Student-Centered Investigation of Sensors in Game Controllers

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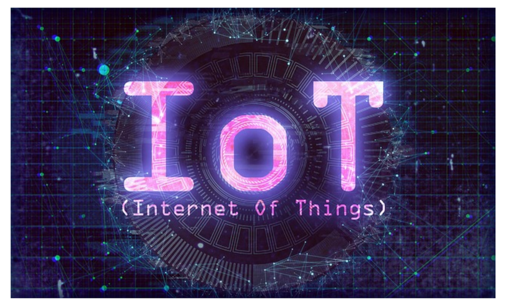


Summary

The IoT Comet program centers on the idea that our world has an abundance of sensors that are interconnected. This has become such a pervasive topic in today's world as our society has become so dependent on technology. With all of the "Smart" homes, cars, fitbits, etc., there is so much data floating around that it has become essential that more technology be developed to manage the flow.

This program was designed to make us more aware of how the sensors work together with the computer networks and, ultimately with the computer hardware so that we can take this information back into our classrooms and increase our students' awareness as well.

This will be brought back to the classroom by focusing on the area of sensors with which students often interact.

Research Activities

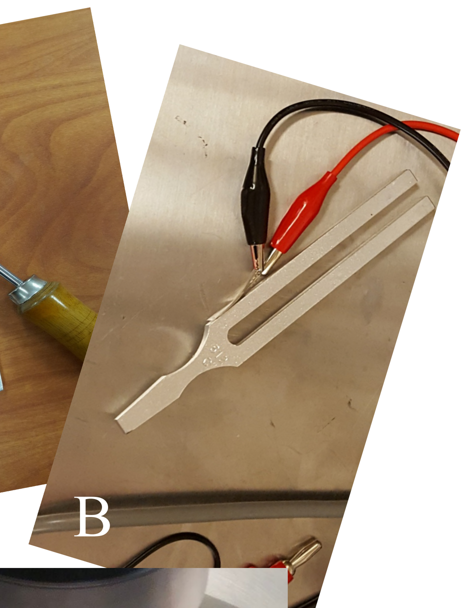
This program involved research in many four main modules, each of which included multiple topics. Program Research Activities and Topics:

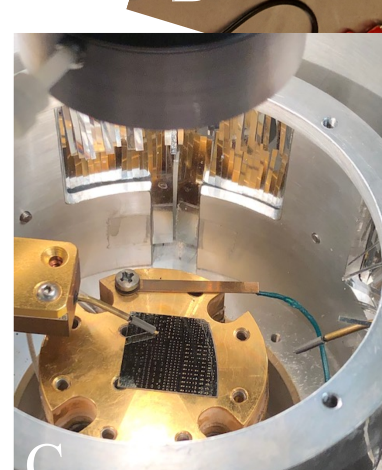
MEMS Sensor Module:
- Resonator activities
- Finding frequency of tuning forks
- Microphone frequency measurement
- Q-Factor analysis

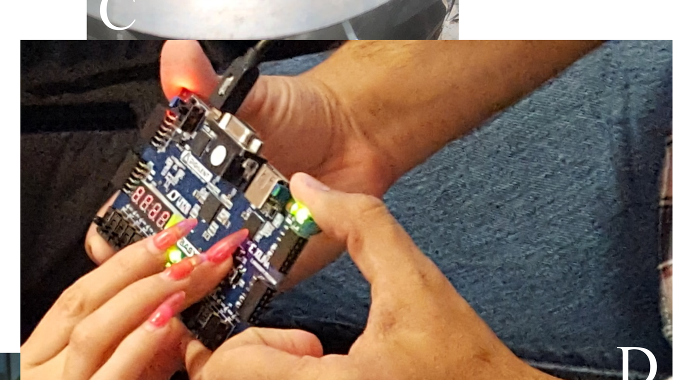
Hardware Component:
- Logic gates
- Truth tables
- Basys Field Programmable Gate Arrays

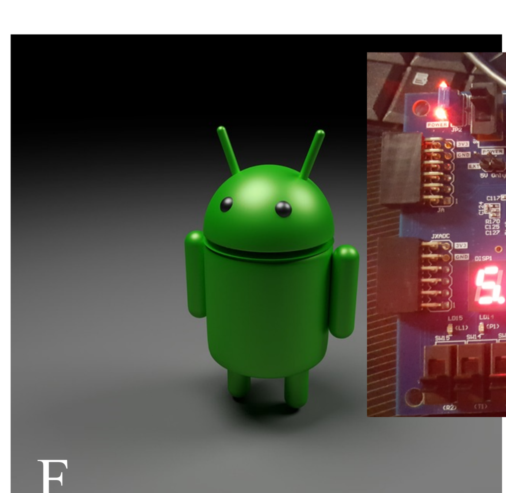
Software and Networking Component:
- OSI Layers
- Issues related to security
- Java programming
- Scratch programming

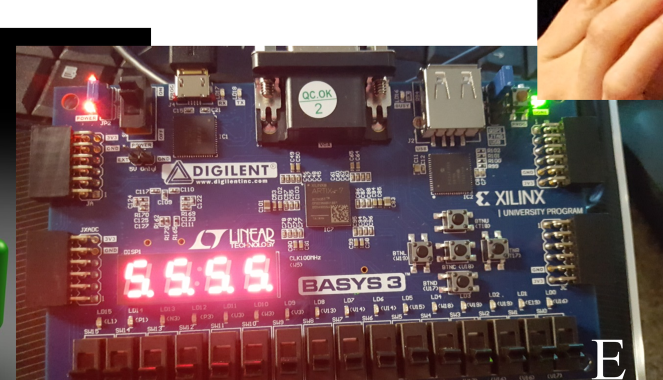
Mobile Computing Component:
- Android Studio











A - Tuning Fork & Mallet
B – Testing Piezoelectric Film
C – Testing the Sensors
D – Basys Board
E - Programming the Basys Board
F - Android

Lesson Plan

As our devices get smaller and smaller, sensors must also. Today's devices and controllers have dozens of sensors in them. In this lesson, students will explore the relationship of sensors in video game controllers with the output that they experience within the games they play.

Lesson Objectives:

Following this lesson, students will be able to:
- explain what a sensor is.
- explain how sensors are used in video game technology.
- understand how science/technology has impacted the tools we use to play games.
- design a game that would incorporate MEMS sensors.
- design a new/improved game control device

Lesson Sequence:

1. Group questions to assess what devices students have used to play games and how they communicate with the game (touchscreens, controllers, etc.).
   - Who in here plays video games (including consoles, tablets, computers, and cell phones)?
   - What tools do you use to interact with the game?
   - Tell me some things that you do to provide input?
   - How do you know that your input is received?
2. Assess beginning understanding (administer Pretest).
3. Place students in groups and give each group a controller or device to deconstruct. Assist them as they explore and deconstruct the devices. Encourage students to research on their laptops as they proceed.
4. Once deconstruction is completed, use the PowerPoint to teach about sensors – what they are, what each type measures, how they work.
5. Use Raspberry Pi and various sensors to demonstrate their functions.
6. Discuss possible applications for these sensors.
7. Final project – design and/or develop (depending on resources) a new and improved controller and design a game or game sequence that would incorporate the new abilities within that controller.
8. Administer Posttest.

Wii Remotes

Implementation Strategy

Where this Fits/Lesson Dependency

This fits into my iChallenge curriculum in game design – semester 1 - as we discuss programming and needs within games we make. It also has a connection to Boolean logic and other operators we discuss.

Instructional Strategies

Strategies incorporated include allowing project choice, cooperative learning, engaging various learning styles, experiential learning, hands-on / active learning, integrating science and computer technology classes, and project-based learning.

Evidence of Learning (Assessment Plan)

Score difference between the Pre and Post Tests

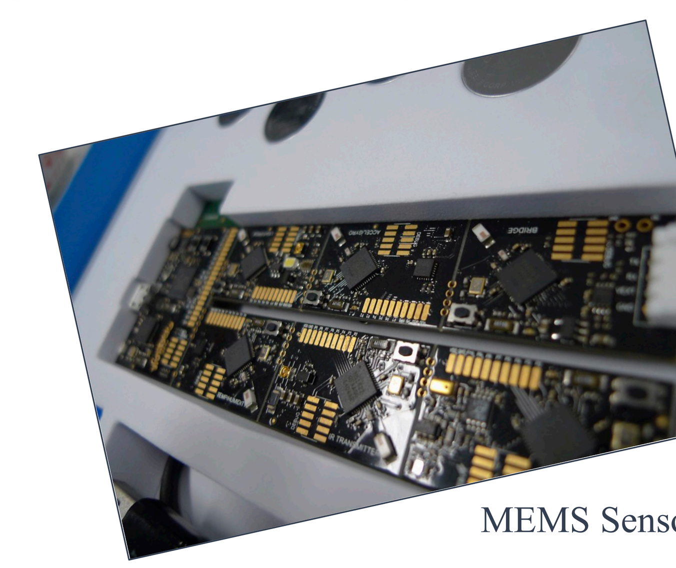
Project developed – either redesign of controller or development of game sequence

Lessons Learned

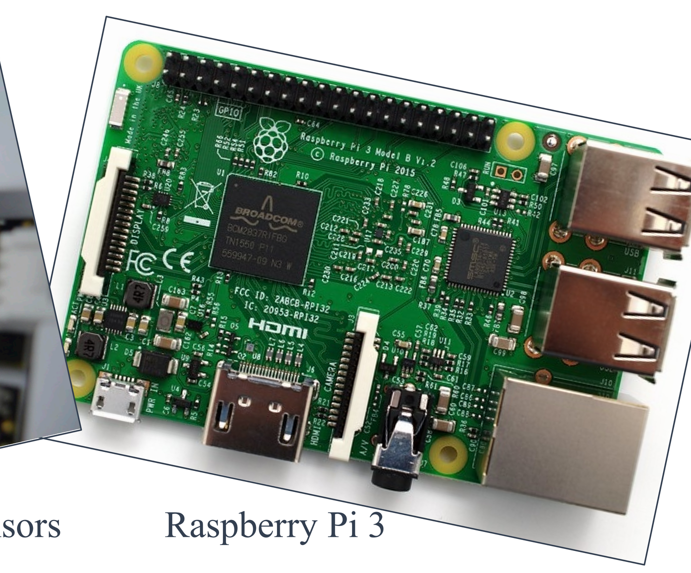
I learned a great deal about sensors, especially Micro-Electro-Mechanical-Systems Sensors (MEMS). I had no real understanding of them before. Dr. Reza explained to us that resonating is everywhere, which I had never really thought about prior to the program. I think that this understanding will be great to help my students, both in my environmental homeroom and in my computer classes. In addition, I have a better understanding about MEMS in general, looking at devices and trying to figure out what MEMS they might have and why and how they are used.

I also learned many new things about coding, programming, and the inner workings of computers that I did not know before. As a computer teacher, it is nice to have a better working understanding of the devices we use so that I can share that with my students. Many topics covered are things that I teach, but somewhat out of context, so now I have a way to connect the information better for my students.

On a personal level, I learned that, even after many years out of school, I can still manage to learn new things and find ways to bring them into my classroom. I am looking forward to sharing my new understandings with my students and other teachers.



MEMS Sensors



Raspberry Pi 3

Acknowledgments

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