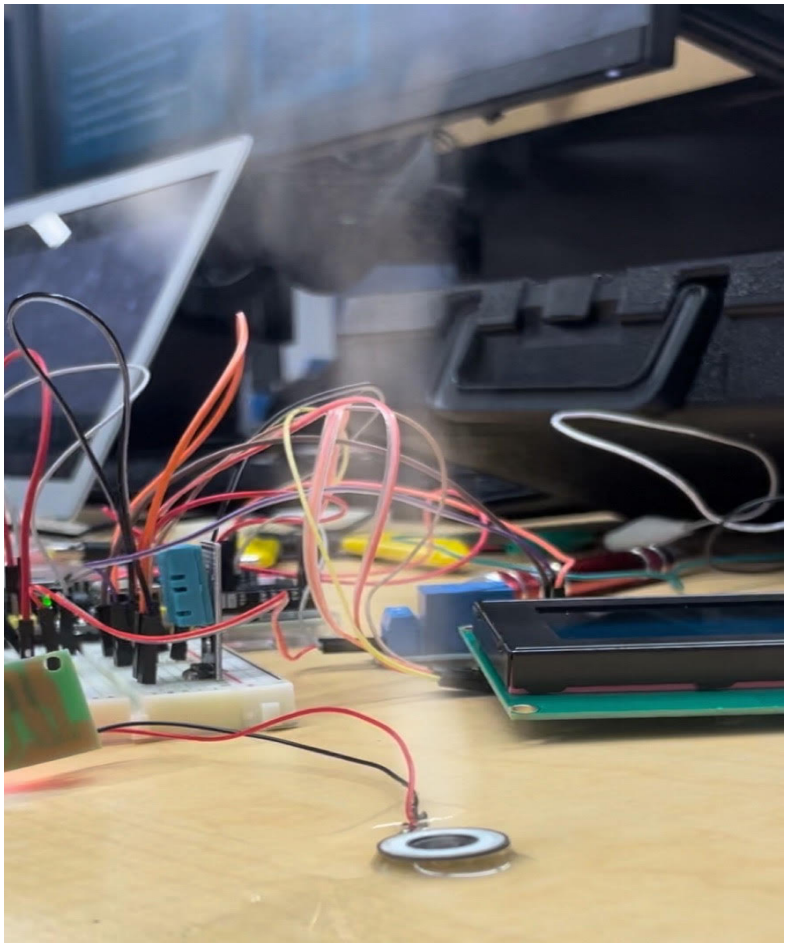
Date: 11/20/2023

Content by: Seyoung Park

Present: Design team

Goals: Checking if the feedback system is working and collecting all the data

Content:



- We covered the humidity circuit with the cardboard box to increase the humidity around. Otherwise, the sensor will measure the humidity of the entire room.

- Since the humidity was low at the beginning, the atomizer was turned on and spayed water.

- The atomizer kept spraying water until the humidity reaches 70%.

- The team lifted the box to decrease the humidity.

- The atomizer stopped spraying water.

- The atomizer turned on again when the humidity dropped below 60%.

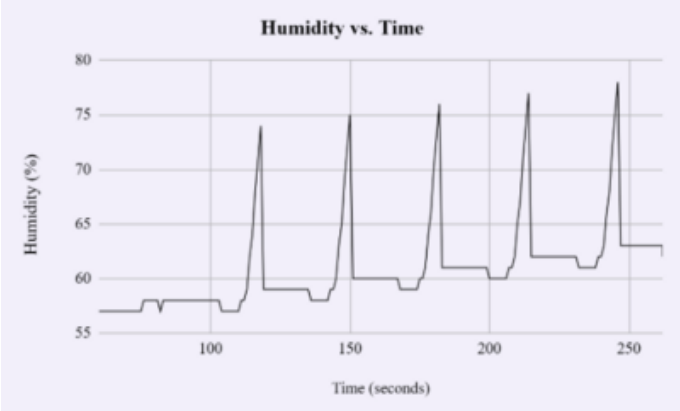
- The humidity was continuously recorded on the Serial Monitor of Arduino.

- The team also tested the circuit inside the dog cage to mimic the incubator environment.

Conclusions/action items:

The humidity feedback circuit was successfully working and we got all the testing data. The team will put the data in the matlab to get the graph.

SEYOUNG PARK - Dec 13, 2023, 5:22 PM CST



Download

Humidity_vs_time_.png (43.7 kB) Image of humidity vs time graph that was developed via testing. There is a slight upward trend that can be seen over time, but overall the humidity stays mostly within the range that was expected and desired.

Temperature circuit testing

SEYOUNG PARK - Dec 13, 2023, 5:03 PM CST

Title: Temperature feedback circuit testing

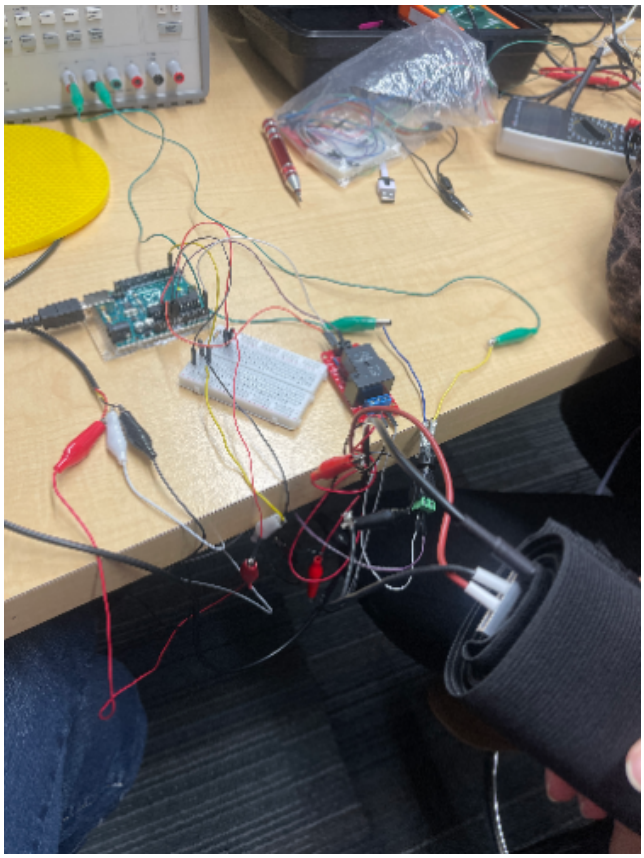
Date: 11/29/2023

Content by: Seyoung Park

Present: Design team

Goals: Checking if the feedback system is working and collecting all the data

Content:



- Temperature was about 23ºC at the beginning, the heating element was turned on.

- The member of the team held the heating element in their hand to ensure it is getting warmer.

- The heating element was turned off when it hit 37ºC.

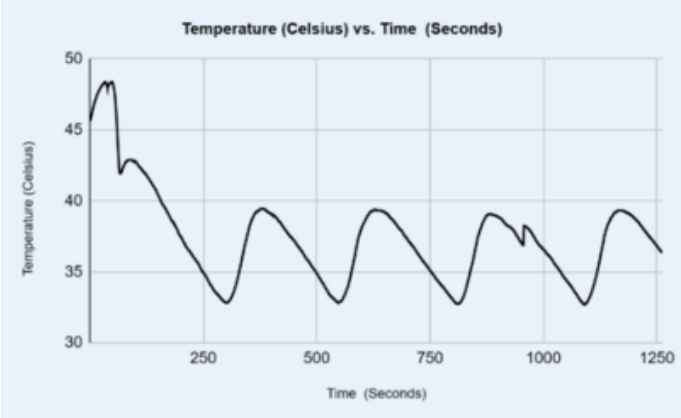
- To make sure that the heating element is turned off, the sensor was placed on the heater and the team member ensured that the element was getting cooler.

- The heating element was turned on again when the temperature hit 33ºC.

- The temperature was continuously recorded on the Serial Monitor of Arduino.

Conclusions/action items:

The temperature feedback circuit was successfully working and we got all the testing data. The team will put the data in the Matlab to get the graph.



Download

Temperature_vs_Time.png (55.4 kB) Image of Temperature vs Time that was obtained through testing data. There is a brief spike that was the calibration period but the temperature feedback system behaved as expected. However, the range is slightly wider (89-104℉) than what would have been desired (92-97℉).

Humidity testing data

SEYOUNG PARK - Dec 13, 2023, 5:09 PM CST

Title: Humidity feeback circuit testing

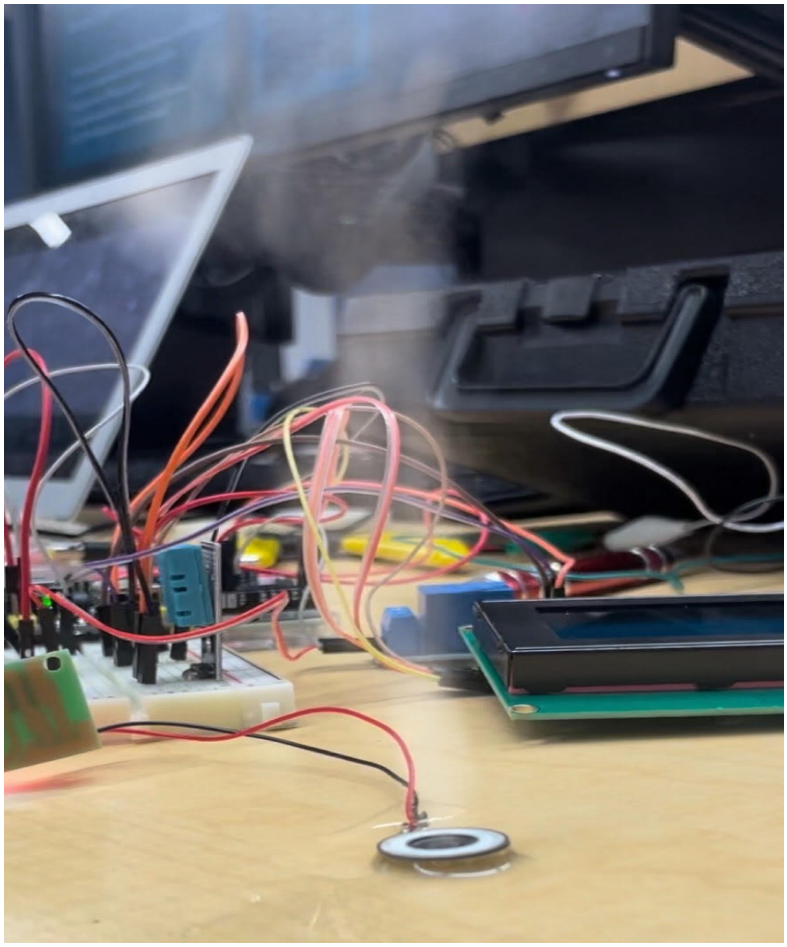
Date: 11/20/2023

Content by: Seyoung Park

Present: Design team

Goals: Checking if the feedback system is working and collecting all the data

Content:



- We covered the humidity circuit with the cardboard box to increase the humidity around. Otherwise, the sensor will measure the humidity of the entire room.

- Since the humidity was low at the beginning, the atomizer was turned on and spayed water.

- The atomizer kept spraying water until the humidity reaches 70%.

- The team lifted the box to decrease the humidity.

- The atomizer stopped spraying water.

- The atomizer turned on again when the humidity dropped below 60%.

- The humidity was continuously recorded on the Serial Monitor of Arduino.

- The team also tested the circuit inside the dog cage to mimic the incubator environment.

Conclusions/action items:

The humidity feedback circuit was successfully working and we got all the testing data. The team will put the data in the matlab to get the graph.

2023/09/22 PDS

SEYOUNG PARK - Oct 11, 2023, 8:30 PM CDT

Title: PDS

Date: 2023/09/22

Content by: The team

Present: N/A

Goals: Understanding the important client requirements and creating PDS

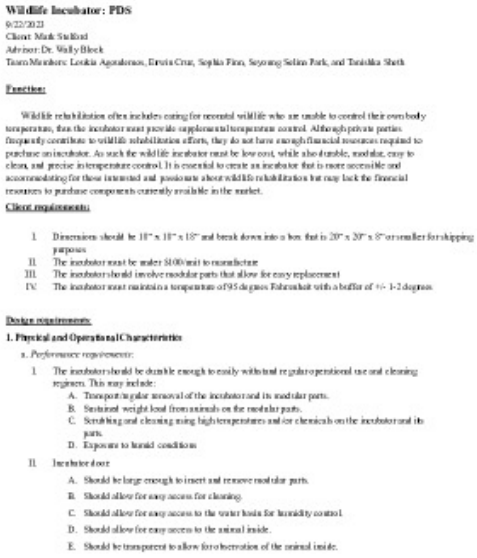
Content:

See the attachment

Conclusions/action items:

The team worked on the PDS during week 3.

SEYOUNG PARK - Oct 11, 2023, 8:30 PM CDT



Wildlife Incubator: PDS
9/22/2023
Client: Mark Stalford
Advisor: Dr. Wally Block
Team Members: Leukia Agustaeus, Erwin Cruz, Sophia Finn, Seyoung Selina Park, and Tanishka Sheth

Function:

Wildlife rehabilitation often includes caring for neonatal wildlife who are unable to control their own body temperature, thus the incubator must provide supplemental temperature control. Although private parties frequently contribute to wildlife rehabilitation efforts, they do not have enough financial resources required to purchase an incubator. As such the wildlife incubator must be low cost, while also durable, modular, easy to clean, and precise in temperature control. It is essential to create an incubator that is more accessible and accommodating for those interested and passionate about wildlife rehabilitation but may lack the financial resources to purchase components currently available in the market.

Client requirements:

I. Dimensions should be 18" x 18" x 18" and break down into a box that is 20" x 20" x 8" or smaller for shipping purposes
II. The incubator must be under $400/unit to manufacture
III. The incubator should involve modular parts that allow for easy replacement
IV. The incubator must maintain a temperature of 95 degrees Fahrenheit with a buffer of +/- 1-2 degrees

Design requirements:

1. Physical and Operational Characteristics

a. *Performance requirement:*

I. The incubator should be durable enough to easily withstand regular pentional use and cleaning regimen. This may include:
   A. Transporting/air removal of the incubator and its modular parts.
   B. Sustained weight load from animals on the modular parts.
   C. Scrubbing and cleaning using high temperatures and/or chemicals on the incubator and its parts.
   D. Exposure to humid conditions
II. Incubator door
   A. Should be large enough to insert and remove modular parts.
   B. Should allow for easy access for cleaning.
   C. Should allow for easy access to the water basin for humidity control.
   D. Should allow for easy access to the animal inside.
   E. Should be transparent to allow for observation of the animal inside.

Download

Wildlife_Incubator_PDS_version1.pdf (105 kB)

2023/09/29 Design Matrix

SEYOUNG PARK - Oct 11, 2023, 8:32 PM CDT

Title: Design Matrix for humidity control, temperature control, and materials

Date: 2023/09/29

Content by: The team

Present: N/A

Goals: Decide the design criteria and determine which design idea is the best option

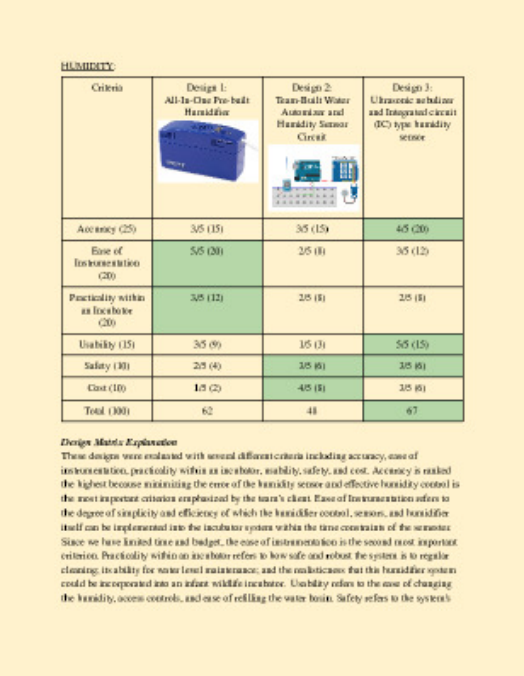
Content:

See the attachment

Conclusions/action items:

The team worked on the design matrix during week 4.

SEYOUNG PARK - Oct 11, 2023, 8:32 PM CDT



HUMIDITY

Criteria	Design 1: All-In-One Pre-built Humidifier	Design 2: Team-Built Water Automizer and Humidity Sensor Circuit	Design 3: Ultrasonic nebulizer and Integrated circuit (IC) type humidity sensor
Accuracy (25)	3/5 (15)	3/5 (15)	4/5 (20)
Ease of Instrumentation (20)	5/5 (20)	2/5 (8)	3/5 (12)
Practicality within an Incubator (20)	3/5 (12)	2/5 (8)	2/5 (8)
Usability (15)	3/5 (9)	1/5 (3)	5/5 (15)
Safety (10)	2/5 (4)	3/5 (6)	3/5 (6)
Cost (10)	1/5 (2)	4/5 (8)	3/5 (6)
Total (100)	62	48	67

Design Matrix Explanation

These designs were evaluated with several different criteria including accuracy, ease of instrumentation, practicality within an incubator, usability, safety, and cost. Accuracy is ranked the highest because minimizing the error of the humidity sensor and effective humidity control is the most important criterion emphasized by the team's client. Ease of Instrumentation refers to the degree of simplicity and efficiency of which the humidifier control, sensors, and humidifier itself can be implemented into the incubator system within the time constraints of the semester. Since we have limited time and budget, the ease of instrumentation is the second most important criterion. Practicality within an incubator refers to how safe and robust the system is to regular cleaning; its ability for water level maintenance; and the realisticness that this humidifier system could be incorporated into an infant wildlife incubator. Usability refers to the ease of changing the humidity, access controls, and ease of refilling the water basin. Safety refers to the system's

Download

WildlifeIncubator_Preliminary_Design_Matrix_.pdf (571 kB)

2023/10/06 Preliminary Presentation

LOUKIA AGOUDEMOS - Dec 12, 2023, 1:08 PM CST

Title: Infant Wildlife Incubator

Date: 10/06/2023

Content by: Design Team

Present: Design Team

Goals: Share preliminary research and selected final design.

Content:

Link: https://docs.google.com/presentation/d/1AA2vnmOmeVknRTkkB8tes2km7XWs_ISHmx38wgcTjz8/edit?usp=sharing

Also, see the attached.

Conclusions/action items:

This semester:

- Assemble multiple iterations for feedback
- Create a prototype and perform testing that can be presented at the conference.

Beyond this semester:

- Prioritize low cost.
- Improve design based on feedback from conference.
- Develop more robust prototype.
- Perform testing.

LOUKIA AGOUDEMOS - Dec 12, 2023, 1:09 PM CST

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Wildlife_Incubator_Preliminary_Presentation.pdf (1.41 MB)

2023/10/11 Preliminary Report

SEYOUNG PARK - Dec 13, 2023, 1:49 PM CST

Title: Preliminary report

Date: 10/11/23

Content by: Design team

Present: N/A

Goals: Finishing preliminary report with all the details included

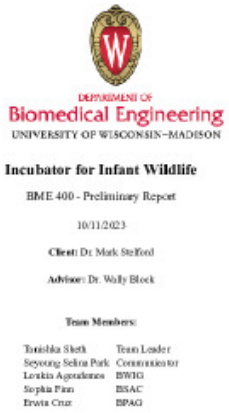
Content:

See the attachment

Conclusions/action items:

The team wrote the preliminary report.

SEYOUNG PARK - Dec 13, 2023, 1:50 PM CST



DEPARTMENT OF
Biomedical Engineering
UNIVERSITY OF WISCONSIN–MADISON

Incubator for Infant Wildlife

BME 400 - Preliminary Report

10/11/2023

Client: Dr. Mark Stelford

Advisor: Dr. Wally Block

Team Members:

Tanishka Sheth	Team Leader
Seyoung Selina Park	Communicator
Loukia Agoudemos	BWIG
Sophia Finn	BSAC
Erwin Cruz	BPAG

Download

Wildlife_Incubator_Preliminary_Report.pdf (920 kB)

2023/12/12 Poster Presentation

LOUKIA AGOUDEMOS - Dec 12, 2023, 12:54 PM CST

Title: Infant Wildlife Incubator

Date: 12/08/23

Content by: Loukia Agoudemos, Erwin Cruz, Sophia Finn, Seyoung Park, Tanishka Sheth

Present: Loukia Agoudemos, Erwin Cruz, Sophia Finn, Seyoung Park, Tanishka Sheth

Goals: Succinct but informational overview of our design project this semester.

Content:

Link to presentation: https://docs.google.com/presentation/d/11pll4vMIBYUFQpBwd7VRGP6LhX8jMyakjbTnlf3Ky54/edit?usp=sharing

[Also see the attached.]

Conclusions/action items:

- The humidity range should remain between 60% to 70%
- Our sensor was able to judge the humidity accurately and turned the atomizer on to increase the humidity when necessary.
- However, the humidity has increased too high at times so the feedback mechanism might have to utilize predictions.
- The temperature range should remain between 93-97°F
- The temperature changed slower than the humidity and was more stable.
- The feedback system was still too slow and allowed the temperature to go above and below ideal limits.
- Improve regulation of temperature and humidity through a feedback system (PID)
- Implement changeable temperature and humidity using a dial.
- Create the external shell via 3D printing or T-Slot 80/20.
- Test the whole system over multiple-hour periods rather than the individual components.
- Test the shell for modularity and or durability.

LOUKIA AGOUDEMOS - Dec 12, 2023, 12:55 PM CST

Download

Incubator_Poster_Presentation_1_.pdf (2.64 MB)

09/21/2023 - Humidity Control Examples

LOUKIA AGOUDEMOS - Sep 28, 2023, 4:18 PM CDT

Title: Humidity Sensor Example

Date: 09/21/2023

Content by: Loukia Agoudemos

Present: N/A

Goals: Look up some ideas for a humidity sensor circuit.

Content:

- DHT11 Temperature Humidity Sensor Module
  - Check out the data sheet for pinout and time: DHT11-Temperature-Sensor.pdf (components101.com)
- DHT22 Temperature and Humidity Sensor

Check datasheets for accuracy levels and pinouts.
There are options for humidity controllers here: W3005 Digital Humidity Controller, Hygrometer, Humidity Control, Switch Regulator, Humidity Sensor With Up And Down Two Buttons, Xh-w3005 220v - Temu

Here is how to make a humidifier system: DIY Smart House 2 - DIY a Humidifier : 14 Steps (with Pictures) - Instructables

Use a Grove Water Atomizer as a DIY Humidifier – SENSING THE CITY

Conclusions/action items: These are all possible options for humidity controls. We need to ask either the client or Dr. Block how we should go about this--diy humidifier parts versus already manufactured humidity control.

LOUKIA AGOUDEMOS - Sep 28, 2023, 12:37 PM CDT

Amazon.com: HUMI-CARE Electronic Humidifier 200-300 Cigar Capacity : Health & Household

10/20/2023 - Controller Notes

LOUKIA AGOUDEMOS - Oct 20, 2023, 3:59 PM CDT

Title: PID Controller Notes

Date: 10/20/2023

Content by: Loukia Agoudemos

Present: Team Meeting

Goals: Get some references for PID controllers.

Content:

PID - Arduino Reference

PID Controller Basics & Tutorial: PID Arduino Project | Arrow.com

Conclusions/action items: Review these and think of ways to incorporate them into the circuit.

2023/09/27- 3D Printing Materials Research

Title: 3D Printing Materials Research

Date: 9/28/2023

Content by: Erwin Cruz

Present: Erwin Cruz

Goals: Perform research on possible materials for the shell of the incubator

Content:

Materials available at UW MakerSpace:

Ultimaker (grams)

- PLA - **.08**
- Tough PLA - **.08**
- Nylon - **.12**
- PC - **.12**
- PP - **.13**
- CPE+ - **.13**
- Nylon 12 Powder - **.15**

Formlabs (mL)

- Clear - **.24**
- White - **.24**
- Black - **.24**
- Flexible 80A - **.29**
- Elastic 50A - **.29**
- Durable - **.26**
- Rigid 4000 - **.29**
- Tough 1500 - **.26**
- High Temp - **.29**
- BioMed Clear - **.36**

Markforged Onyx Pro

- Onyx Filament - **.28**

Stratasys F370 (cubic in.)

- ABS - **2.96**
- PC-ABS - **3.31**
- ASA - **3.33**
- TPU - **3.84**
- ABS-ESD7 - **4.19**

- QSR Support Filament - **4.01**

Fuse 1 (grams)

- Nylon 12 Fused - **.15**

https://making.engr.wisc.edu/3dprint-cost/

3D Printing vs. Injection Molding

PLA: Polylactide

3D Printing (Ultimaker 2+)

- Cheaper for small batches
- Faster
- Higher crystallinity; opaque (PLA)
- Higher elastic modulus for PLA and PLA/TPU blend
- Higher fracture toughness

Injection Molding (DSM Xplore Micro)

- Requires a mold
- Cheaper for mass production
- Often stronger
- Lower crystallinity; transparent (PLA)
- Higher strength and elastic modulus for PLA/GF and PLA/TPU/GF blend

https://journals-sagepub-com.ezproxy.library.wisc.edu/doi/pdf/10.1177/0892705718772867

Material Comparisons for Ultimaker:

PLA

- Fast
- Cheap
- Heat resistant up to 60C

ABS

- Tough
- Heat Resistance up to 85C

- Prone to UV Sensitivity

Nylon

- High strength-weight ratio
- Semi-flexible
- Heat resistant up to 80C
- “features reduced humidity absorption”

PC (Polycarbonate)

- Heat resistant up to 110C
- UV Resistance
- Strong
- Flame Retardant

CPE (copolyester)

- Heat resistant up to 70C for CPE
- Heat resistant up to 100C for CPE+
  - CPE+ is also chemically resistant
  - Harder to print with due to temperature resistance
- Can be translucent if desired

PP (polypropylene)

- Translucent
- Semi-flexible
- Fatigue resistant
- Chemical resistance
- Electrical resistance
- Low density (lightweight)

TPU (thermoplastic polyurethane)

- Semi-flexible
- Strong
- Resistant to oil and chemicals
- Sensitivity to UV, moisture and high temperature

https://support.makerbot.com/s/article/1667337612208

https://ultimaker.com/learn/which-3d-printing-material-should-i-use/

Material Comparisons for Formlabs:

Water absorption of traditional and 3D printed materials, measured in percentage:

MANUFACTURED WITH TRADITIONAL METHODS			3D PRINTED		
ABS [%]	Nylon [%]	Polypropylene [%]	ABS (FDM) [%]	Formlabs High Temp Resin (SLA) [%]	Formlabs Nylon 12 (SLS) [%]
0.05-1.8	0.7-1.6	0.01-0.1	0.14	0.21	0.66

Heat deflection temperature (HDT) of traditional and 3D printed materials, measured in °C @ 0.45 MPa:

MANUFACTURED WITH TRADITIONAL METHODS			3D PRINTED					
ABS [°C @ 0.45 MPa]	Nylon [°C @ 0.45 MPa]	Polypropylene [°C @ 0.45 MPa]	ABS (FDM) [°C @ 0.45 MPa]	ULTEM (FDM) [°C @ 0.45 MPa]	Formlabs Clear Resin (SLA) [°C @ 0.45 MPa]	Formlabs High Temp Resin (SLA) [°C @ 0.45 MPa]	Digital ABS (PolyJet) [°C @ 0.45 MPa]	Formlabs Nylon 12 (SLS) [°C @ 0.45 MPa]
200	160	210	96	216	73	238	92	177

Vicat softening point of traditional and 3D printed materials, measured in °C:

MANUFACTURED WITH TRADITIONAL METHODS			3D PRINTED		
ABS [°C]	Nylon [°C]	Polypropylene [°C]	ABS (FDM)[°C]	Formlabs High Temp Resin (SLA) [°C]	Formlabs Nylon 12 (SLS) [°C]
100	125-165	143-152	99	230	175

NOTE: “As a rule of thumb, [use] should lie 15C below the Vicat softening point.”

Onyx Filament Research:

> Aging had a significant impact on the mechanical properties of the specimens. Between a newly printed specimen and a 165-day-old specimen, the difference in the absorbed moisture content and Young's modulus was 2% and 66%, respectively. This is a notable weakness of onyx, which is extremely sensitive to moisture compared with PLA and ABS, which are less moisture-sensitive.

Table 2. Tensile mechanical properties of onyx (supplier values).

Mechanical properties of Onyx	Value
Young's modulus *E* (MPa)	2400
Yield stress *Re* (MPa)	40
Tensile strain at break *A* (%)	25

https://support.makerbot.com/s/article/1667412427414

Conclusions/action items:

PLA, Nylon, PC, CPE and PP are likely our best options for 3D printing, either for prototyping or for the final product. Now the materials must be compared so that one can be chosen.

2023/09/29- Injection Molding Materials Research

ERWIN CRUZ - Oct 11, 2023, 7:41 PM CDT

Title: Injection Molding Materials Research

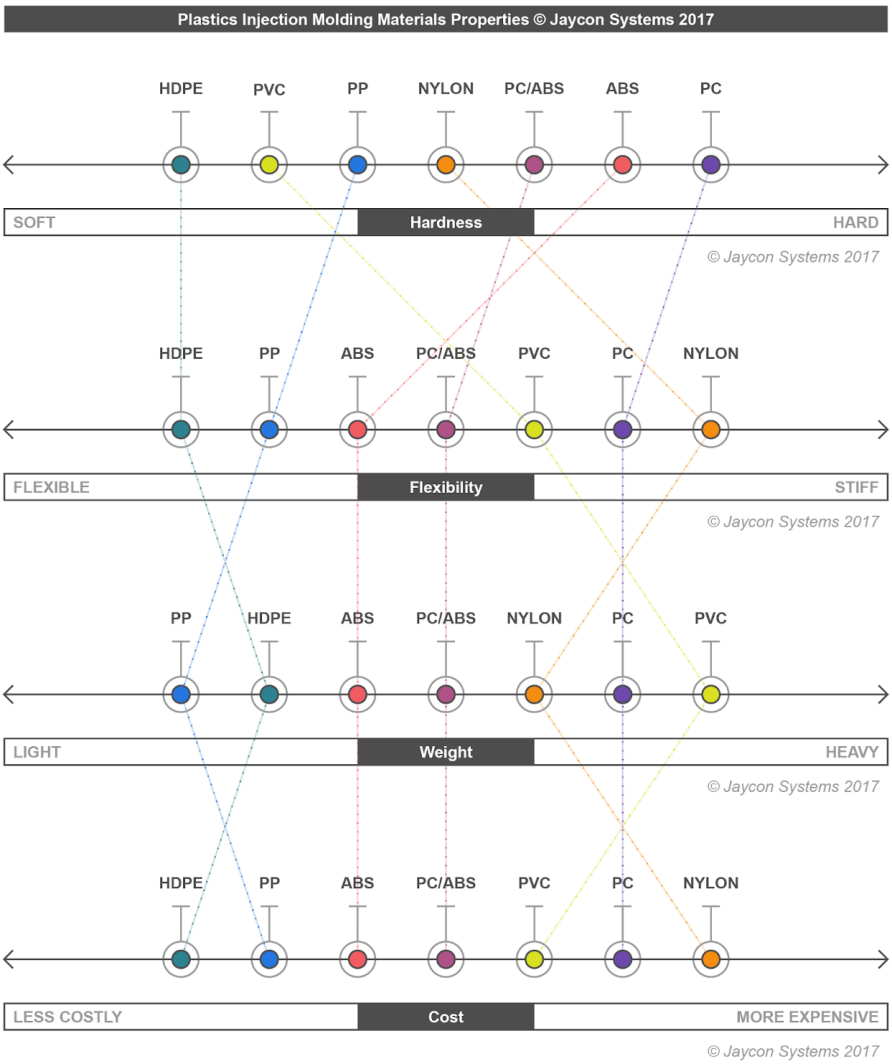
Date: 09/29/2023

Content by: Erwin Cruz

Present: Erwin Cruz

Goals: Learn more about the differences between the plastics that we may use for our prototype and/or final product

Content:



https://jayconsystems.com/blog/plastics-101-selecting-the-right-material-for-injection-molding

Conclusions/action items:

The image found is a good summary of the differences between several common plastics used, however, the only plastic that it provides information on of which we are thinking of using is PP.

2023/10/26 - Incubator Shell Ideas and Notes

ERWIN CRUZ - Dec 13, 2023, 10:46 PM CST

Title: Incubator Shell Ideas and Notes

Date: 2023/10/26

Content by: Erwin Cruz

Present: Erwin Cruz

Goals: Brainstorm ideas for making connecting points for the walls of the incubator

Content:

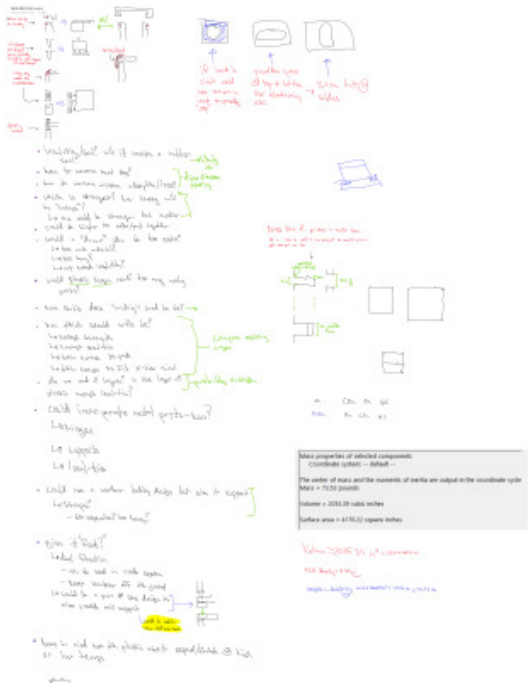
See Attached.

Note: file was updated several times throughout the semester

Conclusions/action items:

Create a CAD design using the proposed ideas, and eventually print the design.

ERWIN CRUZ - Dec 13, 2023, 10:46 PM CST



Download

BME400_CAD_notes.pdf (780 kB)

2023/12/5 - Prototype Incubator Shell CAD Drawings

ERWIN CRUZ - Dec 13, 2023, 10:55 PM CST

Title: Prototype Incubator Shell CAD drawings

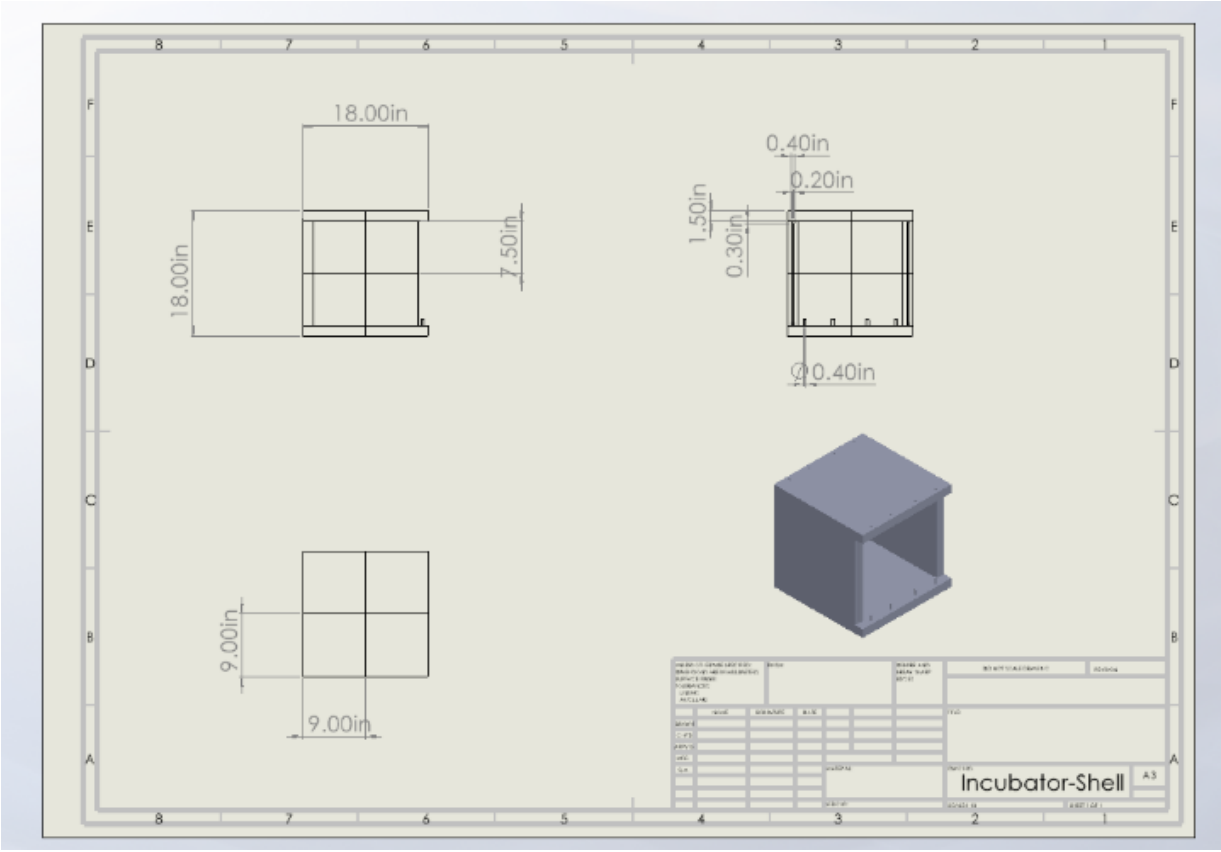
Date: 2023/12/5

Content by: Erwin Cruz

Present: Erwin Cruz

Goals: Create CAD drawings for the incubator shell so that they can be printed and preliminary testing can be performed

Content:



See attached. Files include assemblies for side walls, back wall, ceiling and floor, as well as an assembly for the full incubator without a door, and a SolidWorks Drawing

Conclusions/action items:

See if it would make sense to print this shell at all, or if it would be better to make it smaller/lighter before even attempting a print. Calculations performed found that the print would result in a shell of around 25 pounds

ERWIN CRUZ - Dec 13, 2023, 10:55 PM CST

Download

Ceiling.SLDASM (143 kB)

ERWIN CRUZ - Dec 13, 2023, 10:55 PM CST

Download

Floor-Ceiling.SLDASM (148 kB)

ERWIN CRUZ - Dec 13, 2023, 10:55 PM CST

Download

Incubator-Shell.SLDASM (182 kB)

ERWIN CRUZ - Dec 13, 2023, 10:55 PM CST

Download

Rear.SLDASM (105 kB)

ERWIN CRUZ - Dec 13, 2023, 10:55 PM CST

Download

Walls.SLDASM (89.8 kB)

9/12/2023 Initial Incubator Research

Sophia Finn - Sep 14, 2023, 12:22 AM CDT

Title: Initial Incubator Research

Date: 9/12/2023

Content by: Sophia Finn

Present: N/A

Goals: The goal of this entry is to establish a background in the existing functions of incubators. This will have a very general scope, extending to human infant incubators, as simply understanding the existing incubator technology is a priority as of now.

Content:

Source 1

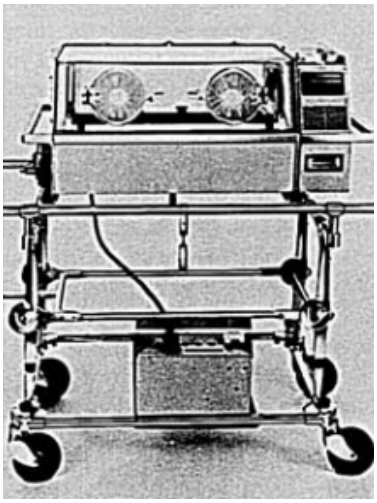
- A consistent and safe humidity level is an essential function of incubators.
- Unsafe humidity levels cause *transepidermal water loss* (TEWL), which increases the chance of infection in a human infant.
- This study found that increased humidity levels caused increased microbial growth.
- This study also found that lowering the incubator humidity level after the "first week of life" decreased the risk of TEWL and improved skin barrier formation.
- A humidity level of 60% -- 70% was found to be ideal.

Source 2

- Thermoregulation is an essential function of incubators.
- Incubators typically utilize convection heating.
- A feedback system is used to regulate the heat in an incubator in a "closed loop control". They primarily detect either infant skin temperature or incubator air temperature.
- If the feedback system detects air temperature, skin temperature tends to fluctuate more. Conversely, if skin temperature is detected, air temperature fluctuates more.
- This study attempted to account for both infant skin temperature and incubator air temperature to find an optimal flow rate.
- An experimental flow rate using theoretical temperature values was concluded.
- The desired temperature range of an incubator is 37-37.5 degrees Celsius.

Source 3

- This article summarizes the features of incubators. Below is a list of these.
    - Plexiglass transparent covering on top and sides.
    - Humidity is provided by a "stream of filtered, temperature-controlled air" from a "water reservoir within hood" that is drained outside the hood.
    - A heated bed.
    - "Control panel" next to the incubator for temperature and humidity.
    - Air temperature regulation, sensing w/ device taped to infant's stomach.
    - The hood includes holes that allow intravenous fluid tubes, draining tubes, and respiratory tubes to slide in and out.
    - Sliding bed that goes in and out of the hod and has restraints on it.
    - Detection for unit malfunction as well as cardiac and respiratory emergencies, as well as visible/audible alarm.
    - The incubator should be easily portable.
    - Thermoregulation uses a conducting unit of "epoxy-coated cast aluminum base for heat storage and uniform radiation".

- 

Sources:

(1) Glass L, Valdez A. Preterm Infant Incubator Humidity Levels: A Systematic Review. Adv Neonatal Care. 2021 Aug 1;21(4):297-307. doi: 10.1097/ANC.0000000000000791. PMID: 33009156. link: Preterm Infant Incubator Humidity Levels: A Systematic Review - PubMed (nih.gov)

(2) Reddy NP, Mathur G, Hariharan SI. Toward a fuzzy logic control of the infant incubator. Ann Biomed Eng. 2009 Oct;37(10):2146-52. doi: 10.1007/s10439-009-9754-6. Epub 2009 Jul 17. PMID: 19609677. link: Toward a fuzzy logic control of the infant incubator - PubMed (nih.gov)

(3) Marks FH. Infant incubators. Nursing. 1972 Nov;2(11):26-30. doi: 10.1097/00152193-197211000-00006. PMID: 4496322. Link: Infant incubators - PubMed (nih.gov)

Conclusions/action items:

There are many key functions that I was able to identify from these three articles. The most integral of the topics to continue research into are thermoregulation, portability, humidity control, and vital sign detection as well as an alarm system. I will continue to research these topics individually, likely in the areas of specific material and fabrication requirements. I will also share my thoughts on the direction we should take our project based on these findings to the rest of my group members.

9/19/2023 Potential Temp. Control Designs

Sophia Finn - Oct 11, 2023, 8:23 PM CDT

Title: 9/19/2023 Potential Temp. Control Designs

Date: 9/19/2023

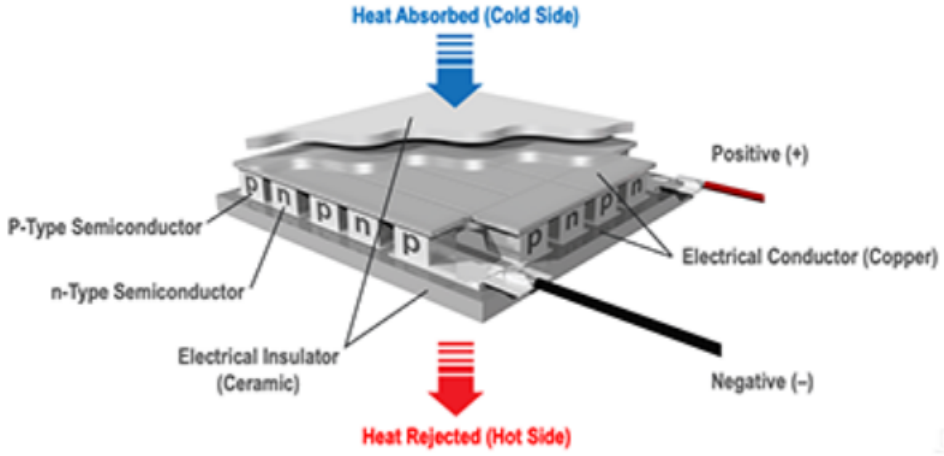
Content by: Sophia Finn

Present: Sophia Finn

Goals: I would like to find potential avenues to explore and test with regard to how we may develop a temperature control system. I will establish options and then evaluate them against the criteria our client has set for us.

Content:

- FBG sensors tend to act faster and more efficiently than standard temperature sensors
- Some incubators utilize a system that detects the heat of the patient directly from the mattress. Others use sensors on the wall of the incubator.
- acrylic windows tend to be common in incubators, as it is very compatible with high temperatures needed.
- Many incubators are "compressor cooled".
- Some incubators use air or water jackets to regulate temperature
- Depending on the size of the incubator, you may need to account for downtime when turning on the temperature system. Some incubators need as much as 24 hours to get to a stable temperature.
- More complicated incubators use semiconductors to heat and cool incubators:



Thermoelectric coolers remove heat by utilizing the Peltier Effect.

  -
  - from Thomas Scientific

Sources:

1. Measurement and Control of an Incubator Temperature by Using Conventional Methods and Fiber Bragg Grating (FBG) Based Temperature Sensors - PubMed (nih.gov)

2. https://doi.org/10.1007%2Fs10815-013-0104-0

3. https://bnmsales.com/wp-content/uploads/2020/09/Heating-and-Cooling-for-Incubator-Chambers-Appnote-082520.pdf

4. Incubator Temperature Control at Thomas Scientific

Conclusions/action items:

From my research on different styles of temperature control within incubators, I believe I want to move forward with simple feedback systems using either ambient air or bed detection. This seems to be the most simple, doable, ad affordable. I will present my finings to the rest of the group and get their opinions on designs to move forward with.

9/26/2023 Programming for Temperature Control

Sophia Finn - Oct 11, 2023, 8:31 PM CDT

Title: 9/26/2023 Programming for Temperature Control

Date: 9/26/2023

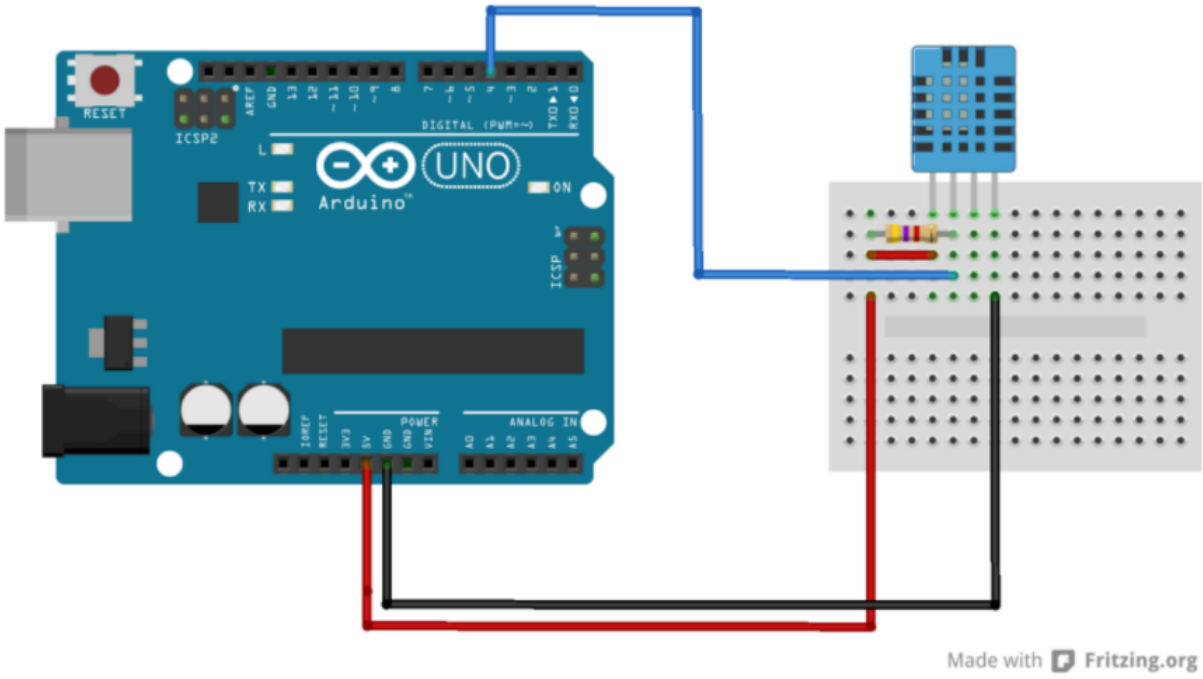
Content by: Sophia Finn

Present: Sophia Finn

Goals: I would like to at least gather pretty solid ideas on how we will program our temperature circuit. If there are existing programs online, I would like to pull from those.

Content:

1. Using DH11 component. Detects humidity and temp.

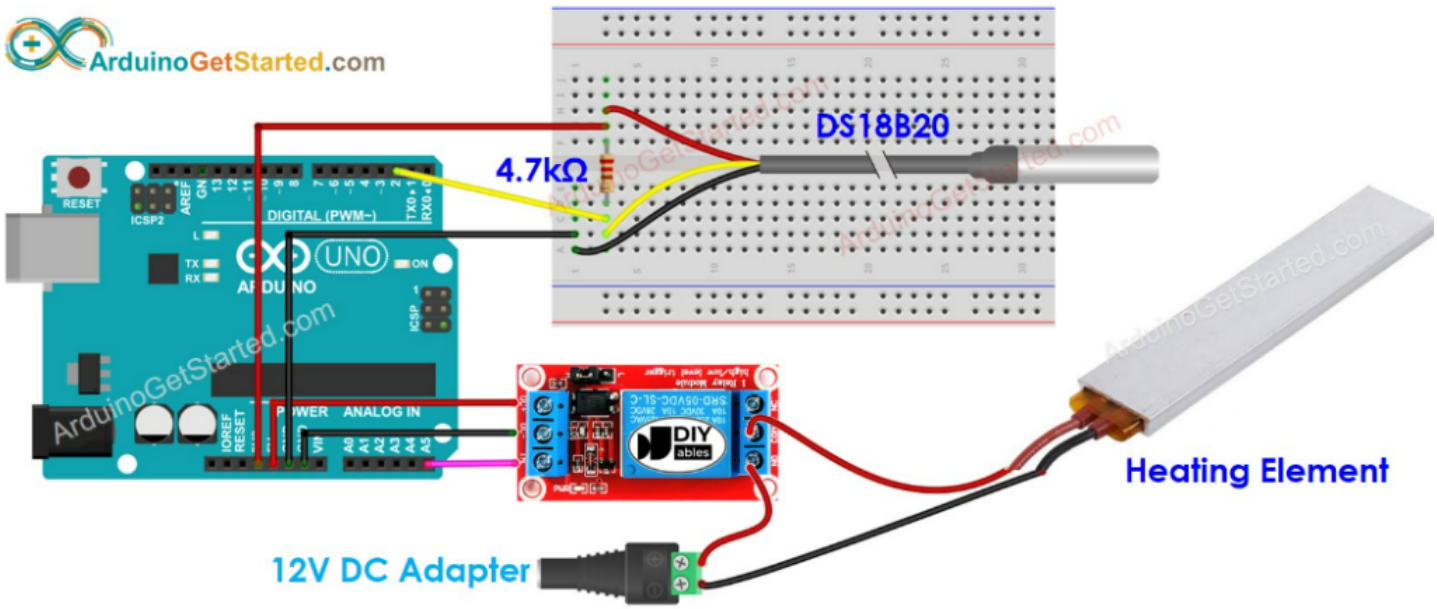


printing it out on the serial monitor.

```
#include <dht11.h>
#define DHT11PIN 4

dht11 DHT11;

void  setup()
{
  Serial.begin(9600);

}

void loop()
{
  Serial.println();

  int chk = DHT11.read(DHT11PIN);
```

2. Heating system using this sensor (https://amzn.to/3Ros9A5) and this heater (https://amzn.to/3xL1D9W)

Wiring diagram with breadboard




```
/*
 * Created by ArduinoGetStarted.com
 *
 * This example code is in the public domain
 *
 * Tutorial page: https://arduinogetstarted.com/tutorials/arduino-heating-system
 */

#include <OneWire.h>
#include <DallasTemperature.h>

#define SENSOR_PIN  2   // Arduino pin connected to DS18B20 sensor's DQ pin
#define RELAY_PIN   A5  // Arduino pin connected to relay which connected to heating element

const int TEMP_THRESHOLD_UPPER = 20; // upper threshold of temperature, change to your desire value
const int TEMP_THRESHOLD_LOWER = 15; // lower threshold of temperature, change to your desire value

OneWire oneWire(SENSOR_PIN);         // setup a oneWire instance
DallasTemperature sensors(&oneWire); // pass oneWire to DallasTemperature library

float temperature;    // temperature in Celsius

void setup() {
  Serial.begin(9600); // initialize serial
  sensors.begin();    // initialize the sensor
  pinMode(RELAY_PIN, OUTPUT); // initialize digital pin as an output
}

void loop() {
  sensors.requestTemperatures();             // send the command to get temperatures
  temperature = sensors.getTempCByIndex(0);  // read temperature in Celsius

  if(temperature > TEMP_THRESHOLD_UPPER) {
    Serial.println("The heating element is turned off");
    digitalWrite(RELAY_PIN, LOW); // turn off
  } else if(temperature < TEMP_THRESHOLD_LOWER){
    Serial.println("The heating element is turned on");
    digitalWrite(RELAY_PIN, HIGH); // turn on
  }

  delay(500);
}
```

Sources:

For 1: Using DHT11 | Arduino Project Hub

For 2: Arduino - Heating System | Arduino Tutorial (arduinogetstarted.com)

Conclusions/action items:

I will present this to my fellow sub-team member (Tanishka) and get our BPAG to make purchases. I will also show this to the humidity team to see if they think it is wise to do a joint humidity - temperature detection system.

10/3/2023 Testing a Temperature System

Sophia Finn - Oct 11, 2023, 8:49 PM CDT

Title: 10/3/2023 Testing a Temperature System

Date: 10/2/2023

Content by: Sophia Finn

Present: Sophia Finn

Goals: I would like to do a bit of research on how to write our testing procedure for our temperature feedback system.

Content:

Heat flow is required depends on the size of the space being heated, quality of insulation, and temperature of inflow.

For this project, here is my proposed testing procedure, assuming we are testing the Arduino system:

- Place the circuitry in a small, closed container. It should be, be or near, 18" x 18"
- Initialize the serial monitor.
- Adjust Arduino code to read:
  ```
  const int TEMP_THRESHOLD_UPPER = 97; // upper threshold of temperature, change to your desire value const int TEMP_THRESHOLD_LOWER = 93; // lower threshold of temperature, change to your desire value
  ```
- Let this run for two hours.
- Read serial monitor data.
- Establish time point where serial monitor begins to read temperature within range.
- If significant variability occurs after this (more than 5% of points), repeat steps with new decreased sensitivity Arduino code:
  ```
  const int TEMP_THRESHOLD_UPPER = 96; // upper threshold of temperature, change to your desire value const int TEMP_THRESHOLD_LOWER = 95; // lower threshold of temperature, change to your desire value
  ```

Sources:

Application of evidence-based recommendations for heat acclimation: Individual and team sport perspectives - PMC (nih.gov)

How to Calculate the Proper Flow Rate for any Hydronic System | Indoor Comfort Marketing

Conclusions/action items:

I believe this is a very doable testing procedure to follow. We will wait for our components to arrive, test the code, and then test the efficiency of the heater using this testing procuedure. I will get approval from my other sub-team member.

10/10/2023 Humidity Arduino Code

Sophia Finn - Dec 13, 2023, 9:43 PM CST

Title: Humidity Arduino Code

Date: 10/10/2023

Content by: All members have troubleshooted this at some point.

Present: All members.

Goals: To make a functioning program for the humidity feedback circuit.

Content:

```
#include "U8glib.h"
U8GLIB_SSD1306_128X64 u8g(U8G_I2C_OPT_NONE);//Set the device name: I2C-SSD1306-128*64 (OLED)

#include "DHT.h"

#define DHTPIN A0

#define DHTTYPE DHT11

#define jiashi 2

#define button 12

DHT dht(DHTPIN, DHTTYPE);

void setup() {

  Serial.begin(9600);
  pinMode(jiashi,OUTPUT);
  pinMode(button,INPUT);
  dht.begin();

}

void loop() {
  float Humid = dht.readHumidity();
  float Temp = dht.readTemperature();
```

```
  Serial.print("Temp");
  Serial.println(Temp);
  delay(1000);
  Serial.print("Humid");
  Serial.println(Humid);
  delay(1000);



  u8g.firstPage();
  do
  {
    u8g.setFont(u8g_font_gdr14r);
    u8g.setPrintPos(25,18);
    u8g.print("DKARDU");
    u8g.setFont(u8g_font_9x18);
    u8g.setPrintPos(1,40);
    u8g.print("Temp: ");
    u8g.print(Temp);
    u8g.print("'C");
    u8g.setPrintPos(1,60);
    u8g.print("Humid: ");
    u8g.print(Humid);
    u8g.print("%");
  } while(u8g.nextPage());

if(Humid<80) {
  digitalWrite(jiashi,LOW);
} else
{
  digitalWrite(jiashi,HIGH);

}


}
```

Conclusions/action items:

This code is functional. We can easily adjust the range to suit our testing needs. Now we need to couple it with a sensor that has the proper tolerance and sensitivity to make the entire circuit appropriate for the client's needs.

10/17/2023 Temperature Code

Sophia Finn - Dec 13, 2023, 9:53 PM CST

Title: Temperature Code

Date: 10/17/2023

Content by: All Members

Present: All members

Goals: We would like to create Arduino code that effectively regulates the temperature of the incubator via a feedback loop.

Content:

```
/*
 * Created by ArduinoGetStarted.com
 *
 * This example code is in the public domain
 *
 * Tutorial page: https://arduinogetstarted.com/tutorials/arduino-heating-system
 */

#include <OneWire.h>
#include <DallasTemperature.h>

#define SENSOR_PIN  2   // Arduino pin connected to DS18B20 sensor's DQ pin
#define RELAY_PIN   A5  // Arduino pin connected to relay which connected to heating element

const int TEMP_THRESHOLD_UPPER = 36.1; // upper threshold of temperature, change to your desire value
const int TEMP_THRESHOLD_LOWER = 33.9; // lower threshold of temperature, change to your desire value

OneWire oneWire(SENSOR_PIN);         // setup a oneWire instance
DallasTemperature sensors(&oneWire); // pass oneWire to DallasTemperature library

float temperature;    // temperature in Celsius

void setup() {
  Serial.begin(9600); // initialize serial
  sensors.begin();    // initialize the sensor
  pinMode(RELAY_PIN, OUTPUT); // initialize digital pin as an output
}

void loop() {
```

```
  sensors.requestTemperatures();             // send the command to get temperatures
  temperature = sensors.getTempCByIndex(0);  // read temperature in Celsius
  Serial.println(temperature);
  if(temperature > TEMP_THRESHOLD_UPPER) {
    digitalWrite(RELAY_PIN, LOW); // turn off
  } else if(temperature < TEMP_THRESHOLD_LOWER){
    digitalWrite(RELAY_PIN, HIGH); // turn on
  }

  delay(1000); // spits out a temp every second.
}
```

Conclusions/action items:

We will use this code in combination with hardware in order to create the functional circuit. We will test this in an appropriate environment (indoors in a box that meets the client's specifications for size) and interpret the resulting data.

10/24/2023 Fabrication Session 1

Sophia Finn - Dec 13, 2023, 10:18 PM CST

Title: Fabrication Session 1

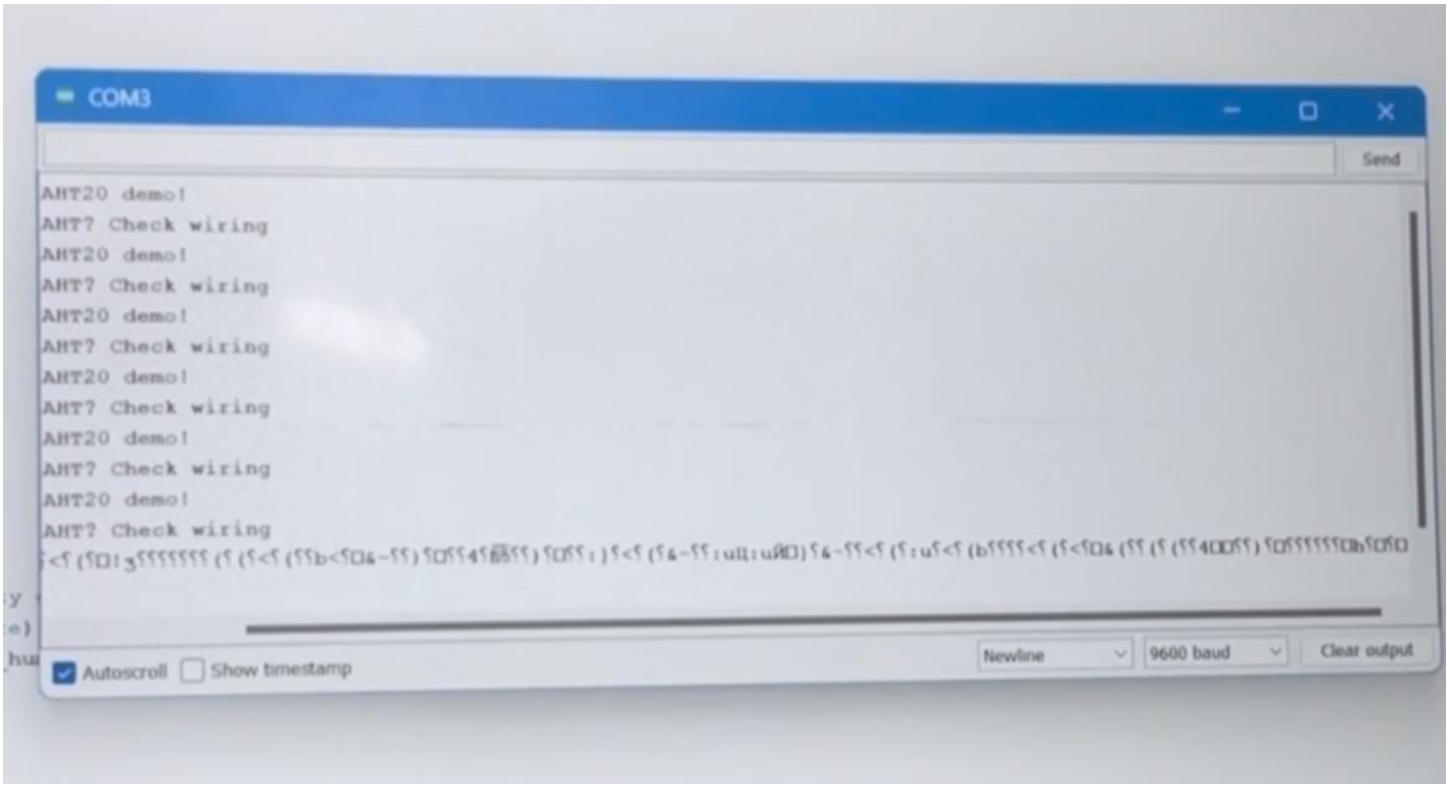
Date: 10/24/2023

Content by: Sophia Finn

Present: All Members

Goals: We would like to use the affordable hardware we've been able to procure in order to, in conjunction with our written code, create effective feedback circuits.

Content:



Result of trying to run the code with the circuit as outlined in initial humidity research.

Conclusions/action items:

Despite playing with this for three hours, we were not able to get our code to read anything. After dissecting this, we found that it was because the libraries we were trying to use did not work for our humidity sensor. We do not know what libraries would work. We will be purchasing a new humidity sensor and going from there, essentially from square 1.

10/31/2023 Fabrication Session 2

Sophia Finn - Dec 13, 2023, 10:38 PM CST

Title: Fabrication Session 2

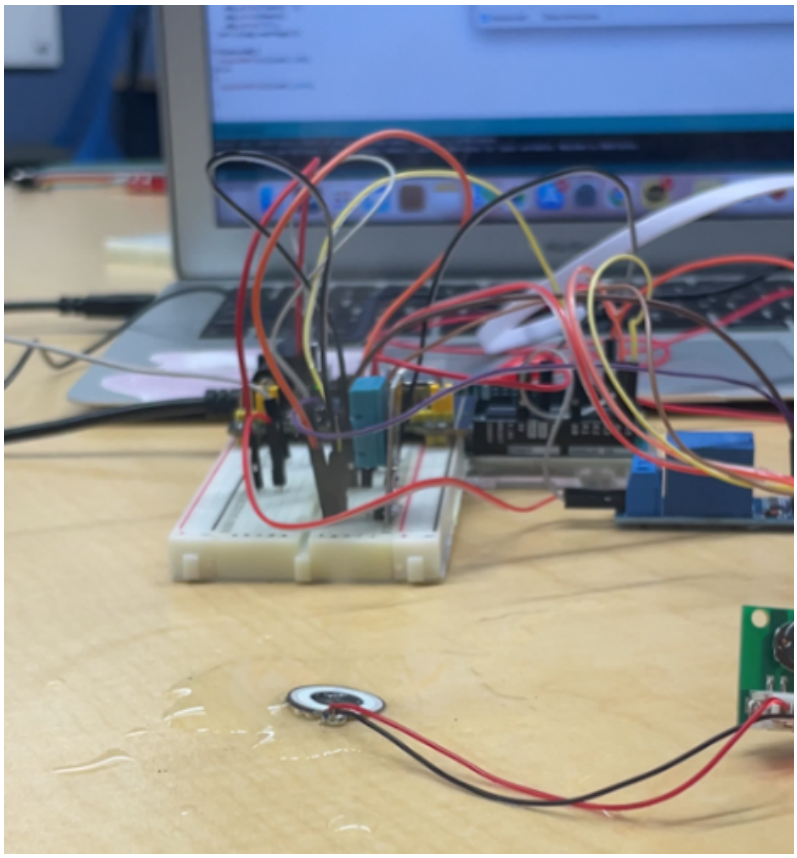
Date: 10/31/2023

Content by: Sophia Finn

Present: All members

Goals: We would like to solve last week's errors in the humidity code and try to get it to display proper functions.

Content:



Conclusions/action items:

The humidity circuit did, in functionality, work. We have not been able to get it to sit properly enough to mimic it in use in the final prototype, thus, it is difficult to get usable testing data. For now, we were able to troubleshoot issues with the libraries and have acquired a workable sensor. As one may see in the image, the device only works if laying in a puddle on a solid surface. We will have to find a way to make it work in a form that is more usable for our final design (ie so it can sit on a source of water that is more easily refillable and not as easily disturbed by an animal).

11/7/2023 Fabrication Session 3

Sophia Finn - Dec 13, 2023, 10:55 PM CST

Title: Fabrication Session 3

Date: 11/7/2023

Content by: Sophia Finn

Present: All members

Goals: We would like to make progress on the hardware for the temperature circuit and additionally improve upon what we already have for the humidity cirucit

Content:

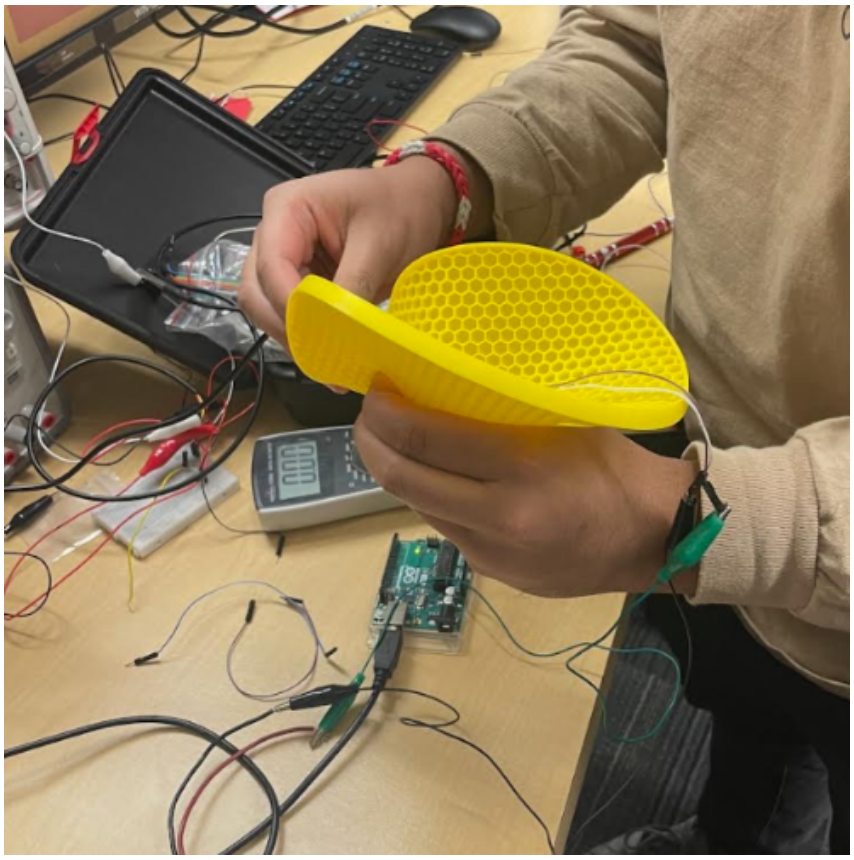


Figure 1: Feeling the heating element warm and cool as commands are run in Arduino.

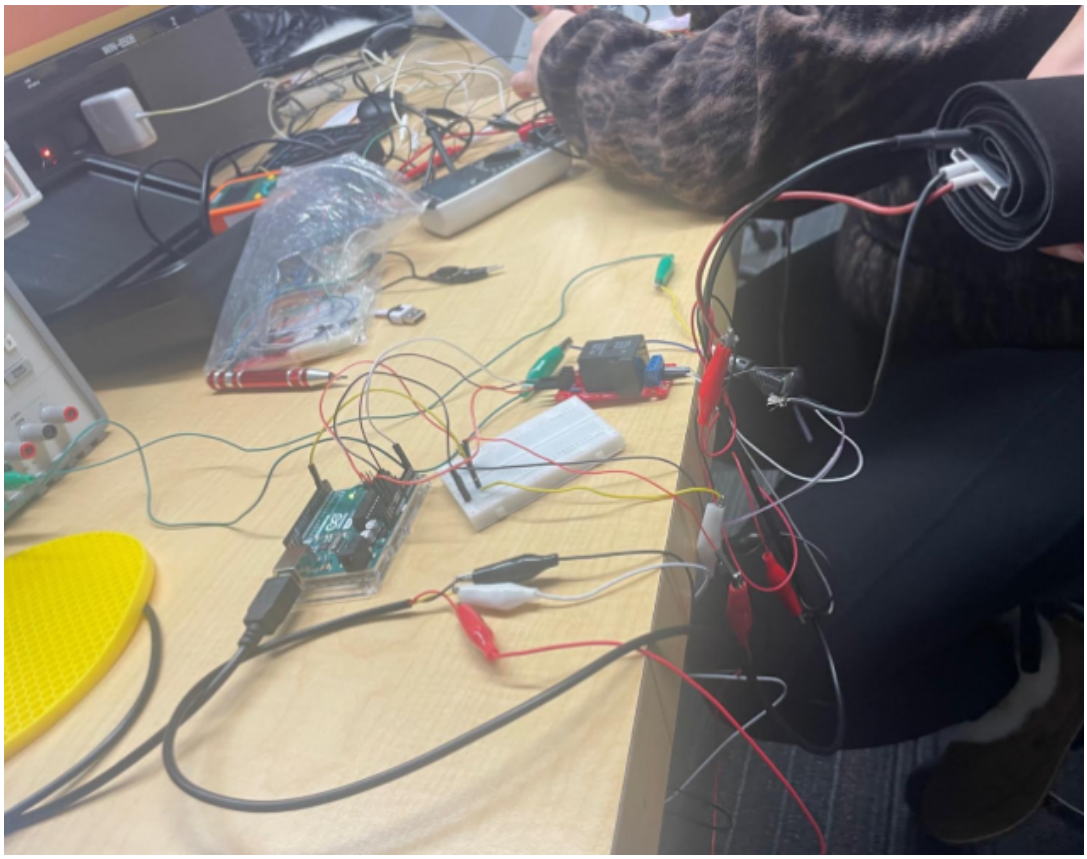


Figure 2: Here, you can see the entire temperature circuit more clearly.

We are using a DC power supply, Arduino UNO, beefcake, basic temperature sensor and ceramic heating element.

Conclusions/action items:

We successfully made the temperature circuit with a borderline functional feedback loop.

We are having trouble managing the slow cooling of the temperature circuit. We will attempt to troubleshoot this before collecting testing data.

11/21/2023 Testing Session 1

Sophia Finn - Dec 13, 2023, 11:03 PM CST

Title: Fabrication Session 4

Date: 11/21/2023

Content by: Sophia Finn

Present: All Members

Goals: We would like to finish the necessary final touches and then collect testing data, if we do not see issues with the circuits themselves.

Content:

Seconds Humidity (%)
0.5
1 64
1.5
2 62
2.5
3 62
3.5
4
4.5
5 61
5.5
6 60
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7 60
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Conclusions/action items:

We were able to get usable testing data for the humidity circuit. I will use this data to create visuals and draw statistically relevant conclusions for our final report and our presentation.

11/14/2023 Purchasing Decision Meeting

Sophia Finn - Dec 13, 2023, 11:15 PM CST

Title: Purchasing Decision Meeting

Date: 11/14/2023

Content by: Sophia Finn

Present: All members

Goals: We have several errors that are due to equipment failure and/or incompatibilities between parts. We will do product research during this meeting, cross-reference with price and usability requirements, and then make final purchases to improve our circuits.

Content:

We will purchase two items that we believe should fix our power supply and lack of consistent regulation issues with our cirucits: 5V Relay Module, DC 12V 2A power supply adapter.

It does not appear that our current power supply model is properly delivering the needed voltage. Additionally, our current beefcake does not (as we saw through troubleshooting it with a multimeter) take in ANY current whatsoever. This new beefcake we are purchasing should perform more to our expectations, as in our product research we see that it is used successfully in similar projects.

Conclusions/action items:

We will wait for the delivery of these parts and then get to integrating them into our circuits, Then we will collect testing data.

11/28/2023 Testing Session 2

Sophia Finn - Dec 13, 2023, 11:21 PM CST

Title: Testing Session 2

Date: 11/28/2023

Content by: Sophia Finn

Present: All members

Goals: We would like to collect the testing data for the temperature circuit. We will first make sure there are no errors and then collect final testing data.

Content:

Time (Seconds) Temperature (Celsius)
1 45.63
2 45.81
3 45.94
4 46.13
5 46.25
6 46.44
7 46.56
8 46.69
9 46.81
10 46.94
11 47
12 47.13
13 47.19
14 47.31
15 47.38
16 47.5
17 47.56
18 47.63
19 47.69
20 47.75
21 47.81
22 47.88
23 47.94
24 48
25 48.06
26 48.13
27 48.13
28 48.19
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52 48.06
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55 47.38
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57 46.56
58 46.19
59 45.69
60 45
61 44.31
62 43.75
63 43.19
64 42.5
65 42.13
66 41.94
67 41.94
68 41.94
69 42
70 42.06
71 42.19
72 42.25
73 42.38
74 42.44
75 42.5
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96 42.81
97 42.75

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125 41.81
126 41.75
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242 35.44
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245 35.19
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247 35.06
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288 33.19
289 33.13
290 33.06
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293 33
294 32.94
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296 32.88
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299 32.81
300 32.81
301 32.81
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Conclusions/action items:

The testing data looks as expected. Next, I (as I have been the group member assigned to this) will conduct basic statistical tests and generate visuals for the data.

12/5/2023 Final Data Visualizations

Sophia Finn - Dec 13, 2023, 11:24 PM CST

Title: Final Data Visualizations

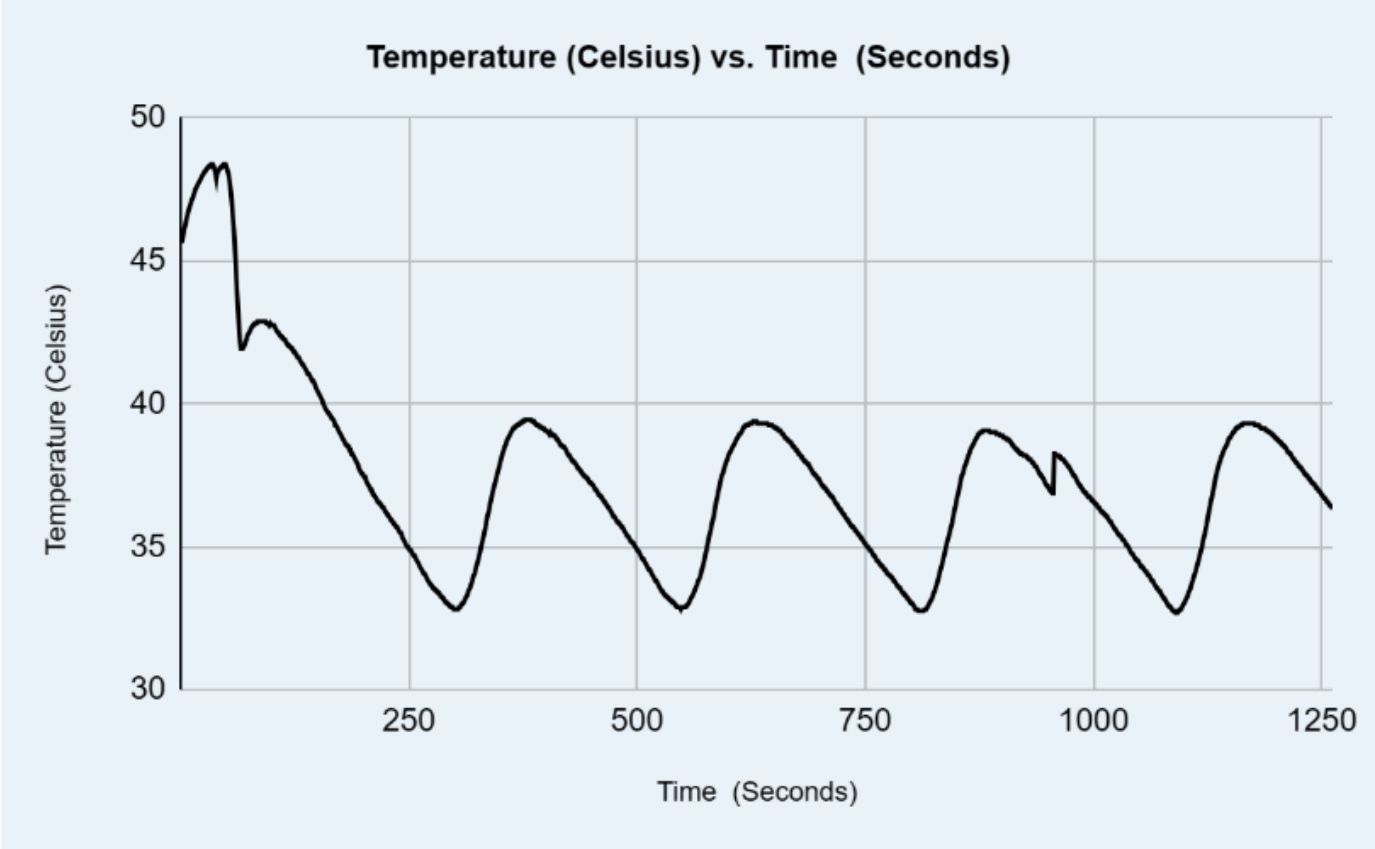
Date: 12/5/2023

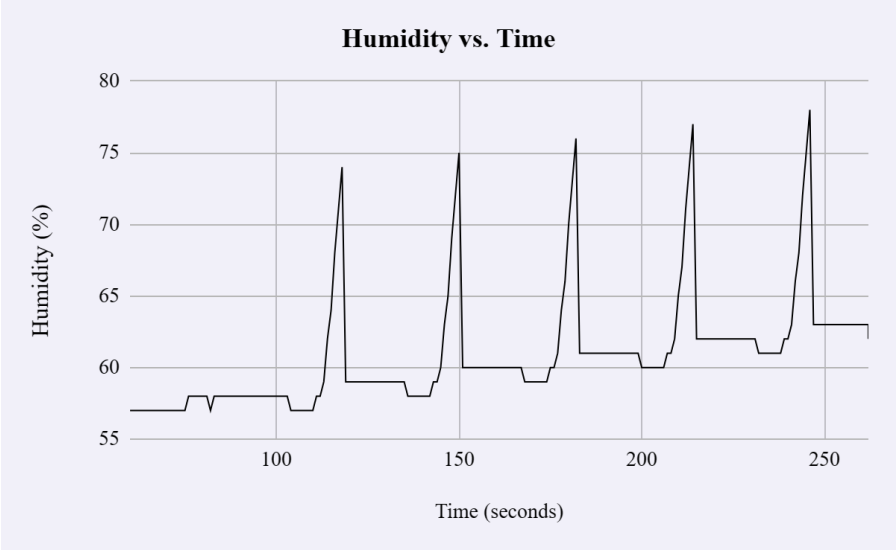
Content by: Sophia Finn

Present: Sophia finn

Goals: I will be finishing my assignment for the presentation, which is creating the data visuals.

Content:





Conclusions/action items:

I will include these in the final presentation and report, along with the appropriate data interpretations as relevant to the needs of our client.

2023/09/14 Incubator standard

SEYOUNG PARK - Sep 21, 2023, 1:53 PM CDT

Title: Incubator standard

Date: 9/14/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: How health and safety standards play an important role in the control of newborn infections

Content:

- Incubators provide an optimal environment with a suitable temperature and humidity for newborns

- Effectively lower the risk of newborns by the external environment in the first few weeks and enhance the immune resistance of newborns

- The “neutral temperature” maintained by incubators means that newborns can keep a stable body temperature, while the appropriate temperature and humidity protects their skin

- When kept at the ideal temperature, newborns use the least amount of oxygen, have balanced metabolic rates, and experience minimal heat loss through evaporation

- The research collected incubator information from 76 infants at the Heping Hospital Affiliated to Changzhi Medical College from January 2021 to January 2022

- Among the 76 infants, 36 were infected during hospitalization, and the other 40 patients were not infected

- The test were conducted to ensure the bacteria culture quantity in the water tanks of the incubators and the water injection ports were ≤ 5 cuf/cm^2

References:

[1] Jiang L, Ma J, Li F, Qin N. Association between incubator standards and newborn nosocomial infection with machine-learning prediction. Transl Pediatr. 2023 Apr 29;12(4):655-662. doi: 10.21037/tp-23-171. Epub 2023 Apr 18. PMID: 37181021; PMCID: PMC10167382.

Conclusions/action items:

Next, I would like to find more information on the incubator durability.

2023/09/15 Project background

SEYOUNG PARK - Oct 11, 2023, 11:19 AM CDT

Title: Project background

Date: 9/15/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Understand the background of the project and the client

Content:

- Dr.Stelford is the VP and the treasurer of Oaken Acres Wildlife Center
- The center's slogan is "Every life matters!"
- The center has provided wildlife care for over 30 years
- They rehabilitate orphaned or injured wild animals that have chance to survive
- It incorporates the mammals and birds which are unable to regulate their own body temperature
- The center have taken in more than 11000 wild animals since opening
- They have insufficient funds to purchase an incubator
- With the exception of first aid and fluids, incubators are crucial
- The goal of the project is creation of a low cost, durable, easy to clean incubator with accurate temperature control
- The design of the incubator will be shared at a national wildlife rehabilitators conference in February 2024

Conclusions/action items:

Through the background information, I could understand the direction of the project.

2023/09/21 Newborn animals' weight

SEYOUNG PARK - Sep 21, 2023, 2:08 PM CDT

Title: Newborn animals' weight

Date: 9/21/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Determine the appropriate weight capacity of the incubator depending on the average weight of newborns

Content:

Chick

- Newborn: 1.5 ounces

- First two weeks after they hatch: keep the temperature between 95 - 100 degrees Fahrenheit

- Reduce the temperature by 5 degrees each week until they are a month old

Goat

- Newborn: 2 to 10 pounds

- Should intake adequate amounts of colostrum within 2 hours of birth

- Recommended amount of colostrum: at least 10 percent of the birth weight

Puppy

- Newborn: 2.5 ounces to 2.5 pounds

- Temperature should be around 96 degrees Fahrenheit

Kitten

- Newborn: 3.5 ounces

- Healthy kittens double their birth weight in the first two weeks

- Normally newborn kittens sleep 90 percent of time for the first two weeks of their lives

Rabit

- Newborn: 35 to 40 grams

- Only nurse once or twice a day, for about 5 minutes at a time

References:

“A Guide to Baby Animals.” *Hello Homestead*, 23 Apr. 2019, hellohomestead.com/a-guide-to-baby-animals/. [Accessed 21 Sept. 2023]

Conclusions/action items:

I looked up the average weight of newborns and general tips for care.

2023/09/22 Client Requirement

SEYOUNG PARK - Oct 11, 2023, 11:37 AM CDT

Title: Client requirements

Date: 9/22/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Organize the information given by client and understand his requirements

Content:

- The goal of the project: low cost incubator (under $100/unit to manufacture)
- It should be durable
- It should have replaceable parts by the user (modular)
- It should be easy to clean
- It should have accurate temperature control that can be set by the user (within 1 to 2 degrees Fahrenheit at 95 degrees Fahrenheit)
- Typical temperature range: 90 to 100 degrees Fahrenheit
- Outside dimensions should be about 18" X 18" X 18"
- Ideally the unit can be broken down and shipped in a box of size 20" X 20" X 8" or smaller
- It needs clear door to see the infant wildlife inside the incubator
- The bottom of the incubator should have 4 inch deep tray (for easy cleaning)
- Base of the incubator needs indentations to fit in a rack (multiple incubator to be stacked)
- The humidity should be able to go up to 60% without any additional sealing on the door
- Humidity control range within 5% at 50% humidity
- Ideally it should go up to 70% (not a must)
- Additional requirement: ability to change the power cord
- Need appropriate electronics for sale in the United States
- Current incubators used at the center run 24 hours a day for about 6 months of the year
- They want a incubator that can last for 10 years
- The incubator should not have sharp edges inside
- The electronics are at the top of the incubator out of the reach of the wildlife
- The door opening needs to be big enough to get the user's hand inside to clean all surfaces

Conclusions/action items:

I understood the client requirements for the incubator, so I would come up with some idea and create design matrix.

2023/09/27 Humidity control

Title: Humidity control of an incubator using the microcontroller-based active humidifier system employing an ultrasonic nebulizer

Date: 9/27/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Research on incubators with humidity control

Content:

- Incubator: infant-stimulating system used for intensive care of the newborn, premature or sick baby

- It provides a safe and clean environment, fresh air, clean and sterile ambient conditions

- It provides a homogeneous and stable temperature, a relative humidity (RH) level and oxygen gas concentration

- 2 methods to humidify the air

- Passive humidifying method
    - Humidity is produced conventionally by a heater
    - The humidity content of the air is increased by evaporation of water by heating it in the water container
    - The humidity level depends on ambient temperature, it is not possible to provide a high humidity level, at low temperatures
    - It is difficult to provide the humidity level higher than 40% RH at low temperatures such as in the range of 23 to 38 degree Celsius
    - Extra heating occurs
    - The passive method is not suitable to humidify the limited volume of an environment such as an incubator
- Active humidifying method
    - Heating source is not used to humidify the control environment
    - Humidifying processes are independent of temperature, it is possible to reach a high humidity level even at a low temperature
    - It is preferable to humidify the limited volume of the environment such as the incubator system
    - The term ‘nebulizer’ can be defined as an instrument for converting a liquid into a fine spray, especially for therapeutic purposes in medicine

- Nebulizer: used to humidify the incubator environment

- Integrated Circuit type humidity sensor: used to measure the humidity level of the incubator environment

- PIC microcontroller: measurement and control processes

- The system mainly consists of four units

- The incubator chamber
- The RH measurement circuit
- The ultrasonic nebulizer
- The microcontroller-based control circuit

- The walls of the incubator are of plexiglas and do not have any air fow

- Plexiglas contains the air in the incubator

- It is suitable for insulating the heat passing in or out of the incubator chamber

- How the system works

- Predetermined RH is entered via the UP button according to patients’ requirements
- Determined values are shown on the three-digit display unit at RH% level
- When the system is activated , determined values and the RH of the incubator environment measured by humidity sensor are compared in the control unit
- If the determined values are higher than the measured values, the ultrasonic nebulizer is energized through the opto-isolator unit and it converts fresh, distilled and sterilized water in the small container into fine water particles
- The water particles are heavier than air, so they should be circulated
- Air circulation is provided by a 12 V DC fan driven through the opto-isolator by a microcontroller

- Measured RH of the incubator environment is continuously compared with the determined RH by the microcontroller
- If these values are equal or greater than the determined RH, the ultrasonic humidifier and circulation fan are stopped
- If the humidity is higher than the required level, the air needs to be replaced
- The incubator chamber is a non-hermetic environment, there are small holes on the walls

References:

[1] I. Guler, M. Burunkaya, "Humidity control of an incubator using the microcontroller-based active humidifier system employing an ultrasonic nebulizer," J Med Eng Technol, Mar 2002, doi: 10.1080/03091900110115478.

Conclusions/action items:

I found a research that used the ultrasonic nebulizer and IC type humidity sensor, and learned how it successfully worked. This will be great reference to our design idea.

2023/10/13 Humidity control for neonatal incubator

SEYOUNG PARK - Dec 13, 2023, 1:42 PM CST

Title: Humidity control tool for neonatal incubator

Date: 10/13/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Learn the appropriate range of humidity in the incubator and how we should control the humidity for the neonatal

Content:

- In the first days of life, the daily evaporative loss from premature neonates can reach up to 20% of body mass

- At 34ºC, the relative humidity level varies between 40% to 77%

- The skin evaporative exchanges between the neonate and the environment are directly proportional to the water vapour partial pressure difference between the neonate's skin and the air

- The control of incubator air temperature alone does not minimize evaporative heat loss

- Skin evaporative water loss is of great magnitude in the first week of neonatal life and can be 15 times greater for premature infants than for full-term neonates

References:

[1] M. Abdiche, G. Farges, et al, "Humidity control tool for neonatal incubator," Med Biol Eng Comput, Mar 1998, doi:10.1007/BF02510752

Conclusions/action items:

I found a research that used the ultrasonic nebulizer and IC type humidity sensor, and learned how it successfully worked. This will be great reference to our design idea.

2023/10/5 Brinsea TLC-30 Eco

SEYOUNG PARK - Oct 11, 2023, 12:52 PM CDT

Title: Brinsea TLC-30 Eco Parrot Brooder/ICU/Recovery Incubator

Date: 10/5/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Look for the competing designs that are already on the market

Content:

- Dimensions: 11 3/4" X 10 1/2" X 10 3/4"
- Internal dimensions: 9 1/2" wide x 9 1/2" deep x 6 1/2" high
- Weight: 2.1kg
- Cost about $310
- Efficient, easily cleaned, portable and quick to set up
- The unit is suited to wildlife rescue or for pet breeding
- Safe 12 volt operation with the adaptor supplied
- Accurate temperature control adjustable by a simple turn of the dial
- Temperature stability maintained by quiet, low speed fans
- Temperature display on a glass-thermometer visible through the clear door
- Double walled cabinet for heat and sound insulation
- Clear door made of tough, UV resistant polycarbonate that can be closed and latched with one hand
- Removable clear door for deep cleaning
- Smooth, mirror finish interior for easy cleaning
- Adjustable fresh air exchange through a door mounted vent
- Portable
- Stackable

References:

[1] Brinsea Incubation Specialists, https://www.brinsea.com/p-615-tlc-30-eco-parrot-brooderintensive-care-unitrecovery-incubator.aspx [Accessed 5 Oct. 2023]

Conclusions/action items:

TLC-30 Eco is quite reasonable price compared to other products on the market, but it is still expensive with our budget and the dimension is smaller than our requirement.

SEYOUNG PARK - Oct 11, 2023, 12:53 PM CDT

Download

TLC30EcoUS.pdf (894 kB)

2023/10/8 Brinsea TLC-40 Eco

SEYOUNG PARK - Oct 11, 2023, 1:02 PM CDT

Title: Brinsea TLC-40 Eco Series II Brooder Parrot Intensive Care Unit

Date: 10/8/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Look for the competing designs that are already on the market

Content:

- Dimensions: 18.5" X 19" X 15"

- Internal dimensions: 15.5" wide x 12" deep x 11" high

- Weight: 6.7 kg

- Cost about $750

- Efficient, easily cleaned, portable and quick to set up

- Accurate temperature control adjustable through an easy to use menu with display in both Celsius and Fahrenheit

- High and low temperature alarms including the new room temperature alarm

- Unique air filtration for removal of airborne bacteria and fungi from the chamber (filter replacements available)

- Water reservoir with external top

- Increased humidity range and an increased evaporating surface

- Adjustable fresh air exchange through a door mounted vent

- Polygiene Biomaster™ anti-microbial plastic construction (easy to clean)

References:

[1] Brinsea Incubation Specialists, https://www.brinsea.com/p-679-tlc-40-eco-series-ii-parrot-brooderintensive-care-unitrecovery-incubator.aspx [Accessed 8 Oct. 2023]

Conclusions/action items:

TLC-40 Eco is re-designed and has improved skills, but it is quite expensive. We could get the design idea from this incubator, but we should come up with better inner components to reduce the cost.

Brinsea
Incubation Specialists

TLC-40 Eco Series II / TLC-50 Eco Series II
Thermal
Life support
Cabinet

User instructions

Contents

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Read instructions before use.

MADE IN BRITAIN

Danger. Not intended for use with oxygen gas. Use of oxygen creates a fire hazard.

Damaged appliances shall not be used.

The appliance and its supply cord must be placed in an indoor area not subject to splashes of water or wet conditions and protected from or out of reach of animals.

Repairs shall be carried out only by a suitably qualified person.

This appliance shall not be used, cleaned or maintained by children or persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge without supervision. Children shall not play with the appliance.

Disconnect the brooder/ICU from the mains power supply during cleaning. Ensure that all electrical parts are kept dry. Avoid alcohol-based solutions and make sure that all disinfectant is thoroughly rinsed off plastic parts with clean water. Disinfectant solutions may cause severe cracking of plastic if not correctly rinsed off.

Record your appliance serial number here: _____

IMPORTANT NOTICE

Brinsea Products Ltd and its agents and distributors will not be responsible for loss of animals in the event of failure however caused and the user is advised to arrange his own insurance cover where loss of power or mechanical or electrical failure might result in unacceptable losses.

Download

TLC4050EcoIIUS.pdf (1.43 MB)

2023/09/28 Humidity control

SEYOUNG PARK - Oct 11, 2023, 12:05 PM CDT

Title: Design idea for humidity control

Date: 9/28/2023

Content by: Seyoung Selina Park

Present: N/A

Goals: Come up with the idea that enables accurate humidity control

Content:

Ultrasonic nebulizer and Integrated Circuit (IC) type humidity sensor

- Use an ultrasonic nebulizer to create aerosol at ambient conditions

- IC type humidity sensor to measure the relative humidity of the incubator environment

- When the measured humidity is lower than the predetermined humidity value, the ultrasonic nebulizer converts sterilized water into fine water particles.

- Accuracy of the sensor is within 2% at 25 degree Celsius

- It has complexity of instrumentation, because we should come up with the way to connect the nebulizer, humidity sensor and controllers

- With the nebulizer, the user can just add water to the nebulizer itself

- It has tiny water tank that can be twisted to open, and the user can easily refill the water -> high practicality

- The user can easily change the filter inside the nebulizer

- Whenever the measured value is lower than the set value, the nebulizer automatically spray fine water particles inside the incubator

- The measured humidity values will be shown through the display

References:

[1] I. Guler, M. Burunkaya, "Humidity control of an incubator using the microcontroller-based active humidifier system employing an ultrasonic nebulizer," J Med Eng Technol, Mar 2002, doi: 10.1080/03091900110115478.

Conclusions/action items:

I should develop the IC type sensor and come up with an idea to connect the nebulizer to the circuit to control the humidity.

2023/10/20 Sparkfun humidity sensor

SEYOUNG PARK - Oct 20, 2023, 1:47 PM CDT

Title: Sparkfun humidity sensor hookup guide

Date: 2023/10/20

Content by: Seyoung Park

Present: N/A

Goals: Figure out the basic set up of the humidity sensor and temperature sensor

Content:

- SEN-09569

- It costs $20.5

- Voltage supply 4V~5.8V

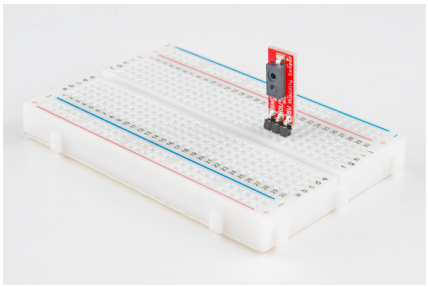
- HIH-4030 humidity sensor

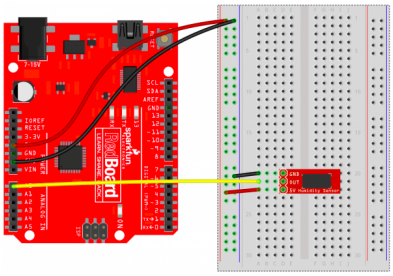
- It only has power, ground, analog output

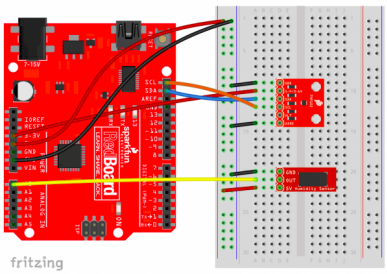
- Maybe we can use with TMP 102 (temperature sensor)

- It costs $5.5

- Operating temperature -40 degC to 85 degC







Reference:

[1] SEN-09569, DigiKey, https://www.digikey.com/en/products/detail/sparkfun-electronics/SEN-09569/5318752?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063506_adg-_ad-__dev-c_ext-_prd-5318752_sig-CjwKCAjwysipBhBXEiwApJOcu3qCsYDC33tjO04rN5Brjjl2_i-5sFcLctY7-CLp_dxBma_WxmJN2BoCD3sQAvD_BwE&gclid=CjwKCAjwysipBhBXEiwApJOcu3qCsYDC33tjO04rN5Brjjl2_i-5sFcLctY7-CLp_dxBma_WxmJN2BoCD3sQAvD_BwE [Accessed: 10/20/23]

[2] HIH-4030 Humidity Sensor Hookup Guide, sparkfun, https://learn.sparkfun.com/tutorials/hih-4030-humidity-sensor-hookup-guide/hardware-hookup [Accessed: 10/20/23]

Conclusions/action items:

The sparkfun guide page provides clear setup for the sensors.

2023/11/6 Humidity circuit fabrication

Title: Humidity circuit design

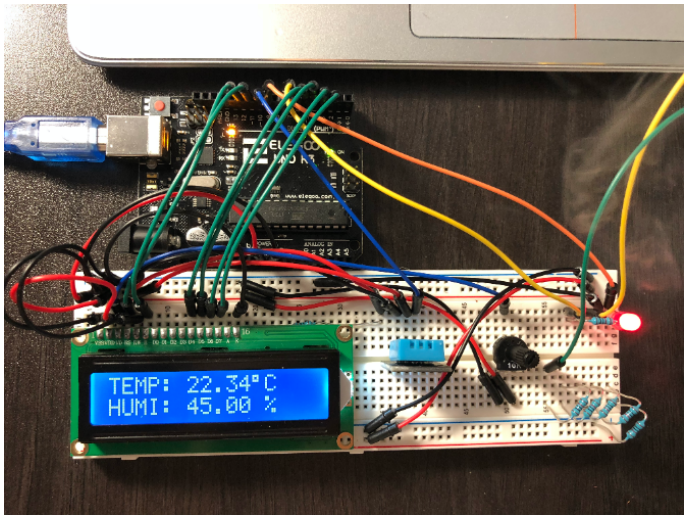
Date: 2023/11/06

Content by: Seyoung Park

Present: N/A

Goals: Making the humidity circuit with a feedback system

Content:



The picture above is from the project hub and I want the reference that circuit to make our humidity circuit.

Components needed: DHT temperature & humidity sensor, Arduino UNO, 1k ohm resistor, 10k ohm resistor, 330 ohm resistor potentiometer, LED, display, humidifier, breadboard, wires

The code is here:

```
#include "DHT.h"
#include "LiquidCrystal.h"

#define DHTPIN  10
#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);

LiquidCrystal  lcd(12, 11, 5, 4, 3, 2);

void setup()
{
  dht.begin();
  lcd.begin(16,  2);
  lcd.print("TEMP: ");
  lcd.setCursor(0, 1);
  float c = dht.readTemperature(true);
  float h = dht.readHumidity(true);
  lcd.setCursor(6, 0);
  lcd.print((c  - 35) * 0.5556);
  lcd.print((char)223);
  lcd.print("C");
  lcd.setCursor(0,  1);
  lcd.print("HUMI: ");
  lcd.setCursor(6, 1);
  lcd.print(h);
  lcd.print(" %");
  pinMode(9, OUTPUT);
```

```
  pinMode(6, OUTPUT);
// init----------------------------------
}

void  loop() {
  int a = 1;
  float c = dht.readTemperature(true);
  float h  = dht.readHumidity(true);
  lcd.setCursor(6, 0);
  lcd.print((c - 35) * 0.5556);
  lcd.print((char)223);
  lcd.print("C");
  lcd.setCursor(0, 1);
  lcd.print("HUMI:  ");
  lcd.setCursor(6, 1);
  lcd.print(h);
  lcd.print(" %");
//---------------------------------------------
  if (h < 50){
  digitalWrite(9, HIGH);
  digitalWrite(6, HIGH);
  delay (250);
  digitalWrite(6, LOW);
  delay (250);
  digitalWrite(6,  HIGH);
  delay (250);
  digitalWrite(6, LOW);
 // send pulse 2X-----------------------------
  while (a = 1){
  delay(1000);
  float c = dht.readTemperature(true);
  float h = dht.readHumidity(true);
  lcd.setCursor(6, 0);
  lcd.print((c  - 35) * 0.5556);
  lcd.print((char)223);
  lcd.print("C");
  lcd.setCursor(0,  1);
  lcd.print("HUMI: ");
  lcd.setCursor(6, 1);
  lcd.print(h);
  lcd.print(" %");
  // LCD---------------------------------------
  if (h  >= 55){
  digitalWrite(6, HIGH);
  delay (250);
  digitalWrite(6, LOW);
  digitalWrite(9, LOW);
  break;}
  }
  }
}
```

Reference:

[1] Automatic Humidifier, Project Hub, https://projecthub.arduino.cc/chenwei19940207/automatic-humidifier-e7cb30 [Accessed: 11/06/23]

Conclusions/action items:

I got the basic idea how we are going to create the humidity circuit.

2023/11/14 New humidity circuit fabrication

Title: Updated humidity circuit

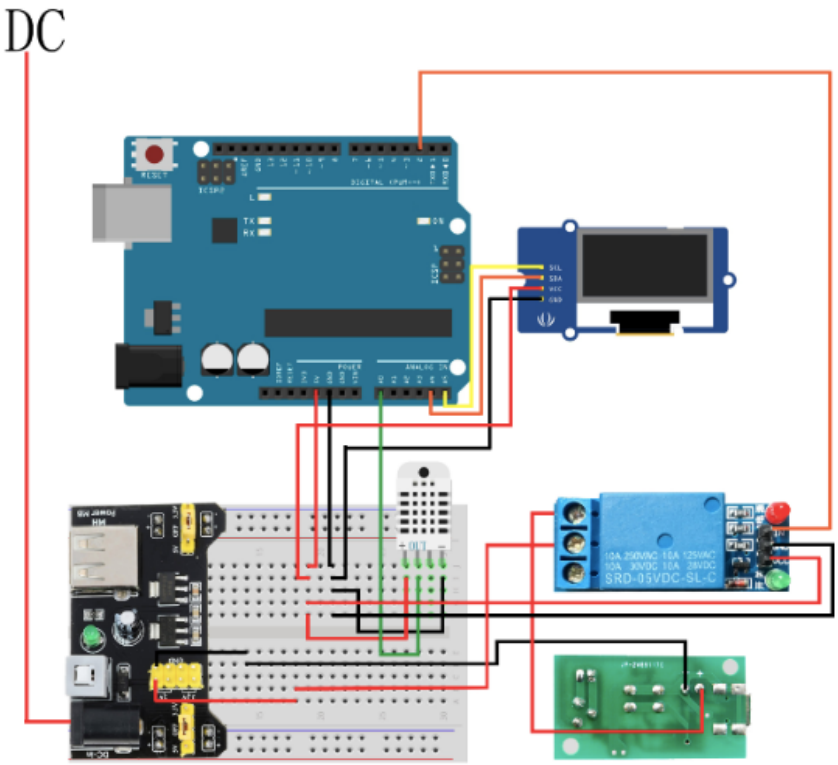
Date: 2023/11/14

Content by: Seyoung Park

Present: N/A

Goals: Making the humidity circuit with a feedback system

Content:



Components needed: Arduino UNO, DHT11 temperature & humidity sensor, MB-102 3.3V/5V Power module, 5V relay module, atomization humidifier, DC 12V charger, display, breadboard, wires

The code is here:

```
#include "U8glib.h"
U8GLIB_SSD1306_128X64 u8g(U8G_I2C_OPT_NONE);//Set the device name: I2C-SSD1306-128*64 (OLED)

#include "DHT.h"

#define DHTPIN A0

#define DHTTYPE DHT11

#define jiashi 2

#define button 12


DHT dht(DHTPIN, DHTTYPE);

void setup() {

  Serial.begin(9600);
  pinMode(jiashi,OUTPUT);
```

```
  pinMode(button,INPUT);
  dht.begin();

}

void loop() {
  float Humid = dht.readHumidity();
  float Temp = dht.readTemperature();

  Serial.print("Temp");
  Serial.println(Temp);
  delay(1000);
  Serial.print("Humid");
  Serial.println(Humid);
  delay(1000);


  u8g.firstPage();
  do
  {
    u8g.setFont(u8g_font_gdr14r);
    u8g.setPrintPos(25,18);
    u8g.print("DKARDU");
    u8g.setFont(u8g_font_9x18);
    u8g.setPrintPos(1,40);
    u8g.print("Temp: ");
    u8g.print(Temp);
    u8g.print("'C");
    u8g.setPrintPos(1,60);
    u8g.print("Humid: ");
    u8g.print(Humid);
    u8g.print("%");
  }while(u8g.nextPage());

if (Humid<80) {
  digitalWrite(jiashi,LOW);
}

  else {
  digitalWrite(jiashi,HIGH);

   }
}
```

Reference:

[1] Automatic-humidity, github, https://github.com/DKARDU/automatic-humidity/blob/master/auto_humid.ino [Accessed: 11/14/23]

Conclusions/action items:

We are going to use the fritzing diagram above for our final humidity circuit with the feedback system.

2023/11/20 Revision of humidity circuit

SEYOUNG PARK - Dec 05, 2023, 9:33 PM CST

Title: Revision of humidity circuit

Date: 2023/11/20

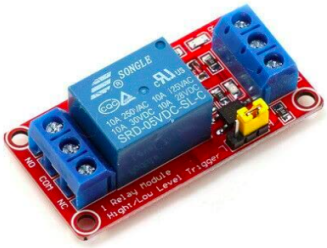
Content by: Seyoung Park

Present: N/A

Goals: Finalize the humidity circuit with a feedback system

Content:

We are not going to use the display, but we could see the sensor is reading the temperature and humidity measurement properly through the serial monitor on the Arduino.



SRD-5VDC-SL-C 1-Circuit 5V Relay Module

Since the fritzing diagram doesn't show the exact connection of the Beefcake Relay, I attached the picture of the Relay above.

While we are fabricating, we moved the wire from NO to NC and the Beefcake Relay finally worked properly.

And the automizer connection only had one USB wire, we had to cut the wire and connect to 5V and Ground from the power module respectively.

We connected DC 12V charger to the power module directly and we should manually turn the module on with the tiny white button on it.

Conclusions/action items:

The team completed fabricating the humidity sensor and the automizer is spraying water when the humidity level is lower than the set point.

2023/12/1 PID controller

SEYOUNG PARK - Dec 13, 2023, 3:29 PM CST

Title: PID controller

Date: 2023/12/1

Content by: Seyoung Park

Present: N/A

Goals: Understand the concept of PID controller and figure out how we can combine them to our circuit

Content:

- PID control: proportional, integral, derivative control

- PID control requires a set point like desired temperature or humidity

- With our current circuit, the heating element turns off when the sensor read 97ºF. However, it needs some time for the incubator to heat up with the provided heat, so there is a delay between the actual temperature and the temperature at the time the sensor is reading. That is when the temperature graph goes higher than the threshold.

- We are using the PID controller to implement this, making the sensor read the average temperature by proportional, integral, and derivative constants

- We can use Max6675 module to control PID algorithm

- We can use MOSFET (metal-oxide-semiconductor field-effect transistor) or TRIAC (bidirectional, three-electrode AC switch that allows electrons to flow in either direction) in case of high AC voltages

References:

[1] "Temperature PID controller," ELECTRONOOBS, https://electronoobs.com/eng_arduino_tut24.php

Conclusions/action items:

PID controller will be combined to the circuit.

2023/9/28 What is Wildlife Rehabilitation

TANISHKA SHETH - Oct 10, 2023, 10:02 PM CDT

Title: What is Wildlife Rehabilitation

Date: 9/28/23

Content by: Tanishka

Present: N/A

Goals: Understand what the purpose of wildlife rehabilitation is and what the process is

Content:

A. Moran, “What is wildlife rehabilitation?,” Urban Utopia Wildlife Rehabilitation, https://www.urbanutopiawildlife.org/wildlife-rehabilitation (accessed Sep. 28, 2023).

The goal of wildlife rehabilitation is to treat sick, injured, orphaned, and otherwise distressed wildlife, and release them back into their natural habitat.

Wildlife rehabilitation incorporates the care of orphaned mammals and birds

Conclusions/action items:

Wildlife rehabilitation is not something that everyone can do. Look into how to become a rehabber! Additionally, rehabilitation can take a large span of time and can range from a few days to many months.

2023/10/5 How to Care for Wildlife

TANISHKA SHETH - Oct 10, 2023, 10:05 PM CDT

Title: Guide for the Care and Use of Laboratory Animals

Date: 10/5/23

Content by: Tanishka

Present: N/A

Goals: Understand what is required to keep animals alive and well when in a closed environment.

Content:

Guide for the care and use of Laboratory Animals, 2011. doi:10.17226/25801

It is not necessary to control it as narrowly as temperature for most mammals, and typically an acceptable range is between 30%-70% for most mammals.

Husbandry and housing design can have an impact on environmental temperature and relative humidity, which can vary greatly across primary and secondary enclosures as well as inside primary enclosures. Housing design, construction material, enrichment devices like shelters and nesting materials, use of filter tops, number, age, type, and size of animals in each enclosure, forced ventilation of enclosures, type and frequency of contact bedding changes, and enrichment devices like shelters and nesting materials are all factors that affect temperature and humidity variations between and within enclosures.

Conclusions/action items:

Look into components that can ensure that the incubator remains within the specified range. Confirm with client that 60-70 is the ideal humidity range.

2023/10/8 How to Get a Wildlife Rehabilitation License

TANISHKA SHETH - Oct 10, 2023, 10:09 PM CDT

Title: How to Get a Wildlife Rehabilitation License

Date: 10/8/23

Content by: Tanishka

Present: N/A

Goals: Understand how someone can become a rehabber

Content:

“How to get a wildlife rehabilitation license,” How to get a wildlife rehabilitation license | | Wisconsin DNR, https://dnr.wisconsin.gov/topic/WildlifeHabitat/permitting (accessed Oct. 8, 2023).

To receive a Basic License to rehabilitate wildlife in Wisconsin, you must complete the following.

- Be at least 18 years of age.
- Pass an examination meeting the requirements of the Wildlife Rehabilitation Rule (s. NR 19.75).
- Complete an application [PDF]. (We highly recommend that you pass the examination before applying for a license.)
- Possess a signed Sponsorship Agreement [PDF] form stating an Advanced Licensee (Sponsor Designation Form [PDF]) is willing to mentor your wildlife rehabilitation activities.
- Possess a signed Consulting Veterinarian Agreement [PDF] stating a veterinarian licensed to practice in Wisconsin is willing to consult and assist with the care and treatment of wildlife being rehabilitated.
- Maintain facilities meeting the requirements of the Wildlife Rehabilitation Rule (s. NR 19.77).
- Actively maintain facility standard protocols signed by your consulting veterinarian. Example protocols are listed below:
    - Adequate Veterinarian Care
    - Euthanasia
    - Pharmaceutical Use
    - Disease Transmission
    - Disposal of Carcasses and Animal Waste
    - Pest Control

Conclusions/action items:

It is difficult to become licensed. Discuss with client if there are features that should be included in the incubator to allow for people who may not be licensed to still use the incubator and effectively provide care.

2023/10/9 Thermoregulation of Infant Wildlife

TANISHKA SHETH - Oct 10, 2023, 10:13 PM CDT

Title: Thermoregulatory competence and behavioral expression in the young of Altricial species--revisited

Date: 10/9/23

Content by: Tanishka

Present: N/A

Goals: Understand the physiology behind thermoregulation when wildlife are young

Content:

M. S. Blumberg and G. Sokoloff, “Thermoregulatory competence and behavioral expression in the young of Altricial species?revisited,” Developmental Psychobiology, vol. 33, no. 2, pp. 107–123, Dec. 1998. doi:10.1002/(sici)1098-2302(199809)33:2<107::aid-dev2>3.0.co;2-n

More than 50 years have been spent researching how newborn and young mammals regulate their body temperatures both behaviorally and physiologically. Psychobiologists have observed that infants of altricial species (such as rats) have anatomical and physiological constraints that make heat loss outweigh heat production. As a result, behavioral thermoregulation is required for the maintenance of body temperature in these infants.

Conclusions/action items:

If it is necessary for the newborns to receive heat externally, what is the best way for this to be done? Look into swaddle (heat blanket esque) vs heating in the floor vs heating in the walls. The idea is to maximize efficiency to ensure that the temperature is regulated effectively within small mammals.

2023/10/9 Behavioral Thermoregulation for Mammals

TANISHKA SHETH - Oct 10, 2023, 10:18 PM CDT

Title: Behavioral thermoregulation in mammals: A Review

Date: 10/9/23

Content by: Tanishka

Present: N/A

Goals: Understand what behaviors animals do in order to maintain their ideal body temperature.

Content:

J. Terrien, “Behavioral thermoregulation in mammals: A Review,” Frontiers in Bioscience, vol. 16, no. 1, p. 1428, Jan. 2011. doi:10.2741/3797

The preservation of homeostasis in mammals depends heavily on thermoregulation. Animals continually try to reduce the energy costs of normothermia due to the close relationship between their thermoregulatory abilities and energy balance. When there are thermal changes, physiological processes are accelerated, resulting in higher rates of energy expenditure. To lessen autonomic labor and, consequently, the energy expenditures of thermoregulatory responses, species can alter their behavioral patterns. In order to prevent hypothermia, heat production must rise while heat dissipation falls. In contrast, preventing hyperthermia increases heat exchange and decreases body heat production.

Conclusions/action items:

Heat regulation significantly differs in animals based on gender, season and aging. This means that we should ensure that the ambient temperature is what is required.

2023/10/10 Minimum Standards for Infant Wildlife

TANISHKA SHETH - Oct 10, 2023, 10:21 PM CDT

Title: Minimum Standards for Infant Wildlife

Date: 10/10/23

Content by: Tanishka

Present: N/A

Goals: Understand what the minimum requirements are for rehabbers to provide acceptable environments for infant wildlife

Content:

E. A. Miller, Minimum Standards for Wildlife Rehabilitation. St. Cloud, MN: National Wildlife Rehabilitators Association, 2012.

Housing design must provide for the safety of both humans and animals. In addition to the above, some important considerations include:

- Avoid areas where animals can become tangled or trapped
- Avoid sharp edges or points (inside and outside cages)
- Cages should be checked regularly for protruding objects which should be removed prior to placing animals in the cages (e.g., nails or screws backing out, bent wire)
- Allow for “running” distance for both human and animal, including hiding boxes
- Ensure proper footing by using flooring with good drainage
- Avoid ledges that can be used as unintended perches or can accumulate feces
- Secure all cages with appropriate locks
- Use food trapdoors if possible to minimize interaction

Conclusions/action items:

These are considerations that we need to ensure are applied in both the center and the incubator.

2023/9/13 Brinsea Wildlife Incubators

TANISHKA SHETH - Sep 13, 2023, 11:47 AM CDT

Title: Brinsea Wildlife Incubators Overview

Date: 9/13/23

Content by: Tanishka

Present: N/A

Goals: Understand what components current wildlife incubators on the market have to determine what is necessary/can be improved when we go into the design process

Content:

Citation: “Company overview,” Brinsea company overview, https://www.brinsea.com/t-companyoverview.aspx (accessed Sep. 13, 2023).

Brinsea's Advance series incubators and brooders feature digital control systems that read temperatures and humidity with built in alarms
The Control systems are electronic and have been protected from power spikes.
The fans are DC Computer types (silent, and cool longer than other types)
Brinsea has over 40 years of experience in developing egg incubators and accessories.

Conclusions/action items:

Meet with the client to determine what aspects of incubators they believe are necessary. Right now it seems that there are a number of different product offerings on the market for different uses, so the team needs to determine what needs the client has. At this time, the necessary electrical components seem to be control systems, fans, and alarms.

2023/9/20 BabyWarm

Title: Baby Warm

Date: 9/20/23

Content by: Tanishka

Present: N/A

Goals: Understand what types of incubators are being used at wildlife rehabilitation centers right now.

Content:

“The incubators,” BabyWarm, https://www.babywarm.org/about-the-incubators/ (accessed Sep. 20, 2023).

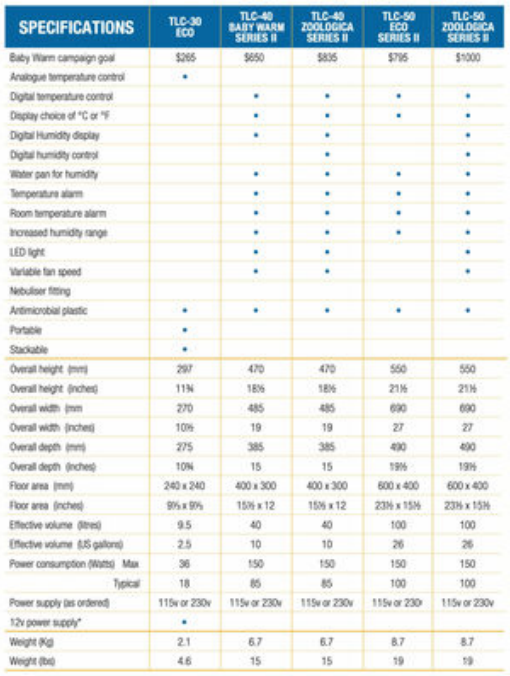
A non-profit organization that funds campaigns for rehabilitation centers uses Brinsea Wildlife Incubators. These incubators range:

SPECIFICATIONS	TLC-30 ECO	TLC-40 BABY WARM SERIES II	TLC-40 ZOOLOGICA SERIES II	TLC-50 ECO SERIES II	TLC-50 ZOOLOGICA SERIES II
Baby Warm campaign goal	$265	$650	$835	$795	$1000
Analogue temperature control	•				
Digital temperature control		•	•	•	•
Display choice of °C or °F		•	•	•	•
Digital Humidity display		•	•		•
Digital humidity control			•		•
Water pan for humidity		•	•	•	•
Temperature alarm		•	•	•	•
Room temperature alarm		•	•	•	•
Increased humidity range		•	•	•	•
LED light		•	•		•
Variable fan speed		•	•		•
Nebuliser fitting					
Antimicrobial plastic	•	•	•	•	•
Portable	•				
Stackable	•				
Overall height (mm)	297	470	470	550	550
Overall height (inches)	11¾	18½	18½	21½	21½
Overall width (mm	270	485	485	690	690
Overall width (inches)	10½	19	19	27	27
Overall depth (mm)	275	385	385	490	490
Overall depth (inches)	10¾	15	15	19½	19½
Floor area (mm)	240 x 240	400 x 300	400 x 300	600 x 400	600 x 400
Floor area (inches)	9⅓ x 9⅓	15½ x 12	15½ x 12	23½ x 15½	23½ x 15½
Effective volume (litres)	9.5	40	40	100	100
Effective volume (US gallons)	2.5	10	10	26	26
Power consumption (Watts) Max	36	150	150	150	150
Typical	18	85	85	100	100
Power supply (as ordered)	115v or 230v	115v or 230v	115v or 230v	115v or 230r	115v or 230v
12v power supply*	•				
Weight (Kg)	2.1	6.7	6.7	8.7	8.7
Weight (lbs)	4.6	15	15	19	19

Conclusions/action items:

Brinsea incubators seem to be the most common incubators used in wildlife rehabilitation. It will be worth looking into these incubators to see what electrical components are used for temperature and humidity regulation. Based off of this, it will be useful to search through how sensors work and can be wired.

TANISHKA SHETH - Sep 20, 2023, 10:21 PM CDT



SPECIFICATIONS	TLC-30 ECO	TLC-40 BABY WARM SERIES II	TLC-40 ZOOLOGICA SERIES II	TLC-50 ECO SERIES II	TLC-50 ZOOLOGICA SERIES II
Baby Warm campaign goal	$265	$650	$835	$795	$1000
Analogue temperature control	•				
Digital temperature control		•	•	•	•
Display choice of °C or °F		•	•	•	•
Digital Humidity display		•	•		•
Digital humidity control			•		•
Water pan for humidity		•	•	•	•
Temperature alarm		•	•	•	•
Room temperature alarm		•	•	•	•
Increased humidity range		•	•	•	•
LED light		•	•		•
Variable fan speed		•	•		•
Nebuliser fitting					
Antimicrobial plastic	•	•	•	•	•
Portable	•				
Stackable	•				
Overall height (mm)	297	470	470	550	550
Overall height (inches)	11¾	18½	18½	21½	21½
Overall width (mm	270	485	485	690	690
Overall width (inches)	10½	19	19	27	27
Overall depth (mm)	275	385	385	490	490
Overall depth (inches)	10¾	15	15	19½	19½
Floor area (mm)	240 x 240	400 x 300	400 x 300	600 x 400	600 x 400
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Effective volume (US gallons)	2.5	10	10	26	26
Power consumption (Watts) Max	36	150	150	150	150
Typical	18	85	85	100	100
Power supply (as ordered)	115v or 230v	115v or 230v	115v or 230v	115v or 230v	115v or 230v
12v power supply*	•				
Weight (Kg)	2.1	6.7	6.7	8.7	8.7
Weight (lbs)	4.6	15	15	19	19

Download

incubator-specs-1179x1536.jpg (259 kB)

2023/9/21 Brinsea Incubators

TANISHKA SHETH - Oct 10, 2023, 9:52 PM CDT

Title: Brinsea Incubators

Date: 9/21/23

Content by: Tanishka

Present: N/A

Goals: Understand what wildlife incubators exist on market right now and compare to what we're creating.

Content:

“TLC brooders/Intensive Care Units,” /Hospital Cage, https://www.brinsea.com/p-682-tlc-50-zoologica-ii-parrot-brooderintensive-care-unitrecovery-incubator.aspx (accessed Sep. 21, 2023).

“TLC brooders/Intensive Care Units,” Home, https://www.brinsea.com/p-615-tlc-30-eco-parrot-brooderintensive-care-unitrecovery-incubator.aspx (accessed Sep. 21, 2023).

TLC-50 Zoologica II ($1199.99): Internal Dimensions: 25” wide x 18” deep x 14” high, Accurate digital temperature control adjustable through menu, Alarms for high/low temp, Automatic humidity control in % Relative Humidity with integral humidity pump, Air filtration and exchange, Variable fan speeds

TLC-30 Eco ($309.99): Internal Dimensions: 9.5” wide x 9.5” deep x 6.5” high, Similar components but no humidity control

Conclusions/action items:

There are a number of wildlife incubators on the market right now, but none are at the price point expected for this project. Incubators at a lower price point do not completely satisfy the client’s requirements. To create an incubator with the same capabilities as ones on the market, the team will have to devise many components by themselves at a lower price point.

2023/10/4 Initial Preliminary Design Idea

TANISHKA SHETH - Oct 10, 2023, 9:55 PM CDT

Title: Preliminary Design Idea

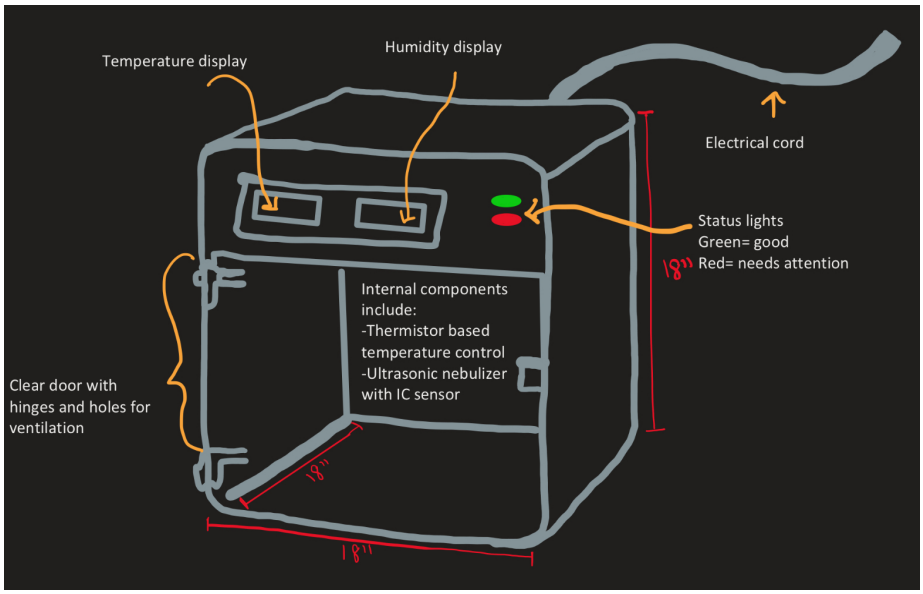
Date: 10/4/23

Content by: Tanishka

Present: N/A

Goals: Draw and describe the initial design that the team wants to pursue.

Content:



Components:

- Design made of injection molded PP
- Temperature and humidity displays from feedback mechanisms
- Lights/alarm to draw attention for issues sensed
- Clear door that allows visibility into the interior
- Holes for ventilation
- Electric power source

Conclusions/action items:

Discuss and show to client after conclusion of preliminary presentations to get the green light/go ahead to continue with fabrication of this design.

2023/10/16 Design Components

TANISHKA SHETH - Dec 13, 2023, 11:40 AM CST

Title: Design Components

Date: 10/16/23

Content by: Tanishka

Present: N/A

Goals: Create a list of components that could be used for the design prototype

Content:

12V power supply: https://www.amazon.com/TMEZON-Power-Adapter-Supply-2-1mm/dp/B00Q2E5IXW/ref=as_li_ss_tl?ie=UTF8&linkCode=sl1&tag=zlufy-20&linkId=6b24988db82588a9281f6fa13c2947c0&language=en_US&th=1

12V Connectors: https://www.amazon.com/Chanzon-Female-Connector-Security-Adapter/dp/B079RCNNCK/ref=sr_1_1_sspa?crid=11TV2ODYAPHMR&keywords=12v%2Bfemale%2Bconnector&qid=1702489000&s=electronics&sprefix=12v%2Bfemale%2Bcon%2Celectronics%2C86&sr=1-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

heating element: https://amazon.com/Aluminum-Heating-Thermostat-Miniature-15028-5mm/dp/B07RS3HQKS/ref=sr_1_5?crid=1ITBI6C021FVZ&keywords=ceramic+heating+element&qid=1702489043&sprefix=ceramic+heating+element%2Caps%2C103&sr=8-5

atomizer: https://www.amazon.com/OCESTORE-3-7V-12V-Ultrasonic-Atomization-Humidifier/dp/B0B6HCG55L/ref=sr_1_20_sspa?crid=24V5QZXVZB6VB&keywords=water+atomizer&qid=1702489070&sprefix=water+atomizer%2Caps%2C116&sr=8-20-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9tdGY&psc=1

Conclusions/action items:

These are some of the components that are needed to power and use the design. Should look into sensor components next. Bring these elements up as potential ideas for the team.

2023/10/25 Testing Plan Ideas

TANISHKA SHETH - Dec 13, 2023, 12:59 PM CST

Title: Testing Plan Ideas

Date: 10/25/23

Content by: Tanishka

Present: N/A

Goals: Come up with key components that are needed to test each device comprehensively.

Content:

Temperature:

1. Ensure that the heating element turns on via tactile testing
2. Need to make sure that the Serial Monitor reads accurate temperature
3. Use a secondary mechanism to make sure that the sensor is reading what temperature it actually is
4. Make sure that the heating element reduces temperature when the threshold is hit

Humidity:

1. Ensure that the atomizer turns on when the humidity drops below threshold
2. Ensure that the atomizer turns off when the humidity is above or at threshold
3. Check to make sure the environment it's in is able to provide accurate ventilation and hold onto humidity.

Conclusions/action items:

Consolidate this information into an actual protocol. Take this information and test the prototype once its completed.

2023/11/1 Temp Feedback Code Attempt

TANISHKA SHETH - Dec 13, 2023, 1:11 PM CST

Title: Temperature Feedback

Date: 11/1/23

Content by: Tanishka

Present: All

Goals: Feedback loop for temperature

Content:

```
#include <BAE910.h>
#include <DS18B20.h>
#include <DS2401.h>
#include <DS2405.h>
#include <DS2408.h>
#include <DS2413.h>
#include <DS2423.h>
#include <DS2430.h>
#include <DS2431.h>
#include <DS2433.h>
#include <DS2434.h>
#include <DS2438.h>
#include <DS2450.h>
#include <DS2502.h>
#include <DS2506.h>
#include <DS2890.h>
#include <OneWireHub.h>
#include <OneWireHub_config.h>
#include <OneWireItem.h>
#include <platform.h>

/*
 * Created by ArduinoGetStarted.com
 *
 * This example code is in the public domain
 *
 * Tutorial page: https://arduinogetstarted.com/tutorials/arduino-heating-system
 */

#include <OneWire.h>
#include <DallasTemperature.h>

#define SENSOR_PIN  2   // Arduino pin connected to DS18B20 sensor's DQ pin
#define RELAY_PIN   A5  // Arduino pin connected to relay which connected to heating element

const int TEMP_THRESHOLD_UPPER = 36.1; // upper threshold of temperature, change to your desire value
const int TEMP_THRESHOLD_LOWER = 33.89; // lower threshold of temperature, change to your desire value

OneWire oneWire(SENSOR_PIN);         // setup a oneWire instance
DallasTemperature sensors(&oneWire); // pass oneWire to DallasTemperature library

float temperature;    // temperature in Celsius

void setup() {
  Serial.begin(9600); // initialize serial
  sensors.begin();    // initialize the sensor
  pinMode(RELAY_PIN, OUTPUT); // initialize digital pin as an output
}

void loop() {
  sensors.requestTemperatures();             // send the command to get temperatures
  temperature = sensors.getTempCByIndex(0);  // read temperature in Celsius
```

```
  if(temperature > TEMP_THRESHOLD_UPPER) {
    Serial.println("The heating element is turned off");
    Serial.println(temperature);
    digitalWrite(RELAY_PIN, LOW); // turn off
  } else if(temperature < TEMP_THRESHOLD_LOWER){
    Serial.println("The heating element is turned on");
    Serial.println(temperature);
    digitalWrite(RELAY_PIN, HIGH); // turn on
  }

  delay(500);
}
```

Conclusions/action items:

Test this code to ensure that it works as expected.

2023/11/8 PID Systems

TANISHKA SHETH - Dec 13, 2023, 1:30 PM CST

Title: PID Systems

Date: 11/8/23

Content by: Tanishka

Present: N/A

Goals: Understand how to validate a temperature control feedback system

Content:

https://www.isa.org/intech-home/2023/august-2023/features/temperature-measurement-control-fundamentals

Proportional control is combined with integral and derivative actions in PID control. Another name for integral action is "reset." When a stable process deviates from the setpoint, it is introduced. "Rate" is another term used to describe derivative activity. When sudden or quick variations in the load impact the controller's reaction, it is introduced.

The purpose of reset and rate is to make up for changes and offsets in temperature. The majority of the time, burners and heaters are not appropriate for the job. The general rule in system design is that "if enough BTUs are good, then more are better." In an ideal world, when the process and the controller are at setpoint, the heater or burner output would be 50%. There are typically a lot more BTUs available in real life than are really required. Reset reduces the amount of this discrepancy.

Conclusions/action items:

Look into ways to introduce a PID controller into the design in the future. This is a way to improve our feedback system to ensure that our elements don't overshoot.

2023/11/15 Statistical Test Methods

TANISHKA SHETH - Dec 13, 2023, 1:49 PM CST

Title: Statistical Test Methods

Date: 11/15/23

Content by: Tanishka

Present: N/A

Goals: Understand ways that we can statistically validate our test results

Content:

https://science.widener.edu/svb/stats/comptest.html

We can use a t-test to compare experimental data :

$$t_{experimental} = \frac{|x_1 - x_2|}{s_{pooled} \cdot \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}}$$

If t-experimental is greater than t-critical then there is a significant difference between the two means. t-critical is determined at the appropriate confidence level from a table of the t-statistic for N1 + N2 - 2 degrees of freedom

Conclusions/action items:

Compare the test results in similar manners to understand if our data is valid or not.

2023/11/30 Testing Results

Title: Testing Results

Date: 11/30/23

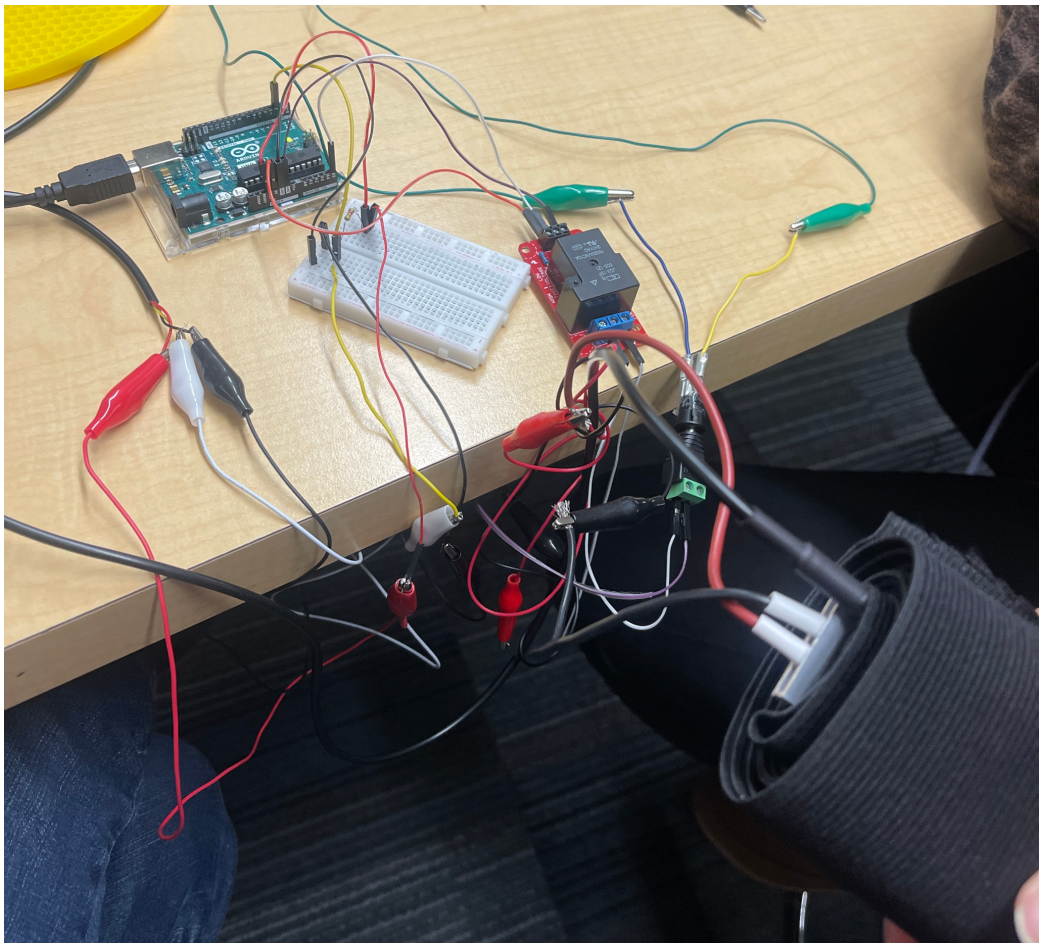
Content by: Tanishka

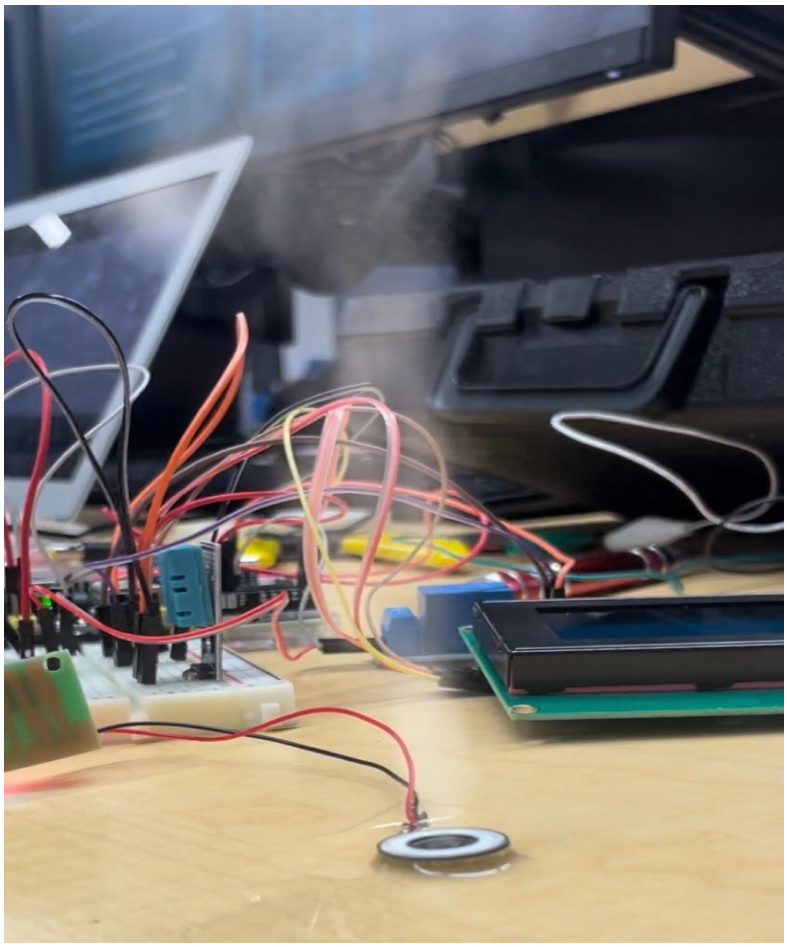
Present: All

Goals: Gather testing results

Content:

Tactile testing results showed that the components worked as expected.





Conclusions/action items:

Consolidate data in serial monitor into graphs that can be used in final deliverables.

2023/12/4 Finalizing Prototype

TANISHKA SHETH - Dec 13, 2023, 1:55 PM CST

Title: Finalized Prototype

Date: 12/4/23

Content by: Tanishka

Present: All

Goals: Complete the testing and prototype

Content:

The components were placed into the dog cage that was received. The team ensured that the components worked in this environment since it's similar to what the incubator would be like.

Conclusions/action items:

Finalize the poster and print it with the testing images and data.

2023/11/10 Tong Lecture

TANISHKA SHETH - Nov 10, 2023, 12:33 PM CST

Title: Tong Distinguished Lecture

Date: 11/10/23

Content by: Tanishka

Present: All

Goals: Understand Dr. Ellis' journey in BME and as a head of diversity and inclusivity at Exact Sciences

Content:

- Went to Pitt thinking she wanted to be a doctor
    - Discovered LVAD and decided to be an engineer instead
- Got accepted into MSTP program at UW-Madison
    - Wanted to learn about tissue engineering
- Encourages us to do 3 things:
    - find your people
        - people that you can rely on
    - do the things that scare you
    - laugh until you cry, cry until you laugh
        - she didn't match into residency but had to lean into it & pivot to something else
        - got married and realized that there were other people that were relying on her
- In present, she is the health equity director at Exact Sciences
    - cancer care for all people (regardless of insurance/socioeconomics)
- Your passions today, will not leave you tomorrow
- We are all connected--everyone is counting on you

Conclusions/action items:

Think about what my story is and how to ensure that it connects and shows what my passions in life are.

2014/11/03-Entry guidelines

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

Use this as a guide for every entry

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

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

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

Date: 9/5/2016

Content by: The one person who wrote the content

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

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

Content:

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

Conclusions/action items:

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

2014/11/03-Template

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

Title:

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items: