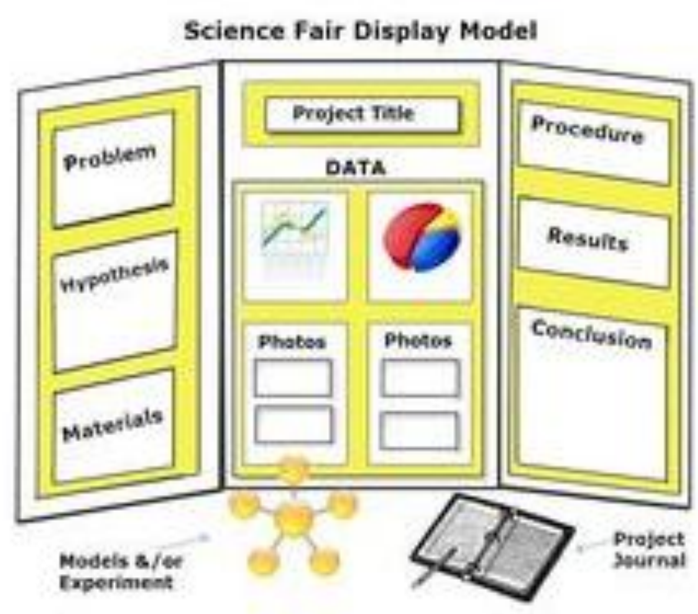
The Science Fair Board
Suggestions & Restrictions



Suggestions

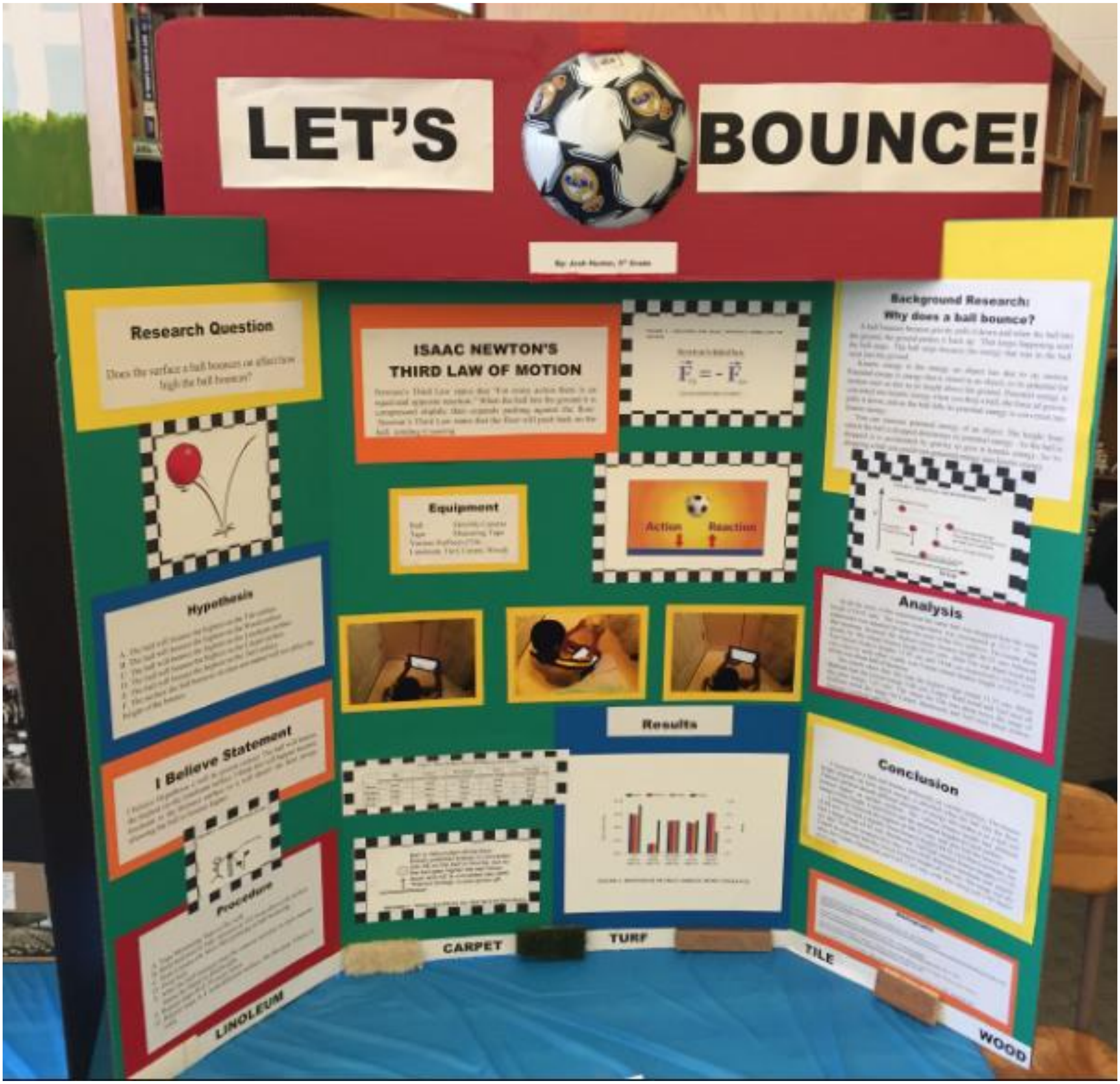
- Take pictures to display on the board or in a journal.
- Use software (Excel) to make chart, graphs and other visuals.
- If you use pictures or graphs you must cite them. If you take the pictures or make the graphs you should include "pictures/graphs taken/generated by *name* using *device/software name.* Cite EVERYTHING
- Make copies of your abstract to hand out and display your journal for judges.
- Must fit within a 3 foot wide space

Restrictions

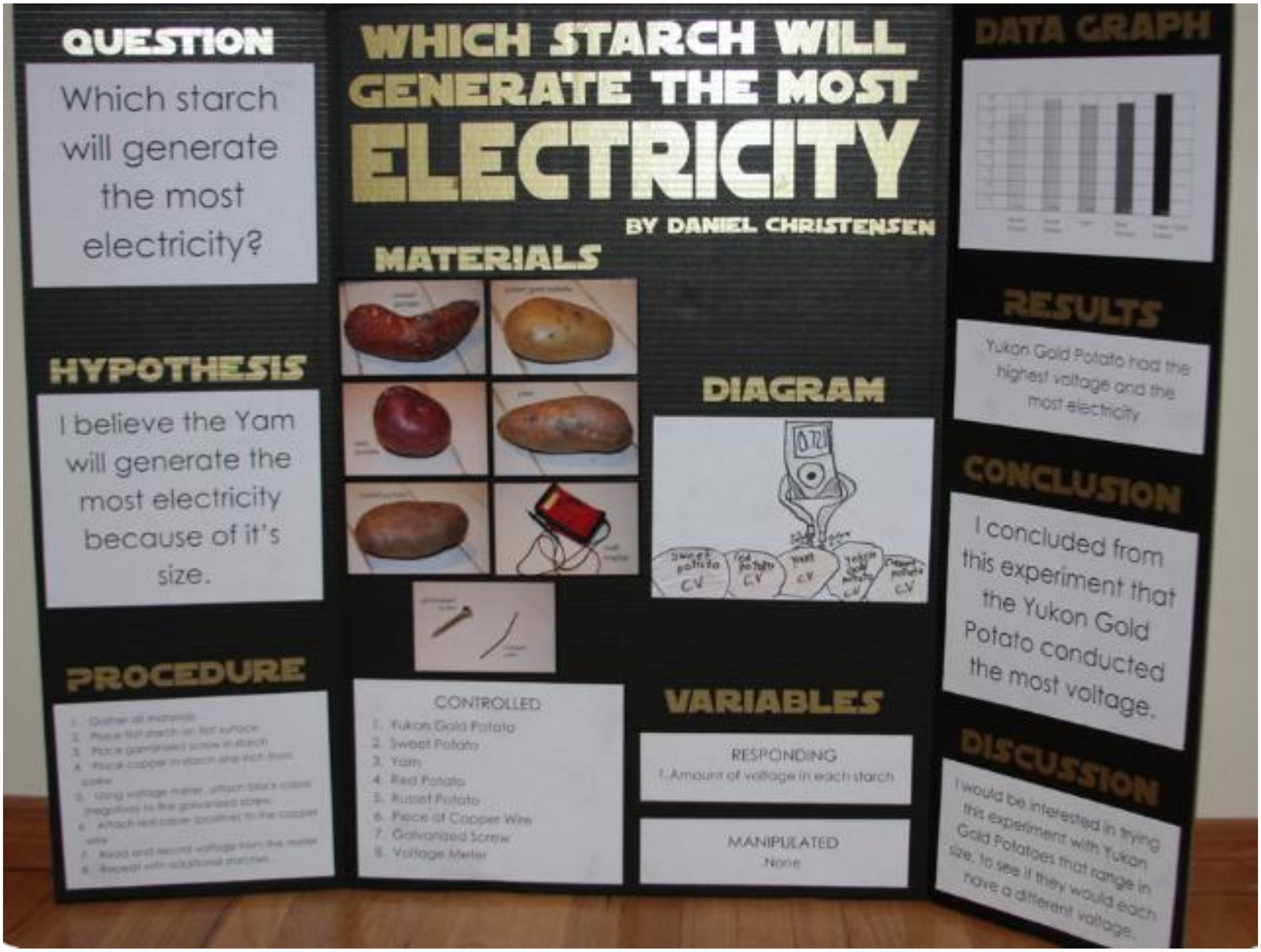
- No abstract on the board
- No pictures of human faces
- No food or liquids including: candy, water, packets containing sugar, yeast, candy, etc. (you can empty them and use them).
- No live organisms
- No chemicals/biological agents (including water)
- For further questions contact MSEF Region V director sciencefair.msstate@gmail.com

Examples

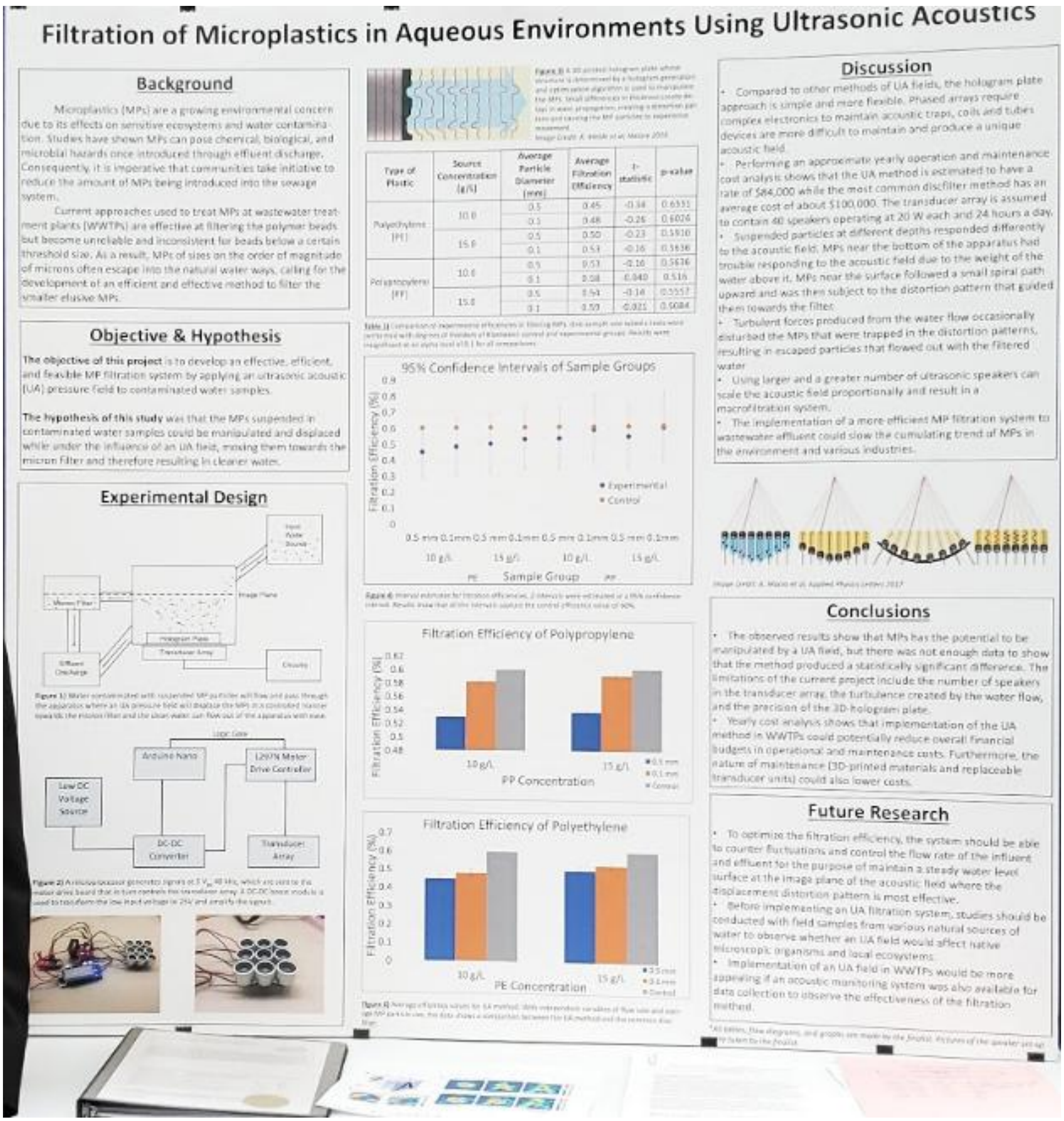
Board A



Board B


QUESTION
Which starch will generate the most electricity?
WHICH STARCH WILL GENERATE THE MOST ELECTRICITY
BY DANIEL CHRISTENSEN
DATA GRAPH
MATERIALS
HYPOTHESIS
I believe the Yam will generate the most electricity because of it's size.
DIAGRAM
RESULTS
Yukon Gold Potato had the highest voltage and the most electricity
CONCLUSION
I concluded from this experiment that the Yukon Gold Potato conducted the most voltage.
PROCEDURE
CONTROLLED
1. Yukon Gold Potato
2. Sweet Potato
3. Yam
4. Red Potato
5. Russet Potato
6. Piece of Copper Wire
7. Galvanized Screw
8. Voltage Meter
VARIABLES
RESPONDING
1. Amount of voltage in each starch
MANIPULATED
None
DISCUSSION
I would be interested in trying this experiment with Yukon Gold Potatoes that range in size, to see if they would each have a different voltage.

Poster



Filtration of Microplastics in Aqueous Environments Using Ultrasonic Acoustics
Background
Microplastics (MPs) are a growing environmental concern due to its effects on sensitive ecosystems and water contamination. Studies have shown MPs can pose chemical, biological, and microbial hazards once introduced through effluent discharge. Consequently, it is imperative that communities take initiative to reduce the amount of MPs being introduced into the sewage system.
Current approaches used to treat MPs at wastewater treatment plants (WWTPs) are effective at filtering the polymer beads but become unreliable and inconsistent for beads below a certain threshold size. As a result, MPs of sizes on the order of magnitude of microns often escape into the natural water ways, calling for the development of an efficient and effective method to filter the smaller elusive MPs.
Objective & Hypothesis
The objective of this project is to develop an effective, efficient, and feasible MP filtration system by applying an ultrasonic acoustic (UA) pressure field to contaminated water samples.
The hypothesis of this study was that the MPs suspended in contaminated water samples could be manipulated and displaced while under the influence of an UA field, moving them towards the micron Filter and therefore resulting in cleaner water.
Experimental Design
Arduino Nano
L297N Motor Drive Controller
Low DC Voltage Source
DC-DC Converter
Transducer Array
95% Confidence Intervals of Sample Groups
Filtration Efficiency of Polypropylene
PP Concentration
Filtration Efficiency of Polyethylene
PE Concentration
Discussion
• Compared to other methods of UA fields, the hologram plate approach is simple and more flexible. Phased arrays require complex electronics to maintain acoustic traps, coils and tubes devices are more difficult to maintain and produce a unique acoustic field.
• Performing an approximate yearly operation and maintenance cost analysis shows that the UA method is estimated to have a rate of $84,000 while the most common discfilter method has an average cost of about $100,000. The transducer array is assumed to contain 40 speakers operating at 20 W each and 24 hours a day.
• Suspended particles at different depths responded differently to the acoustic field. MPs near the bottom of the apparatus had trouble responding to the acoustic field due to the weight of the water above it. MPs near the surface followed a small spiral path upward and was then subject to the distortion pattern that guided them towards the filter.
• Turbulent forces produced from the water flow occasionally disturbed the MPs that were trapped in the distortion patterns, resulting in escaped particles that flowed out with the filtered water.
• Using larger and a greater number of ultrasonic speakers can scale the acoustic field proportionally and result in a macrofiltration system.
• The implementation of a more efficient MP filtration system to wastewater affluent could slow the cumulating trend of MPs in the environment and various industries.
Conclusions
• The observed results show that MPs has the potential to be manipulated by a UA field, but there was not enough data to show that the method produced a statistically significant difference. The limitations of the current project include the number of speakers in the transducer array, the turbulence created by the water flow, and the precision of the 3D-hologram plate.
• Yearly cost analysis shows that implementation of the UA method in WWTPs could potentially reduce overall financial budgets in operational and maintenance costs. Furthermore, the nature of maintenance (3D-printed materials and replaceable transducer units) could also lower costs.
Future Research
• To optimize the filtration efficiency, the system should be able to counter fluctuations and control the flow rate of the influent and effluent for the purpose of maintain a steady water level surface at the image plane of the acoustic field where the displacement distortion pattern is most effective.
• Before implementing an UA filtration system, studies should be conducted with field samples from various natural sources of water to observe whether an UA field would affect native microscopic organisms and local ecosystems.
• Implementation of an UA field in WWTPs would be more appealing if an acoustic monitoring system was also available for data collection to observe the effectiveness of the filtration method.