SCVSEFA

Example Project Boards

NOTES

About these Project Boards

These are examples of boards from several years ago, but we would like to let you compare some things. No board is the absolute "right" way, but here are some suggestions:

- Color helps, but stay away from fluorescent colors that distract from reading.
- Use a large font (not this) - judges are reading from a distance.
- Photos still "say a million words."
- Follow a chronological order.
- Don't crowd your information - judges can't read long paragraphs. Use Bullets that emphasize your main unique contributions and findings are best. Judges will look at your notebook for more details.
- Discussing problems you encountered is encouraged.

Procedure:

1. Build temperature kit
   - A. Resistors
     - a. 1k5 (brown-green-red-gold) in R1
     - b. 2k4 (red-yellow-red-gold) in R2
     - c. 5k (green-black-red-gold) in R3
     - d. 10k (brown-black-orange-gold) in R4, R9, R15
     - e. 2k (re-black-red-gold) in R8
     - f. 6k8 (blue-gray-red-gold) in R10
     - g. 3k3 (orange-orange-red-gold) in R11, R12
     - h. 1k (brown-black-red-gold) in R14. Put 2 1 k resistors in parallel three times and place into R5, R6, and R7
   - B. Trimmer potentiometers
     - a. 102 or 13 in VR1, VR2
   - C. Electrolytic capacitor
     - a. 47 μF in C1, C2
   - D. Ceramic capacitor
     - a. 0.1 μF in C3
   - E. Transistor
     - a. C9012 in TR1
   - F. Diodes
     - a. 1N4148 in D1, D2, D3
   - G. IC
     - a. 78L05 in IC1
     - b. LM324 in IC2
     - c. LM335Z in IC3
   - H. Jumpers
     - a. Jumpers in J1, J2
   - I. Speaker in SP
   - J. Battery cap
     - a. Red is positive (+)
     - b. Black is negative (-)
   - K. LED
     - a. Red in LED3 and LED power
     - b. Yellow in LED2
     - c. Green in LED1
2. Build relay
   - a. Make a loop on the bottom left (D)
   - b. Make a loop on the top left (E)
   - c. Make a loop on the top right (A)
   - d. One side of 75Ω resistor goes to one side of a wire (C)
   - e. The other side of the 75Ω resistor goes to the 1st leg on the 2N3904
   - f. One side of a wire (B) goes to the 2nd leg of the 2N3904
   - g. The 3rd leg of the 2N3904 goes to one side of the 1N4148
   - h. The other side of the 1N4148 with a black line goes to A
3. Get voice module
   - a. Record message
   - b. Test to see if working properly
4. Wire together the temperature sensor, relay, and voice module and pressure switch.
   - a. A goes to the positive side of the battery from the temperature sensor
   - b. B goes to the Red LED power from the temperature sensor
   - c. C goes to the negative side of the battery from the temperature sensor
   - d. D goes 1st leg on the pressure switch
   - e. E goes to negative side on the battery from the voice module
   - f. The 2nd leg of the pressure switch goes to the PLAY button on the voice module
5. Put pressure into car seat
6. Weigh "baby" filled BBs
7. Place "baby" on car seat. Car seat and "baby" will be contained in a plastic, transparent cube.
8. Heat up the outside of the cube. Time how long it takes for the alarm to activate.
9. Repeat steps #1-#8 but vary the mass of the "baby" and temperature of the "car

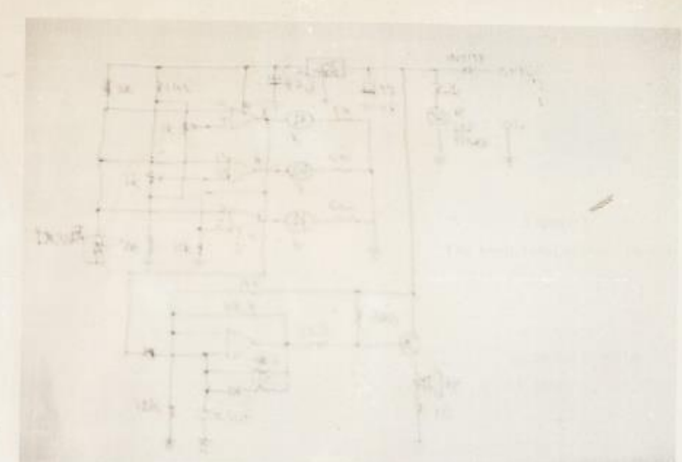
Problems:

1. This is my 4th project that I started on. I had three other projects but I could not finish them because of different reason
2. In the temperature kit, instead of giving me 500 Ω resistors, it gave me 5k instead. So I use 2 1k resistors instead.
3. I put the 2 1 k resistors in series instead of parallel.
4. Did not know what to do after I have the temperature sensor and voice module

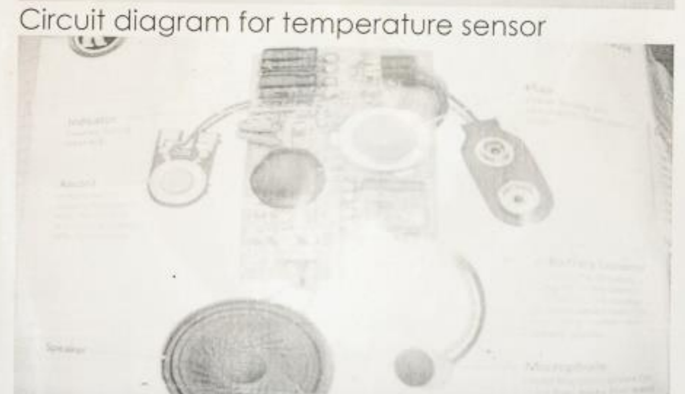
CONCLUSION:

The temperature sensor did work with the voice module because of the relay.
The voice module can be heard but not five feet since it is small speaker.
The temperature sensor has work up to 37°C (98.6°F).
The pressure sensor has work at least up to 4535.92 grams (10 lbs).
Temperature sensor is constant and reliable.

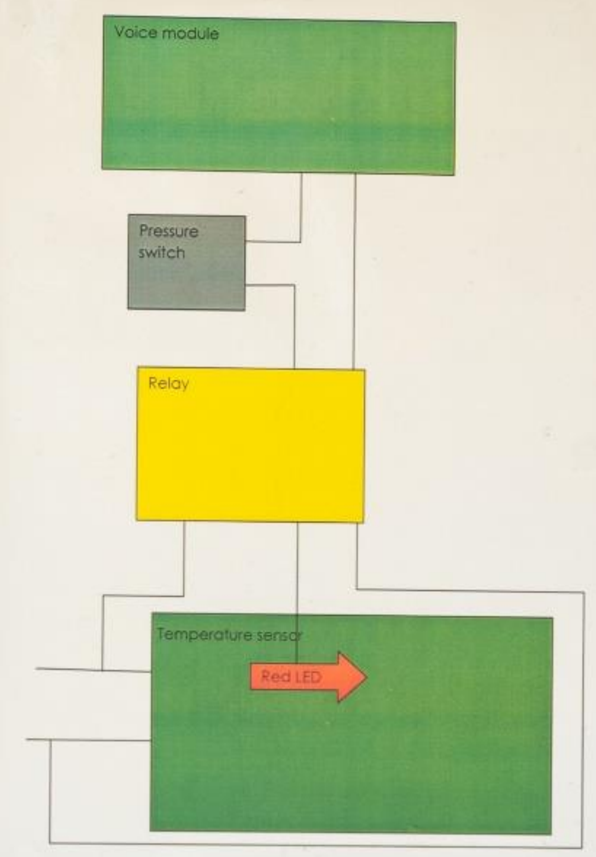
Baby on Board

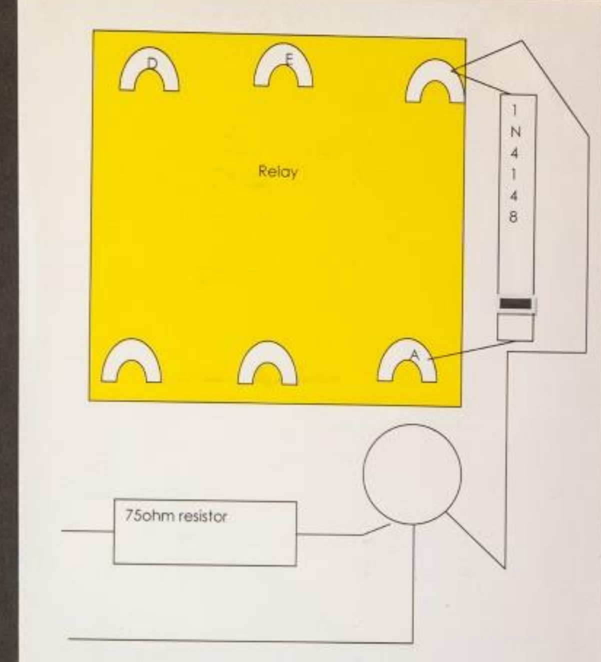


Circuit diagram for temperature sensor

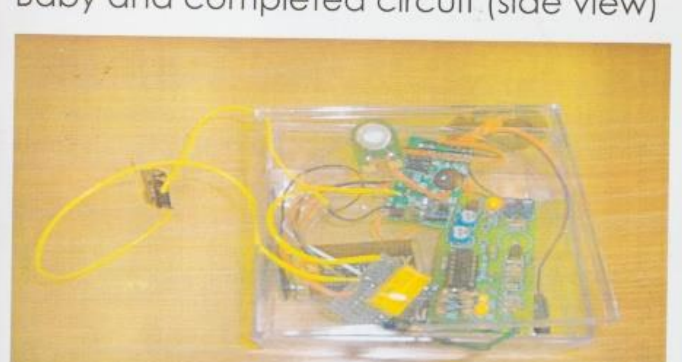


Circuit diagram for voice module



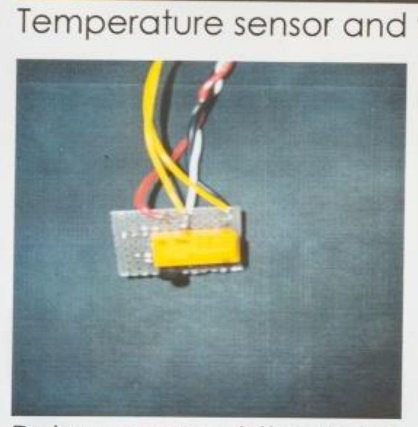


Baby and completed circuit (side view)

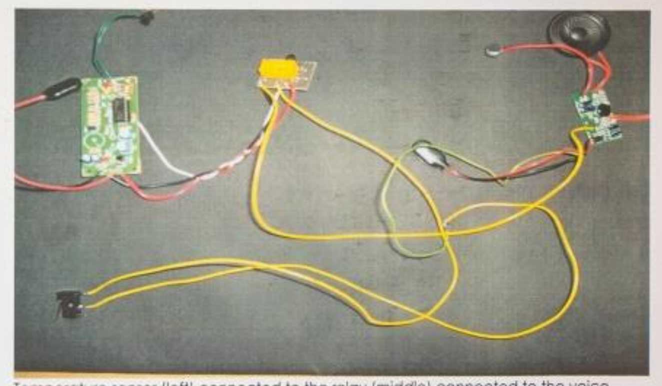


Complete circuit (sky view)

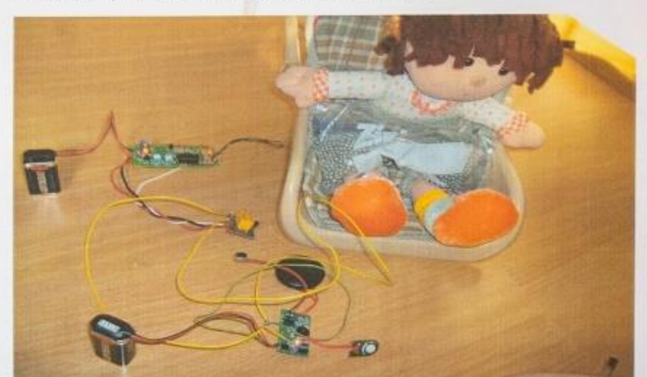
Temperature sensor and voice module



Relay connect the voice module and temperature sensor



Temperature sensor (left) connected to the relay (middle) connected to the voice module (right) connected to the pressure switch (bottom)



Pressure switch under baby, BBs on baby for weight, temperature goes off sent to relay which then sent it to the voice module completing the circuit

	Temp °C	Weight g	Time sec
Trial 1	34	1814.37	2.39
Trial 2	35	1814.37	1.72
Trial 3	35	1814.37	1.62
Trial 4	35	1814.37	2.00
Trial 5	36	1814.37	1.33
Trial 6	36	1814.37	1.09
Trial 7	36	1814.37	1.48
Trial 8	36	1814.37	1.31
Trial 9	36	1814.37	1.00
Trial 10	36	1814.37	0.99

	Temp °C	Weight g	Time sec
Trial 1	34	2721.55	1.79
Trial 2	35	2721.55	2.24
Trial 3	35	2721.55	2.10
Trial 4	35	2721.55	1.80
Trial 5	36	2721.55	1.37
Trial 6	36	2721.55	1.62
Trial 7	36	2721.55	1.38
Trial 8	36	2721.55	1.73
Trial 9	36	2721.55	1.26
Trial 10	36	2721.55	1.34

Solder iron and solder holder

Desolder on top of solder, next to solder helper

	Temp °C	Weight in g	Time in sec
Trial 1	80	4535.92	1.00
Trial 2	80	4535.92	.97
Trial 3	80	4535.92	.95
Trial 4	80	4535.92	.95
Trial 5	80	4535.92	.94
Trial 6	80	4535.92	.93
Trail 7	80	4535.92	.90
Trail8	80	4535.92	.87
Trail 9	80	4535.92	.85
Trail 10	80	4535.92	.84

Purpose:

When parents leave their kids in a hot car, the baby can suffer and this can even lead to death. With this product installed, the car seat will detect the mass of the baby in the car seat and the temperature inside the car. If the temperature reaches above 40 degrees C, then the car alarm will go sound and alert people about the baby. The car alarm is not a regular car alarm that just makes noise but will say something like "baby in hot car."

Engineer design:

1. Temperature sensor will work above 40°C (104°F).
2. Pressure sensor will work up to 11339.81 grams (25 lbs).
3. Temperature and pressure sensor will work together.
4. Voice chip will be built and will be loud enough to be heard five feet away

Materials:

1. Solder
2. Solder wick
3. Solder iron
4. Solder holder
5. 9 volt batteries
6. Wires- 30-26 gauge
7. Up to 10 lbs of metal BBs
8. Digital voice recording module
9. Body temperature kit
   - A. Resistor (ohm-Ω)
     - a. 1k5 (brown-green-red-green)
     - b. 2k4 (red-yellow-red-gold)
     - c. 5k (green-black-red-gold)
     - d. 3 10k (brown-black-orange-gold)
     - e. 7 1k (brown-black-red-gold)
     - f. 2k (red-black-red-gold)
     - g. 6k8 (blue-gray-red-gray)
     - h. 2 3k3 (orange-orange-red-gold)
     - i. 4k7 (yellow-violet-red-gold
     - j. 10 (brown-black-black-gold)
   - B. Trimmer potentiometers
     - a. 2 102 or 13
   - C. Electrolytic capacitors
     - a. 2 47 μF
   - D. Ceramic capacitor
     - a. 0.1 μF (104)
   - E. Transistor
     - a. C9012
   - F. Diodes
     - a. 3 1N4148
   - G. IC
     - a. 78L05
     - b. LM324
     - c. LM335Z
   - H. 2 jumpers
   - I. Battery cap
   - J. LED
     - a. 2 Red
     - b. Yellow
     - c. Green
10. Relay
    - a. 75 Ω resistor (violet-green-black-gold-brown)
    - b. IC- 2N3904
    - c. Diode- 1N4148
    - d. Jumpers a-e
11. Thermometer
12. Stop watch
13. Balance

Sunil Bodapati
9th Grade

Problem

Sand acts like a non-Newtonian fluid during an earthquake and liquefies, thus not providing the stability for the foundation of building structures. This in turn weakens the foundation base and causes it to sink.

Hypothesis

By creating biofilm enhanced sand that is more stable than ordinary sand, liquefaction will either be reduced or eliminated. This hypothesis states that biofilm enhanced sand should withstand higher compression strengths than sand on its own, thus being able to minimize damage caused by earthquakes.

Materials

- Pipettes
- Sterile sand
- *Flavobacterium johnsoniae* (FJ)
- Weights
- Gliding Medium
- Distilled Water
- Plastic cups

Using Bacterial Biofilms to Reduce Liquefaction

Procedure

Test Number 1 (Concentration Tests)

For this test, 28 cups are needed with 560mL of sterilized sand Firstly, add 20mL of sand to every cup. Then add 11mL of gliding medium to 4 cups. Add 11mL of Flavobacterium to the cups, changing the concentration for every 4 cups. The concentration for the Flavobacterium should be 0, 0.5, 1, 2, 3, 4, 5 McFarland. After allowing the bacterium to grow for 5 days, add weights to the sand and record how much weight it took before breaking.

Test Number 2 (Liquefaction Tests)

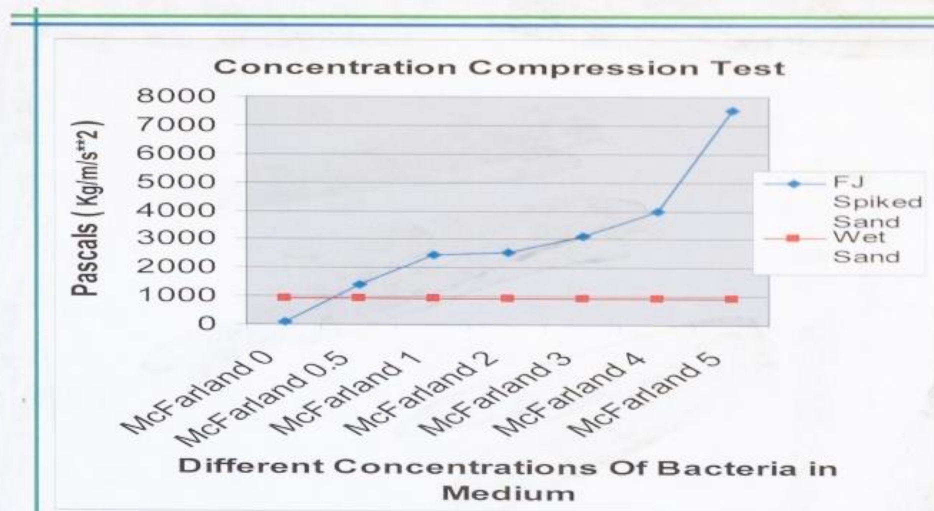
For this test, 10 tubes are needed with 400mL of sand. Add 40mL of sand to each tube, and add then add 30mL of water to 5 of those tubes.

Add 30mL of Flavobacterium at 5 McFarland to the other 5 tubes. Everyday, place two of these samples in a machine that produces lateral movement and check the results the following day. Record the amount of liquid sitting on top of the sand. Repeat these steps over a period of 5 days.

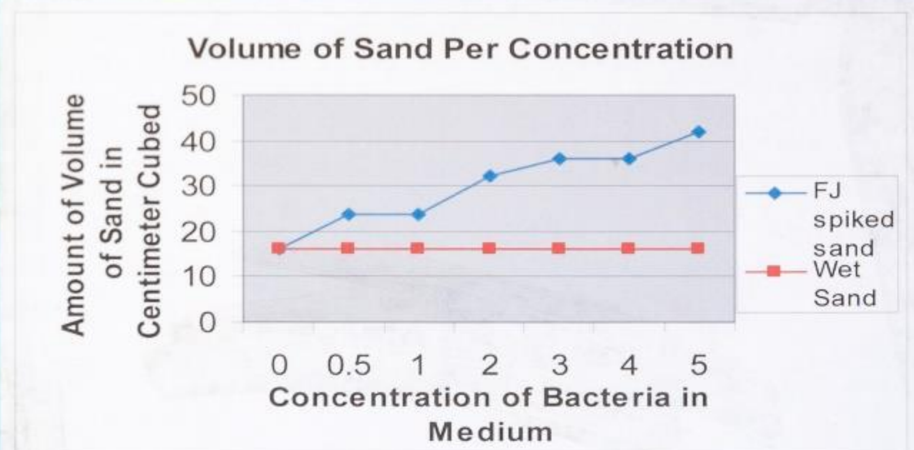
Test Number 3 (Daily Compression Tests)

For this test, 25 cups and 500mL of sand are needed. Firstly, add 20mL of sand to each cup. Separate the cups into 5 groups with 5 cups each. Each group should then be labeled "Day 1, Day 2, Day 3, Day 4, or Day 5." Add 20mL of Flavobacterium to each cup. Conduct the compression test each day for the corresponding group and record the results.

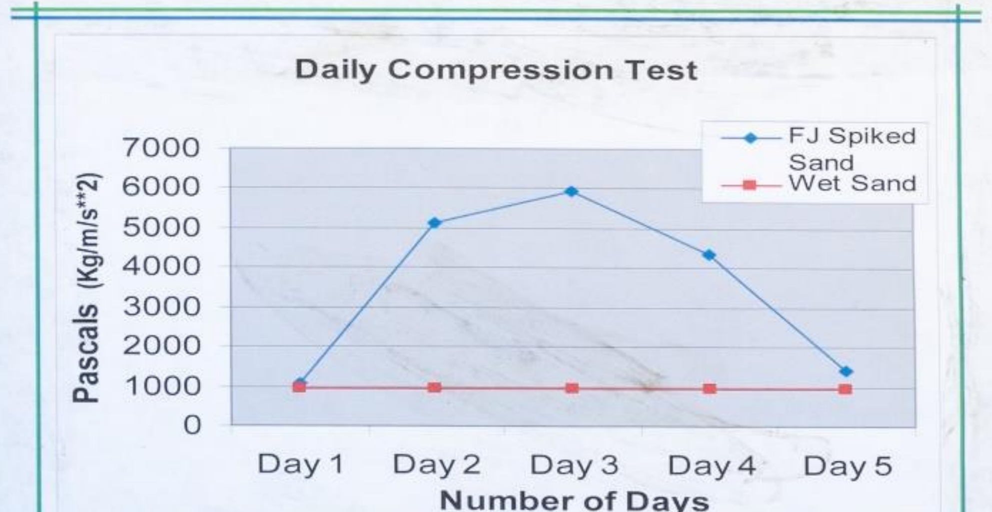
Data and Observations



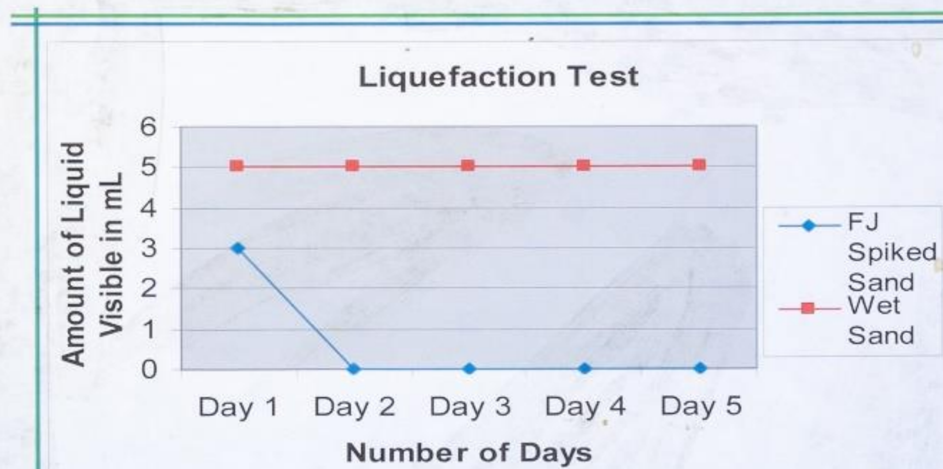
This graphs shows the pressure (Pascals) that the sand withstood before having its integrity compromised. The average percent strength increase per concentration is 319.95%. There is a 9668.21% increase in strength from the first concentration to the last.



This graph shows the volume of sand held together by the biofilm in the concentration tests. The volume of sand increased as the concentration of bacteria increased.



This graph shows the results of the daily compression test. The compression strength of the biofilm enhanced sand seems to have peaked on day 3, but then slowly lost strength in the next two days.



This graph shows the liquid released from the sand after being left in a vibrating water bath for one day. The biofilm enhanced sand released water on the first day, and then did not release any more.

Results

- For the concentration tests, there was a steady increase of strength as the concentration of bacteria was increased.
- For the liquefaction tests, the biofilm enhanced sand released liquid on the first day only, and then stopped.
- For the compression tests, I noticed that the biofilm enhanced samples' strength strength peaked on Day 3, but decreased from then on.

Conclusion

The hypothesis was supported.

The bacteria enhanced sand underwent very little liquefaction. Further the biofilm enhanced sand withstood a much higher compression force than normal sand. Normal sand withstood 50 grams before falling apart, but the Flavobacterium enhanced sand withstood 800 grams, clearly showing how the bacteria enhanced sand is much more stable than ordinary sand.

Further Research

- To improve the technique used to spike the sand, to ensure that the bacteria is ubiquitous in the sand sample.
- To find the optimal (cost and time effectiveness) concentration of bacteria that stabilizes the soil.
- To build a real world prototype so practical issues can be addressed.

Bibliography

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Acknowledgements

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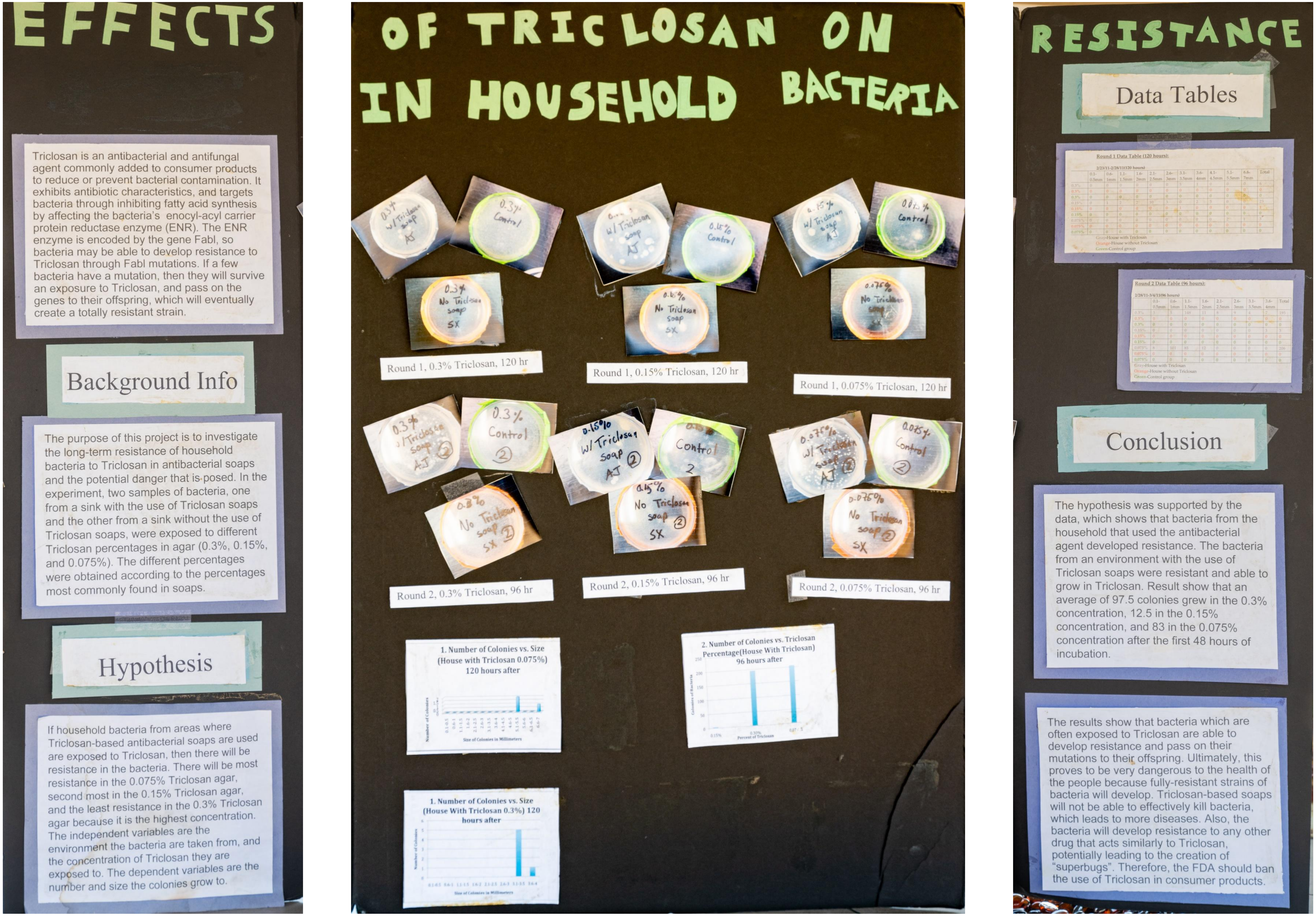
EFFECTS OF TRICLOSAN ON RESISTANCE IN HOUSEHOLD BACTERIA
Triclosan is an antibacterial and antifungal agent commonly added to consumer products to reduce or prevent bacterial contamination. It exhibits antibiotic characteristics, and targets bacteria through inhibiting fatty acid synthesis by affecting the bacteria's enocyl-acyl carrier protein reductase enzyme (ENR). The ENR enzyme is encoded by the gene FabI, so bacteria may be able to develop resistance to Triclosan through FabI mutations. If a few bacteria have a mutation, then they will survive an exposure to Triclosan, and pass on the genes to their offspring, which will eventually create a totally resistant strain.
Background Info
The purpose of this project is to investigate the long-term resistance of household bacteria to Triclosan in antibacterial soaps and the potential danger that is posed. In the experiment, two samples of bacteria, one from a sink with the use of Triclosan soaps and the other from a sink without the use of Triclosan soaps, were exposed to different Triclosan percentages in agar (0.3%, 0.15%, and 0.075%). The different percentages were obtained according to the percentages most commonly found in soaps.
Hypothesis
If household bacteria from areas where Triclosan-based antibacterial soaps are used are exposed to Triclosan, then there will be resistance in the bacteria. There will be most resistance in the 0.075% Triclosan agar, second most in the 0.15% Triclosan agar, and the least resistance in the 0.3% Triclosan agar because it is the highest concentration. The independent variables are the environment the bacteria are taken from, and the concentration of Triclosan they are exposed to. The dependent variables are the number and size the colonies grow to.
Round 1, 0.3% Triclosan, 120 hr
Round 1, 0.15% Triclosan, 120 hr
Round 1, 0.075% Triclosan, 120 hr
Round 2, 0.3% Triclosan, 96 hr
Round 2, 0.15% Triclosan, 96 hr
Round 2, 0.075% Triclosan, 96 hr
1. Number of Colonies vs. Size (House with Triclosan 0.075%) 120 hours after
2. Number of Colonies vs. Triclosan Percentage(House With Triclosan) 96 hours after
1. Number of Colonies vs. Size (House With Triclosan 0.3%) 120 hours after
Data Tables
Round 1 Data Table (120 hours):
Round 2 Data Table (96 hours):
Conclusion
The hypothesis was supported by the data, which shows that bacteria from the household that used the antibacterial agent developed resistance. The bacteria from an environment with the use of Triclosan soaps were resistant and able to grow in Triclosan. Result show that an average of 97.5 colonies grew in the 0.3% concentration, 12.5 in the 0.15% concentration, and 83 in the 0.075% concentration after the first 48 hours of incubation.
The results show that bacteria which are often exposed to Triclosan are able to develop resistance and pass on their mutations to their offspring. Ultimately, this proves to be very dangerous to the health of the people because fully-resistant strains of bacteria will develop. Triclosan-based soaps will not be able to effectively kill bacteria, which leads to more diseases. Also, the bacteria will develop resistance to any other drug that acts similarly to Triclosan, potentially leading to the creation of "superbugs". Therefore, the FDA should ban the use of Triclosan in consumer products.