Conclusion

The world today has many problems, and one that is at the top of the list is safety. Safety is one of the basic rights that every human deserves. However, most of the time it is very hard to secure, especially for the hearing disabled. With normal life, this group of people *already* have a hard time trying to complete daily tasks without assistance, so how would it be possible to ensure their safety when they are alone? Using the device created in the past few months, it would easily reduce the number of deaf injuries and deaths to 0%. There are many key facts that made this project possible. Firstly, Arduino acts as a handler in this device as it collects the data from the Sound Level Meter and passes it to the phone. The Arduino is a programmable logic controller or an open-source electronics prototyping platform. Secondly, to program this project, MIT App Inventor was used to easily create a user-friendly app which allowed for simple solution to a major problem. It is an intuitive, visual programming environment that allows everyone, even those with no prior coding experience, to build fully functional applications for smartphones and tablets. Additionally, decibels played an important role in this project as the device detects danger based on the sound intensity of the user's surroundings. Essentially, the project was designed to create a way for the hard of hearing to be alerted to their surroundings based on the circumstances such as location, time, and the general sound intensity.

The procedure for creating the device was to first build the Arduino with all of the attachments to the expansion port which included the HC-05 Bluetooth module, the sound level meter, the battery, a light, and a vibration module. Afterwards, it was necessary to write code for finding the location, allowing the user to write their 10 most visited locations, connectivity between the Arduino and phone, and for the overall "look and feel" of the app. Next, in order to

attach the device to the phone for easy detection, it needs to stick on the back of the phone using a velcro attachment as well as a 3D printed case. Finally, one must be able to connect the phone to the module by pressing the blue Bluetooth button in the app, and select the HC-05 module. Then the user must use the split screen function on an android phone to make the app run in the background.

Throughout the experiment, it was necessary to measure the output at different decibel readings between 60-120+ decibels. The conclusions that could be creating using the percentages of the alert levels that were created as an output were that the higher the decibel level, the more it will alert the user. For example, at 105-110 decibels, the alert level 3 was created only 14.29% of the time while at 120+ decibels, it was created 100% of the time. This is one way each of the tests in the experiment differed from one another. Furthermore, one of the biggest goals of the project was to show that the device would only alert the user at a decibel level where it could come from something that is harmful. For example, in tables 1-5 the data shows that no alert was present so the alert was occurring 0% of the time. The hypothesis that was stated was upheld and supported from this data because it showed that the device would be able to pick up loud noises which may lead to danger. Also, the hypothesis that the higher the decibel level increases, the higher the alert level will become. In addition, there could have been multiple sources of error. One could have been the background noise that may have interfered with the precise decibel level that was emitted. Another could have been a technical problem where the code that the app runs on was too slow, so then it could have glitched as the program runs.

After conducting the experiment, it was fundamental to figure out the accuracy of our device to make sure that the analog sound sensor was actually reliable. This hypothesis was

actually upheld because of the fact that when the difference between the average decibel levels official sound sensor and the device, each one was less than 1. This displays that the device was very accurate which means that whenever the device needs to be activated, the device will be active. Additionally, the mean of the standard deviations of all the 5 tests for each item was also somewhat less than 1.5 which means that the data collected for each item was very precise and was close to one another with no outliers.

Likewise, another experiment was taken by changing the distances which was hypothesized to change the decibel levels of the items. This hypothesis was upheld according to the data that was collected in all of the tables and figures. For example, when the leaf blower was on at 30ft, the average was 84.1 decibels but at 2ft it was 93.8 decibels. Moreover, the average for the standard deviation was also calculated as well and it was less than 1.5 every time it was tested.

According to the World Health Organization, 466 million people are deaf in the world at this moment, and it is necessary to expand the project in ways that can help more people. One way is with the code functionality, it would be better if the code was written in Java or Python whereas it would be much easier to involve more functions and abilities for the app to help improve the runtime of the program and would be much easier to read and edit. Additionally, this would allow for the device to be compatible with IOS devices. This would help us expand the device and allow for more people to be potentially saved. Another improvement that could be made would be to make the program run in the background instead of opening the app. This would allow for the user to be alerted to the danger before it's too late. From the information gathered, it would be very useful to people when trying to save their lives from people in their

daily lives that they cannot always see. This information has the potential to save millions of lives.