GNG2101 Introduction to Product Development and Management for Engineers

Project Deliverable J: User Manual

Submitted by

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Abstract

Modern times require modern solutions. Our brand, Smart Tech, strives to help those lives in need of a convenient, reliable, and affordable resource to aid them with their disabilities. The purpose of our project was to construct a solution for those who have particular disabilities that do not allow them to seek the assistance of their support that they may require at any time. All of our possible users' needs with compiled and research began on the problem at hand and possible solutions. After completing the initial steps of finalizing a concept to focus our project on, a voice-activated pager based device became the center of our process. It was the most sensible solution we had that met our requirements and was within realistic reach. Further research was done on what would be needed to manufacture our concept and how it would be successful. These materials were bought and the procedures for the product creation were organized into our project plans. Once we had prepped for the main focus of our project we were able to go ahead with the process of completing a physical functioning product of our concept. Now that we are at the end of this journey, our team can say that we have successfully completed this project. We have met our goal of creating a fully functioning prototype solution to fulfill our brand's purpose.

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Introduction

Our product's purpose is to help those who have difficulty seeking assistance from their support due to their disabilities. In certain situations, often the disability of a person is what restricts them from contacting their support workers or guardians. An example would be the difficulties of controlling and coordinating physical movement as well as speaking due to a condition like cerebral palsy. Other than when a person's support staff is present in the same room, there are many restrictions to possible ways this person can contact their support. Support staff may have routine check-ins with those they are supporting but there is always the possible need for unexpected check-ins which can range to severe extents. It is very important that a person with a disability has a convenient way to contact their support staff in an emergency situation as the outcomes could even possibly be fatal.

Currently, a possible solution to this problem that exists in the market would be hospital pagers. Hospital pagers are used between medical staff and their patients when those patients require assistance. According to the Journal of Hospital Medicine study, nearly 49% of assistance received by hospital patients is through pagers.

However, not all pagers and similar products have easy accessibility. They are often standardized and are not reliable for everyone, specifically our users. Of course similarly to hospital pagers, the users of our product require something that would replace the physical action of getting up and going to go get help from their support staff. But our users also require a product that does not require physical contact to function. Essentially the product needs to be something that doesn't require them to move especially if they cannot do so in the situation they are in.

In order to meet the basic user requirements, our brand has come up with a voice-activated pager. It is made to be distinctive for those who may have difficulty utilizing products that are already out there.

Smart-tech has come up with this device that is meant to help our customers go about their daily routines with more ease and comfort. We want to offer our customers a simple solution to seek the assistance that they should be getting.

User Manual

Product Features and Functions

Our product consist of 2 main functionality areas:

1. One User's End Voice-Activated Device:
- Microphone (Voice Module)
- Battery Switch
- Light Indicator
- Aesthetic Cover

2. Notifying the Second User's End Pager

The microphone in the voice-activated device is used to detect the client's or patient's voice whenever he/she needs help or asks for assistance. This product will detect only the distinct (unique voice) voice of the client and transmit the signal to the notifying device located at the caretaker or the support staff. This is to prevent the product to be activated whenever it hears the client's voice or other people's voices all the time that could cause unnecessary disruption.

The distance of connection between the voice-activated switch and the notifying pager is within 80m in distance. This is because this product uses a radio frequency that has a better transmittance reach. Additionally, the radio frequency use gives the product to have a better signal transmittance. The notifying pager will produce sound and vibration to the support staff to tell that the client or patient is asking for help.

This product will be equipped with a switch for the battery connection and the circuit. This is intended to prevent the product to be turned on 24/7. This product also has a light indicator to show whether the voice-activated device is activated or not. This is to prevent the client from asking for help and becoming tired after that, without knowing the voice-activated device already sends a signal to the notifying pager.

Instructions to Prototype Manufacturing

The following are the components needed in order to create our product:

1 X voice recognition module
1 X Arduino Uno/Nano

1 X 1K Ohm resistors
1 X 220 Ohm resistors
1 X Relay SRD -05VDC-SL-C
1 X pagers transmitter (depending on the chosen pagers)
1 X 2222A Diode
1 X USB to TTL module
1 X Protoboard
1 X 9V battery
1 X switch

The following are the software that would be required in order to create our product:

Arduino IDE
Hterm.exe

Using the voice recognition module:

1) The voice recognition module communicates with the Arduino using hexadecimal codes. The voice recognition also requires a program such as hterm.exe to set up the instructions for the device. The lists of instructions for the device can be found on the official website of the products: https://www.geeetech.com/Documents/User%20Manual.pdf.

2) To send the lists of instructions to the voice recognition module, we need to have a USB to TTL converter to connect it to the internet and send the hexadecimal codes to the voice recognition module.

3) The connection of voice recognition must always be TX to RX and RX to TX from both devices (voice recognition module and the USB to TTL converter) as shown below:

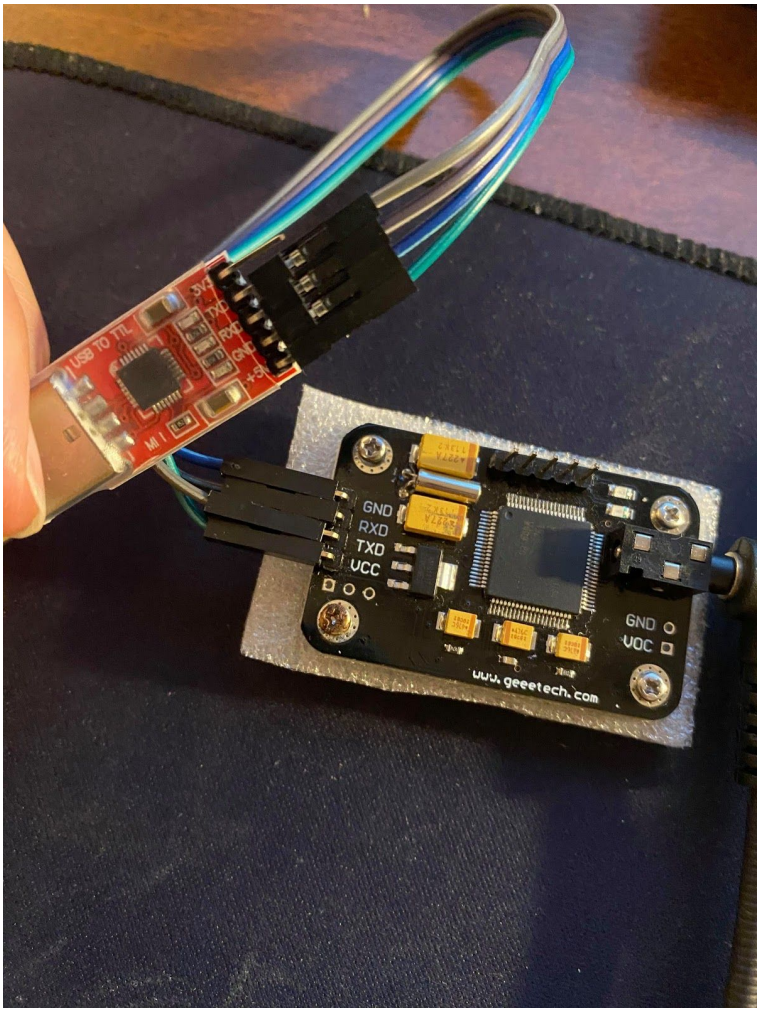

Figure 1. The connection os USB to TTL module with the Voice recognition module

4) The first step for the voice recognition module is to send the instruction to record a list of voice instructions to the voice recognition module (VR) by sending the instructions 0X11 where the VR module will start to record the set of 5 voice commands

5) The voice commands in this prototype are from the client herself where there is 5 distinct sound that she prefers to make to call the support staff.

6) After the process of recording is complete, the next step is to upload the recorded voice instructions as a set of voice commands by sending the 0X21 hexadecimal code.

7) After the voice commands upload is complete the VR module will start to operate and will return a set of hexadecimal codes as an output when it receives the correct voice commands as the input.

These hexadecimal codes will then be used by Arduino to translate it into output to activate the VR module.

The following are the detailed steps to creating our prototype:

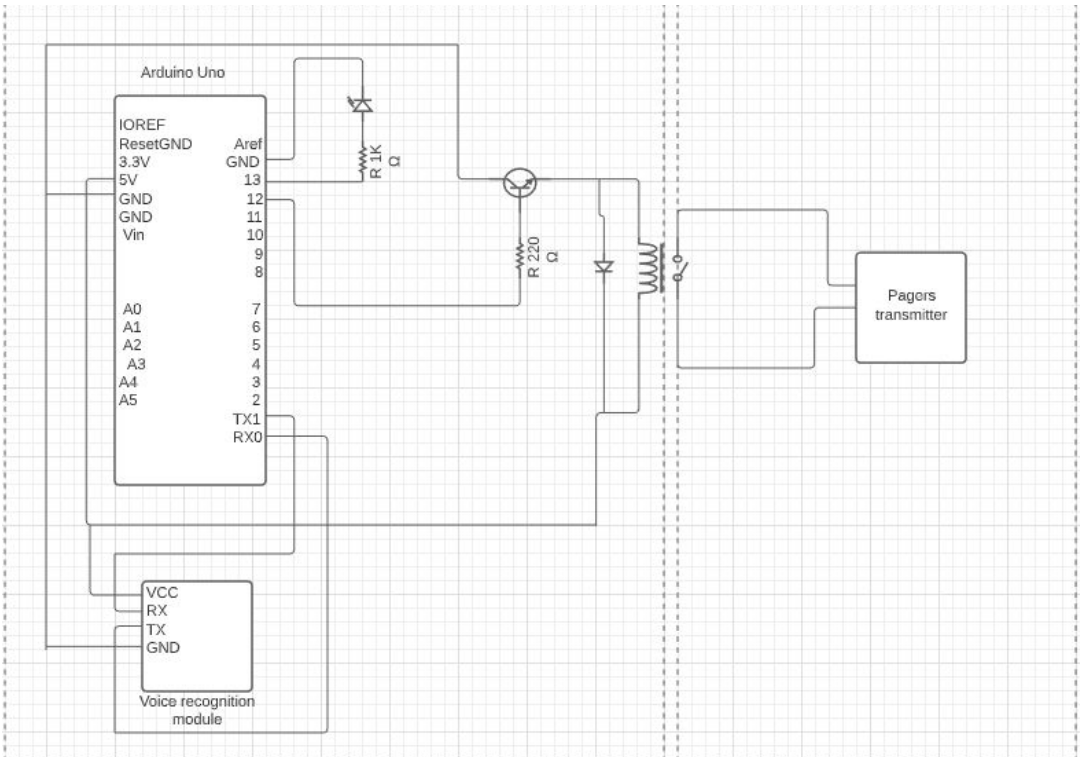

Figure 2. The schematic diagram for the final prototype and its components required for completion.

1. Using the schematic diagram we created the connection of components using soldering tools except for the voice recognition module on the protoboard as shown below. When the process of soldering was made we are using a prototype shield board due to a shipping problem with our protoboard that accidentally sent to a different location/

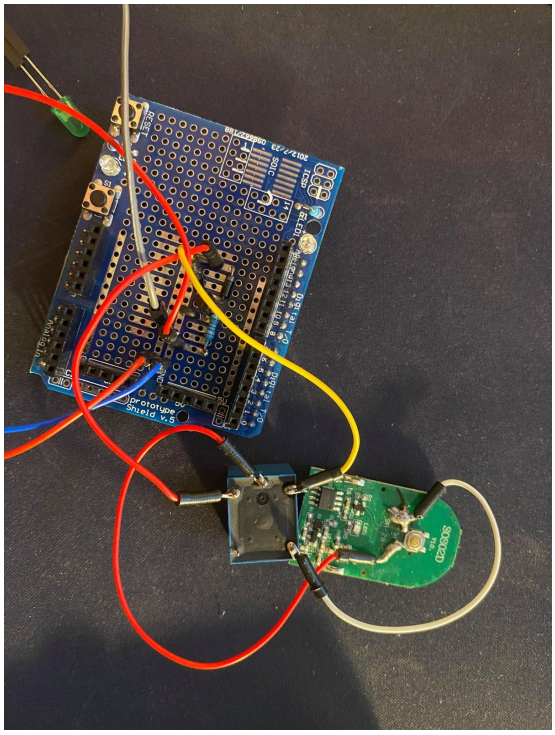

Figure 3. Image of soldered prototype shield board.

2. The Arduino code must always be uploaded first before connecting the Arduino to the VR module as the process of uploading the code while both devices connected will disrupt the precious instructions in the VR module.

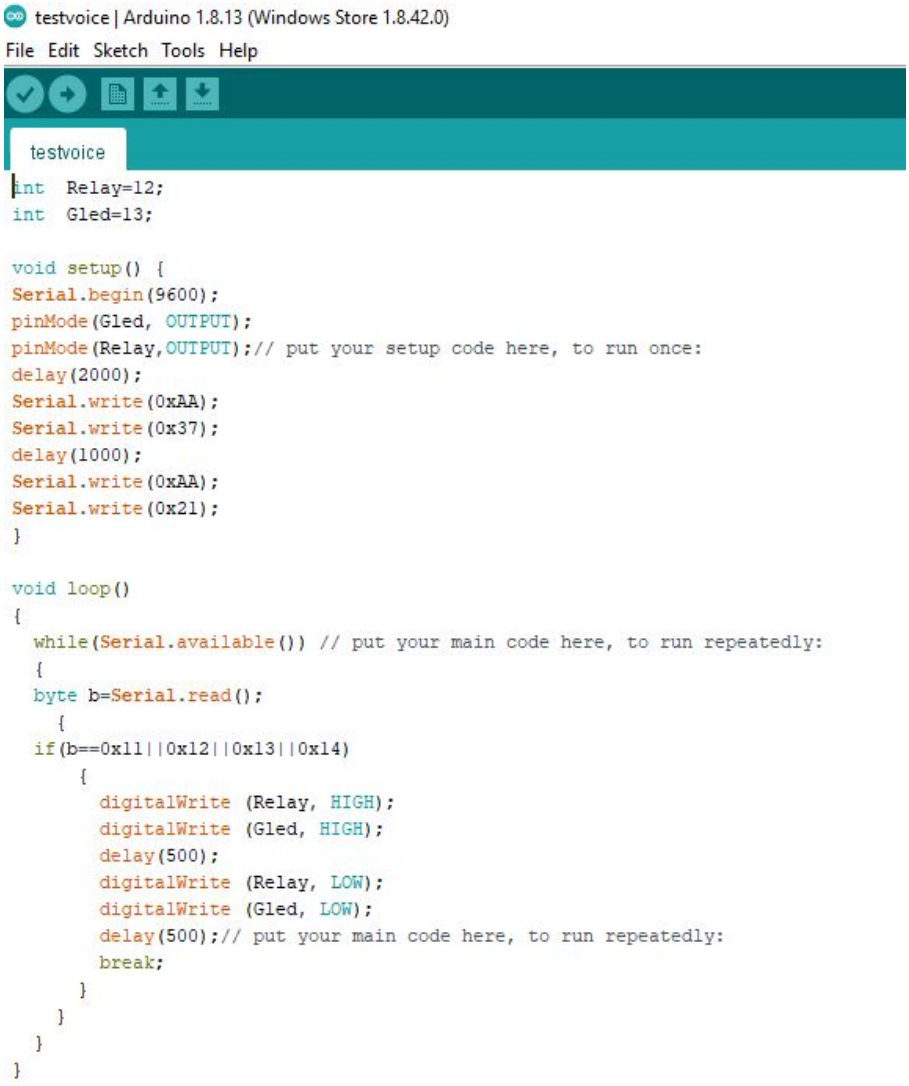

Figure 4. The Arduino code uploaded to the device.

3. After the process of uploading the code to the Arduino, we can connect the voice recognition module using the connections as shown in the schematic diagram in the figure.
4. The power source to the Arduino is supplied by a 9V battery where we modify the wires to install a switch so that we can control the power source to the Arduino.
5. When the connection is completed the final prototype is ready to be tested.

How Prototype Works

The beginning of our prototype's functionality begins on the user with the voice-activated device's side. The user would use the preset word they had chosen to say which would activate

the device on their end which is indicated by a green LED light. Once the device detects the activation word from the user and it is activated, it sends a signal to the other user's end with the pager. Once the signal is received by this pager, the pager would ring and vibrate.

How to Install and Operate Prototype

The following are the steps to set up our prototype:

1. Place the voice-activated device and the notifying pager side by side.
2. Turn on the switch located near the microphone. Turn on the notifying pager as well
3. Look at the light indicator and the notifying pager.
4. If the light indicator, the green LED located at the side of the voice-activated device blinks twice. The notifying pager will produce vibration and sound.
5. The product is now ready to be used

Prototype Maintenance Instructions

The following are the steps to changing the device's batteries:

Changing the Voice-Activated Device Battery: 9 V Battery

1. Open the top casing of the voice-activated device
2. Detached the 9V battery in the voice-activated device from the battery connector
3. Attached a new 9V battery to the battery connector.
4. Closed-back the top casing

Changing the Notifying Pager Battery: 2x AAA Batteries

1. Open the cover of battery slots
2. Remove the used up batteries. Dispose of the battery properly.
3. Insert the new 3A batteries into the battery slots
4. Close back the battery slot

Health and Safety Guidelines and Precautions

Throughout the tests conducted our voice detection device and the notifying pager was found not to link with any health issues. For the safety precautions, the device must not be allowed to contact with water or immersed in water. This is because this product contains electrical components such as wires, electrical boards, batteries, circuits, etc. The contact with water may cause a short circuit or short circuits and may lead the device to be broken or fail to operate.

Troubleshooting Instructions

The Voice recognition module has some nuances that need to be paid attention to when using it. First of all, it has two modes: compact and common mode. When using the common mode the VR module will send an understandable string of characters so that we can understand the status of the operation that the VR module is running on. Before using the VR module with the Arduino make sure to change it to a compact mode so that the output is in Hexadecimal characters where we can use it in an Arduino ide environment.

Design Files

The following is a list of the design files that we have included for our client and/or students planning to continue and improve our work. We have included these files links to their locations on MakerRepo:

1. File: GroupConcept.pdf

This file includes an image of the initial diagram created to map out a more realistic version of our chosen group concept. It is when we were able to start figuring out the actual materials we would be needing to create the real device.
MakerRepo Link:
https://uottawa-makerspace.s3.us-west-2.amazonaws.com/vmwbeq8kv27nn03v6ijy48zcpp64?response-content-disposition=inline%3B%20filename%3D%22GroupConcept.pdf%22%3B%20filename%2A%3DUTF-8%27%27GroupConcept.pdf&response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA34PB766H365QOAG6%2F20201210%2Fus-west-2%2Fs3%2Faws4_request&X-Amz-Date=20201210T173447Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=f8f7962b4d818c8fc2b9e0796dc7ade657ada36300f855a0d5b68e0b937f7ef3

2. File: FinalPrototypeCircuitDiagram.pdf

This file includes an image of the circuit diagram our group had based our physical final prototype off of.
MakerRepo Link:
https://uottawa-makerspace.s3.us-west-2.amazonaws.com/nm2hg2y7xon29s4wdfarw9vz0dxs?response-content-disposition=inline%3B%20filename%3D%22FinalPrototypeCircuitDiagram.pdf%22%3B%20filename%2A%3DUTF-8%27%27FinalPrototypeCircuitDiagram.pdf&response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA34PB766H365QOAG6%2F20201210%2Fus-west-2%2Fs3%2Faws4_request&X-Amz-Date=20201210T173429Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=10c893a10197388d15bf1d5330f89140cebdd520557b117b91a3b6f828d93764

3. File: gng2101.ino

This file includes the code that was created and uploaded to our Arduino in our final prototype.
MakerRepo Link: Link not available, file downloads automatically

4. File: PrototypeStages.pdf

This file includes a few images of our devices at different stages of our project and how they transformed into what our final prototype ended up being.
MakerRepo Link:

https://uottawa-makerspace.s3.us-west-2.amazonaws.com/z4zlf27e1ma03x0g770y1oo2p9oe?response-content-disposition=inline%3B%20filename%3D%22PrototypeStages.pdf%22%3B%20filename%2A%3DUTF-8%27%27PrototypeStages.pdf&response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA34PB766H365QOAG6%2F20201210%2Fus-west-2%2Fs3%2Faws4_request&X-Amz-Date=20201210T173515Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=a512ef6532fd8e47f1f86a264827cc6a7c6589ce08ba8bb9e16f9e6e4235c7c6

5. File: VoiceModuleUserManual.pdf

The Voice Recognition Module User Manual resource that we have included does not belong to us but is very important for understanding one of the main components of our prototype which is the voice recognition module.

MakerRepo Link:
https://uottawa-makerspace.s3.us-west-2.amazonaws.com/h45bybtqd6t8uwe3qokbcwwb9vcu?response-content-disposition=inline%3B%20filename%3D%22VoiceModuleUserManual.pdf%22%3B%20filename%2A%3DUTF-8%27%27VoiceModuleUserManual.pdf&response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA34PB766H365QOAG6%2F20201210%2Fus-west-2%2Fs3%2Faws4_request&X-Amz-Date=20201210T173528Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=b862ef50e87821f2deba519499936838441480c09efb2403d20267204cd0eafe

Conclusion and Recommendations for Future Work

The production of our prototype was done with very little knowledge of the concepts and parts used prior to the beginning of this project. Essentially our group learned everything regarding the topics involved in our prototype solely for the purpose of creating our product. A majority of the credit for the success of our prototype goes to the time our group spent in researching and actually understanding what was going on with our product concept. It is most likely the only reason our product is functioning today. One of our main recommendations to other groups who plan to continue and improve our work would be to not slack on the research aspect of the project. Taking more time to do so will only benefit you.

As for any suggestions our team had for other groups to improve and continue our work, there was one functional aspect our group wishes we had the time to complete in our prototype. If our team had the time and resources we would've wished to add a function to our prototype that indicated the battery percentage of the batteries in our device. This function would have been very beneficial for our users. Knowing the battery percentage of the device would have notified our users of when it was time to replace the product's batteries. The batteries still being alive is essential for our device to operate which is why this function could've been a vital solution. It is one of our main suggestions for any team who wished to continue and improve our work.

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Appendices

Item Number	Item	Quantities	Price (CAD)	Extended Price (CAD)
1	Microcontroller	x1	0	0
2	Alert pendants	x1	33.99	33..99
3	Voice recognition module	x1	66.30	66.30
4	Battery	x1	0	0
5	Resistors	x~2	0	0
6	Capacitors	x~2	0	0
7	Jumper wires	>10	0	0
8	Protoboard	x1	0	0
9	Diode	x1	0	0
10	Relay	x1	0	0
Total			100.29	100.29

The items with $0 for cost are personally owned

Table 1: Final prototype bill of materials (BOM)