**STEM INTERNSHIP**

**PROJECT OVERVIEW**

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**GOAL**

The goal of this project is to provide an Internet of Things (IoT) “petting zoo” for display in the Wadsworth Public Library. The display will have a small network of IoT nodes and a Raspberry Pi that reports data through a web interface. There will be printed infographics and flow charts detailing how data is processed in each node and how the sensors work. These infographics will be designed so that non-technical users can understand the high-level processes that happen in the hardware. There may be more technical details on a separate page that go more in-depth about the function of each hardware piece. Ideally, though, this display is intended to introduce a non-technical audience to the growing world of IoT.

**TARGET DEMOGRAPHIC**

The intended audience for this interactive display will be teenagers. Because the entire display is being constructed by high school students, the intended audience will be middle and high schoolers. However, it will be intended to be accessible to anyone with an interest in IoT technology, whether it be those younger or older.

**DATA FLOW**

The display will be a network of IoT devices that are routed through a Raspberry Pi. The network will consist of a variety of nodes that act as physical sensor to gather and report data back to the Pi. Each node will have an ESP8266 Thing as its driving component, with a sensor attached. The Thing will receive information from its attached sensor and report that data to the Pi through a wireless connection.

Each physical sensor will gather data from the environment around it. This data is then sent to the ESP8266 Thing through wires and headers and processed on the Thing. After receiving data, the Thing will send a GET request to the web server hosted on the Pi. This request will call for the web server to store the new data in a SQL database, also hosted on the pi. The Raspberry Pi will periodically check the SQL database for changed values. If a changed value is found, the Pi will update the GUI to display proper information.

**RASPBERRY PI**

The Raspberry Pi will act as a coordinator for the rest of the nodes (Master-Slave). The Pi will serve its own LAN Wi-Fi network for the ESP8266s to connect to. The Pi will access the data from a SQL database that the ESP8266s have been posting to. The Pi will post all the information to a web server GUI.

**TEMPERATURE & HUMIDITY NODE**

This node will employ the Si7021 temperature and humidity sensor from SparkFun. The sensor will be connected to an ESP8266 Thing. It will report information regarding the temperature and humidity of the room. There may be a fan pointed towards the sensor that can be controlled by users in order to cause fluctuation in the temperature readings. The readings may then be plotted on a graph to be displayed by the Raspberry Pi for user consumption.

**MOTION NODE**

This node will employ the ultrasonic range finder from SparkFun. The sensor will be connected to an ESP8266 Thing. It will report information regarding the distance the ultrasonic travel before being reflected. The readings may be plotted on a graph to be displayed by the Raspberry Pi for user consumption. There may also be one or many colored LEDs connected to the Thing that may light up when responding to changes in the readings.

**NOISE NODE**

This node will employ the SparkFun Electret Microphone. The microphone will be connected to an ESP8266 Thing. It will report information regarding the sound levels in the surrounding space. The readings may be plotted on a graph to be displayed by the Raspberry Pi for user consumption. There may also be colored LEDs connected to the Thing that may light up with rising sound levels or issue warning that the library is too loud.

**LIGHT NODE**

This node will employ both a gesture sensor from SparkFun and a LIFX Wi-Fi light bulb. The gesture sensor will be connected to an ESP8266 Thing. The LIFX bulb will be plugged into a light-to-wall adapted nearby and connected to the local Wi-Fi network. The Thing will report data it receives from the gesture sensor to the Raspberry Pi. The Pi will use this data to send commands to the light bulb. The Pi may set the bulb to a dim setting for a left swipe or a bright setting for a right swipe. The Pi may also allow the user to dynamically assign gestures to light settings through a web interface.

**VIBRATION NODE**

This node will employ an MMA8452Q accelerometer, DRV2605L motor driver, and a vibration motor. The accelerometer and driver will be connected to an ESP8266 Thing. The accelerometer will be attached to the vibration motor through some adhesive. The driver will periodically cause the motor to vibrate which will be recorded by the accelerometer. This data will then be reported to the Raspberry Pi which may display a message such as “Laundry is running.” The Pi may also report the times and durations for which the motor was running and display it for the user to consume. It is to be determined what will control when the motor runs. It may run on a timer or possibly respond to user input.

**USER INTERFACE**

The user interface may be an application such as OpenHAB, or a custom web interface. The user interface will display meaningful information in an easily-digestible fashion for the user to consume. It may display things such as a heads-up display to show what appliances are currently turned on (e.g. LIFX bulb, vibration motor). It may also display graphs to show historical data (e.g. temperature, LIFX bulb state). It may also include a live-update sound level meter. These are just a few examples of what the user interface may do.

