Project Deliverable F

GNG 1103

Team D6

“Diamond Hands”

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March 7, 2021

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1.0 Introduction

Our second client meeting with JAMZ was held on february 22, 2021, and focused on gathering their feedback and recommendations regarding our proposed design ideas. This helped us to further clarify our planned proof of concept for our first prototype. Specifically, we converged on a wired system, transmitting data through the RX/TX pins, and using a readily available 9V power supply to support a proof of concept, thus reducing the variables and potential sources of error.

Included in this document is an overview of our estimated schedule for our first prototype and a summarized analysis of our test results. Our proposed prototyping plan will be updated following additional feedback from JAMZ on our subsequent prototypes and test results.

2.0 Prototyping Test Plan

For our first prototype, the aspect we are testing is the proof of concept for our desired method of data communication. A physical working prototype is crucial to proceed with our tests planned for our later prototypes. In order to reduce the scale and inherent risks of making a fully comprehensive prototype and doing a single test, we plan on segmenting our tests to be more focused on the key subsystems. By separating the process into 3 core tests, we can reduce the number of variables associated with each test therefore increasing the clarity of our results. This will ensure that by the completion of our first prototype and the 3 tests which accompany it, we will be able to accurately determine whether or not our proposed design will work based on our results.

Table 1: Prototyping Test Plan

Test ID	Test Objective ~Why~	Description of Prototype used and Basic Test Method ~What~	Description of Results to be Recorded and how these Results will be used ~How~	Estimated Test Duration and Planned Start Date ~When~
1.1	Data communication between Pi and Arduino. The objective of this test is to be a proof of concept for our core data communication pathway.	Wiring the Arduino and Pi with a logic converter, transferring data through RX and TX pins and serial. Physical focused test on core data communication pathway. `Arduino ⇒ Logic Convertor ⇒ Raspberry Pi`	Test completed upon reading data sent from Arduino on the Raspberry Pi. The results will be used to confirm that our core data communication pathway from the Arduino to the Raspberry Pi is working.	1 Day 2021-03-05
1.2	Reading values from sensor to Ardunio. The objective of this test is to be a proof of concept for data recording.	Use a photoresistor to measure values on the Arduino accurately. Physical focused test on data recording. Photoresistor is substituted for MPU6050 as input. `Input ⇒ Aduino`	Test completed when values are consistent based on illumination levels in the surroundings. These results will be used to confirm that we can record a data input and have the Arduino read that input.	1 Day 2021-03-06
1.3	Sending photoresistor values to Raspberry Pi.	Combining aspects of test 1.1 and 1.2 to transmit data from the photoresistor to the Pi VIA the Arduino.	Test completed when the same readings on the arduino are seen on the Raspberry Pi.	1 Day 2021-03-07

	The objective of this test is to be a proof of concept for data transmission.	Physical comprehensive test on the entire data communication pathway. `Input ⇒ Aduino ⇒ Logic Convertor ⇒ Raspberry Pi`	These results will be used to validate our initially proposed data communication pathway.	

3.0 Prototype Test Analysis

3.1 Test Fidelity

Table 2: Test Fidelity Analysis

Test ID	Test Fidelity (1-5)	Clarity of the Signal (1-5)	Justification
1.1	3	5	Test 1.1 has medium fidelity and a high clarity because it is a very focused test which limits the chance for other variables to potentially interfere with our results.
1.2	2	4	Test 1.2 has the lowest fidelity because it is the most focused test. Test 1.2 also has a lower clarity because there is a photoresistor being substituted as the input for our system. This is due to our desired input (MPU6050) not arriving until after our first prototype will be due. This introduces potential risk for when we integrate our desired input in our final design.
1.3	4	3	Test 1.3 has the highest fidelity because it is a comprehensive test combining the 2 smaller, more focused tests to more accurately represent our final assembly. This being said, there is an added element of noise that could result from a larger, more comprehensive test. Also, this test is not a 5 fidelity because there is still a substituted input to facilitate our proof of concept.

3.2 Test Observations and Results

Table 3: Test Observations and Results

Test ID	Observations	Results
1.1	Communication with GPIO RX TX pins on UART protocol proved to be troublesome, data is being transferred to the Raspberry Pi after resolving the issues found, data transmission seems to be consistent	Data transmission using the UART protocol with GPIO wiring is possible and data is being successfully transferred from the Arduino to the Raspberry Pi
1.2	Testing of reading photoresistor values on the Arduino went flawlessly, on the first try we saw the values we were anticipating We have not received the MPU 6050 as of yet, once the MPU 6050 arrives we will be able to conduct further testing	We are reading proper values off a photoresistor. Once the MPU 6050 arrives, there will be a larger degree of difficulty of variables to track within the arduino.
1.3	Compiling both Test 1.1 and 1.2 into Test 1.3, we observed the values of the photoresistor changing consistently between the Arduino and Raspberry Pi	The data transfer or a changing variable based on real world inputs was successful over a GPIO based UART connection protocol.

4.0 Conclusion

Our estimated timelines were accurate as initially proposed. While there were some issues with shipping times and we did not receive our MPU 6050 on time, we were able to substitute in a photoresistor instead. We anticipate that the final product/ design will be significantly more complicated using an MPU6050 than our initial designs in this prototyping phase using a photoresistor. A photoresistor only returns a simple integer value whereas the MPU 6050 will return all kinds of data. This application of the MPU 6050 will be the focus of our upcoming prototypes and the most critical part of our violent shake alarm. Test 1.1 proved to be most challenging to work correctly. We encountered many issues with permissions, ports, wiring etc. but in the end we were able to get data communication working over UART through a GPIO interface.

Overall our work for this prototype is simply for a proof of concept for our final design, and we may have some changes made to it as compared to the work we did here. For future prototypes, we plan on interpreting the data from the MPU 6050 as opposed to a continuous data stream to the Raspberry Pi to conserve bandwidth and ensure that only relevant data is passed through the system. We will have to do some real world testing to turn out qualitative analysis of what constitutes as violent shaking into the sensor's corresponding quantitative interpretations of those same actions.