Project Deliverable J: NiCa Bell User Manual

GNG2101 [A03] – Professor Hanan Anis

Submitted by:

Team A2

Ayesha Khan, 300056179

Alessandro Furlano, 300116738

Aunonto Bhuiya, 300115942

Ethan Chan, 300006808

Dieudonne Lomamba, 300095212

Due Date: 10/12/20

University of Ottawa

Abstract

Team A2 created the NiCa Bell, a system of communication devices meant for those with low dexterity and mobility. This device was design based on input from their clients and the OFP (Ontario Foyers Partage). They organized the client's statements into a ranked list of needs, each of which has an assigned metric. This list was then used to create a list of design specifications, which were used to evaluate their conceptual designs and select a final design. The NiCa Bell consists of a main and portable unit, the main unit is the unit that will stay at an individual's bedside, and the portable unit will stay with a staff member or caretaker. Upon the user saying "Hey" or "Help", the main unit will send a signal to the portable unit making it buzz, thus, notifying the individual with said unit. Both units have various features motivating and prompting its users to help the individual calling for help from the main unit. This manual outlines how to build the devices, as well as, how to maintain and operate it safely.

Table of Contents

Table of Figures

Table of Tables

1 Introduction

Team A2 created The NiCa Bell, a system of communication devices to help those with low dexterity and mobility. The devices have also been calibrated to be accessible to those who have difficulty projecting their and it has been specialized for use during the nighttime.

1.1. The Problem

In Ontario alone there are about 77, 257 long term care beds and more than 34, 000 people live with cerebral palsy []. Furthermore, 1.85 million people in Ontario have some kind of a disability and these individuals may have difficulty with their dexterity. Thus, utilizing the typical button style help buttons found on long term care beds can be incredibly difficult. The client and the OFP require a device to overcome this difficulty, as calling for care staff can be a matter of safety and wellbeing. More specialized to the client, she requires the device to be discreet, voice activated and specialized for nighttime use. Based on the meetings with the client, Team A2 formulized the following problem statement:

Our client requires a set of devices that can discreetly and effectively communicate with each other, thus, notifying her support staff through voice activation. The device should be low maintenance and function over a variety of distances.

1.2. Needs and Requirements

To begin designing the device, Team A2 had a client meeting allowing them to better empathize with them. Based on that meeting they were able to compile a list of needs and rank them (refer to **Table 1**). The needs were ranked from 1 (one) to 5 (five); 1 being the most important and 5 being the least important. The more directly the need correlated to the functionality of the device or the safety of the client, the higher up in the list it was placed.

1: 2: 3: 4: 5:.

Rank	Need	Metric	Units
1	Device is sensitive to sound/voice, but is quiet	8	dB
1	The device simply notifies the staff - no complicated commands	9, 10	dB, s
1	The device works independently of external equipment		
1	The device effectively notifies the staff	9, 10	dB, s
1	The device recognizes the words “hey” and “help”	8	dB
1	The device can be operated by one person alone		
1	The device has to be plugged into the wall, limits any complications with battery and charging	6	Amps, Volts, Kw
1	Device needs to be easy to use and multiple different workers come in and out		
2	Device interacts solely with the client and her staff	9	dB
2	The device is wearable and portable	3,4	mm^3, g
2	The device uses lights to notify clients	11	cd
2	Device needs a light so that the client can be noticed help is coming	11	cd
3	The device is small, similar to a tissue box, and fits on a side table.	2	cm^3
3	Device is hot pink		
4	Device needs to be the size of a tissue box if on a side table, device on wall mount has to be light in weight.	1,2	cm^3, kg
5	The device can be connected to the internet		

Table 1: Ranked List of Needs with Metrics

Metric Number	Metric	Unit
1	Total Mass (Main device)	kg
2	Total Volume (Main device)	cm^3
3	Total Mass (Staff Device)	g
4	Total Volume (Staff Device)	mm^3
5	Cost	CAD$

6	Power source (Main Device)	Amps, volts, kilowatts
7	Power source (Staff device)	Amps, volts, watts
8	Sound sensitivity	dB
9	Indicator sound volume	dB
10	Notification Duration	s
11	Light indicator brightness	cd

Table 2: List of Metrics

Each need in this list was then assigned a metric from **Table 2** and a table of specifications (refer to **Table 3**) was created using information from benchmarked products (Deliverable B) and the client's requirements.

Metric number	Metric	Unit	Values
1	Total Mass (Main device)	kg	0.25 - 0.50
2	Total Volume (Main device)	cm^3	65.5
3	Total Mass (Staff Device)	g	30 - 50
4	Total Volume (Staff Device)	cm^3	4
5	Appearance	---	Pink
6	Cost	CAD$	100
7	Power source (Main Device)	Amps, volts, watts	15, 110-120, 1800
8	Power source (Staff device)	Amps, volts, watts	15, 110-120, 5
9	Sound sensitivity	dB	60
10	Indicator sound volume	dB	60
11	Notification Duration	s	5
12	Light indicator brightness	cd	110

Table 3: List of Design Specifications

This information was used to create the problem statement (**Section 1.1**) and select the top three designs (Deliverable C), eventually narrowing the list down to the current design, as described in the

sections below. Following the first prototype of The NiCa Bell, the team received invaluable feedback from the client leading to creating the following table of improvements to the device.

Client Feedback	Improvement
Vibration needs to be strong enough to wake up staff	Improvement on vibration idea as now having three different levels of vibration
Potential use of an alarm (sound notification on portable unit) - staff may be sleep	Improvement - the team hadn't considered that the staff may be sleeping
Option 2 of mic with wire is preferred	Neutral - provided clarification but didn't add to the concept
Wants a dramatic change in colour when signal is sent and when signal has been confirmed	Improvement - the team didn't specify the difference in colour.
No flashing lights, not too bright as well as calming colours is preferred	Improvement - this will help ensure that the device doesn't scare Fran
Vibration can not be strong enough to make the staff uncomfortable and encourage them to remove the portable unit	Improvement - the team didn't consider the staff's mental state.
Has no difficulty distinguishing colours from each other	Neutral - this provided clarification but did not change the design.
Side dresser is fairly big, no size constraints.	Neutral - This provided clarification but did not change the design.
If the main unit is small enough in size, it can be mounted on to the bed, as a solution for the mic.	Important Note - this created a new alternative for the mic option in case an external mic is expensive.
They suggested that the device be triggered based on noise level in the case that there are troubles distinguishing "hey" and "help" from other noise.	Important Note - the team has been given a new fallback option

Table 4: List of Improvements

1.3. Key Features

There are a number of features in the design ranging from the device shape to its power source, however, the key features are the following:

→ The two devices work independently of any other device; thus, the user doesn't need an app or device in order to utilize the NiCa Bell.

→ The two devices communicate via Wi-Fi; thus, it can be utilized in large buildings such as hospitals or care homes. This means that so long as there is a stable internet connection the devices can be used, therefore the connectivity limitations found in devices utilizing Bluetooth or radio are not an issue.

→ The main unit features a large LED on top, this light is used to notify the user about the status of their signal. For example, once they call for help and the signal is successfully sent to the portable unit the large LED will turn yellow, indicating that that signal was sent. Once the individual with the portable unit hits the "OK" button, the large LED will turn green letting the user know that a staff member has seen the signal and are on their way.

→ The large LED is positioned in such a manner, that the light from the device will be projected on to the ceiling, making it visible to the user from multiple angles.

→ The main unit also features an external mic; thus, its main body can be placed on the bedside and the mics position can be adjusted depending on what position works best for the user. This feature makes it more accessible to the clients as it can be easily adapted to each person.

→ The main unit is small in size. Adding on to the previous point, the main unit's sizes makes it so that even though it is a full device, finding a spot for it to sit is very easy. It is also lightweight making wall mounting it a possibility.

→ The portable unit features an "OK" button. This button is used to send a signal back to the main unit to indicate that the signal was received by a staff member. This makes sure that the user is aware of what is happening at all times.

→ The portable unit will not stop buzzing after the "OK" button has been pushed. The button only exists to notify the individual using the main unit, it does not stop the portable unit from buzzing.

- → If the “HERE” button on the main unit hasn’t been pressed for a given amount of time, the buzzing on the main unit will increase in intensity. After each minute the main unit’s “HERE” button hasn’t been pressed the vibrating motor will increase in intensity. Once the vibrating motor has been maxed out, a sound will begin to play, this sound will also increase in intensity.
- → Having the portable unit vibrate as its initial notification mode makes it so that only the user is notified. If the portable unit user is in a crowded room the others in the room will not be disturbed.
- → The portable unit has an indented power/reset button. This way the device can’t be accidently turned off or ignored.

All in all, the NiCa Bell is a system specifically built to fulfil the client’s needs. It is discreet, effective and simple to use. This system can be utilized in large buildings such as care homes, hospitals and retirement homes. Furthermore, due to the design’s simplicity and cost effectiveness it can also be utilized in anyone’s home.

2. Software

The goal of the software is to communicate between the 2 pi zero devices through Wi-Fi. The main device listens for audio for a set amount of time and runs the resultant file through a speech to text software. Should any key words be recognized, a message is sent to the portable device to trigger the "neglect function". This function activates the speaker on the device to notify the staff of the client requiring help. The portable device then waits to receive a confirm signal, sent only by the main device when the confirm button on it is pressed.

2.1. Features and Functionality

On the teams MakerRepo, the code (main.py and portable.py) is included. The code used to run on start-up will not be explained, as it was taken from online sources directly.

The functions:

Main.py

Startup

Args: None

Return: None

This function is called upon running the file. It calls the record and connect functions in separate threads and initiates the power led.

Record

Args: None

Return: None

This function is usually run in a separate thread from the main. At its current settings, it records 5 seconds of audio using any device 0 on card 1. This function then calls the recognize function and may

use the send function based on the returned value. The filteraudio function is called to verify this return value. If the return is true, then the led on the top will be turned on as well. This function then loops, overwriting the previous audio file each time.

Recognize

Args: “location”:string

Return: “res”:string

This function takes the location of the recorded audio file and returns the resultant recognized speech in English as a string. If the filetype of the audio file does not match the required type of the speech recognition function (flac), then the translate function is called to convert it.

Translate

Args: “location”:string, “ftype”:string

Return: “ret”:string

This function takes the location of a file to translate, and the file's original file type. It checks to ensure that there is no file of the same name but in flac type. If this is confirmed false, a converted file is created of the proper type and its location is returned.

Filteraudio

Args: “audio”:string

Return: “ret”:string

This function takes a string and returns True if designated keywords are within.

Send

Args: “Message”:byte

Return: None

This function takes a message in its encoded form and sends the message across a designated ip/port.

Connect

Args: None

Return: None

This function is usually run in a separate thread from the main. In an infinite while loop, the function attempts to connect to a designated ip/port. If the connection is successful, then the communication led is turned on. This function attempts this connection every 15 seconds. If a message is received from the designated ip/port, then message_recieved is called with the decoded message.

Message_recieved

Args: “msg”:string

Return: None

This function takes a string, msg, and performs an action based on the text. If “staff pressed” is received, then the communication led is flashed.

Confirm

Args: None

Return: None

This function is called upon the confirm button being pressed. Send function is then called to stop the portable device’s neglect function.

Power

Args: None

Return: None

This function is called upon the power button being pressed. Connect function is stopped and shutdown is sent to the command line. Pressing the button again will use the wake function between pins 5 and 6 to turn back on.

Portable.py

Held

Args: None

Return: None

This function is called upon the reset button being pressed. It calls the restart function.

Restart

Args: None

Return: None

This function disconnects the ssh connection to the main device and restarts the python program.

Startup

Args: None

Return: None

This function is called when the program is run. It calls for the connect function in a separate thread, which is necessary to ensure the buttons function properly.

Connect

Args: None

Return: None

This function is usually run in a separate thread from the main. In an infinite while loop, the function attempts to connect to a designated ip/port. If the connection is successful, then the communication led is turned on. This function attempts this connection every 15 seconds. If a message is received from the designated ip/port, then message_recieved is called with the decoded message.

Message_recieved

Args: “msg”:string

Return: None

This function takes a string, msg, and performs an action based on the text. If “help required” is received, then the neglect function is called in a separate thread. If “main unit received” is received then the neglect function is stopped through a global variable, and timer values are reset.

Neglect

Args: None

Return: None

This function is called by the message_recieved function. Inside a while loop, the function uses a counter to track the number of seconds occurred since the function call. At specific counter values, different sounds are played.

Confirm

Args: None

Return: None

This function is called upon the confirm button being pressed. It calls the send function with the message “staff press”.

Send

Args: “Message”:byte

Return: None

This function takes a message in its encoded form and sends the message across a designated ip/port.

2.2. Design and Coding Instructions

Setting up The Pi

This first part includes necessary steps to take before being able to run the software provided. Running the pi directly is much more convenient but requires a couple pieces of hardware to run. Otherwise, one can do all of this through sshing into the pi and making changes that way. This won’t be explained as the group had the required hardware. The following explains how to set up both pi’s for usage.

Generic pi setup equipment and instructions:

- pi
- computer
- power supply for pi
- sd card
- usb sd card reader

From this link: https://www.raspberrypi.org/software/ download the raspberry pi imager onto the computer. Install it and plug in the card reader with the sd card in it. Under “raspberry pi other”, install the version “raspberry pi os full” onto the sd card. Once that’s finished, remove the usb and move the sd card to the raspberry pi.

Physical setup required equipment:

- monitor
- mini hdmi to hdmi cable
- mini usb to usb cable
- usb cable hub
- mouse and keyboard

Physical setup instructions:

Connect power, hdmi, and mouse+keyboard (via the usb hub). Go through the setup screens and update when asked (May take 1 or more hours).

Installing necessary software

Inside the command line, the following commands should be run to install the required software for the code to run. On the 16gb sd card the team used, there were some issues (Crash at x% downloaded) with the SpeechRecognition cache size so “pip install SpeechRecognition --no-cache-dir” was used instead.

Run each of the following lines separately and only once the installation has been completed.

python -m pip install pydub

apt-get install flac

pip install SpeechRecognition

pip install pathlib

Other setup steps

For enabling ssh: In the Pi menu, go to preferences->raspberry pi configuration->interfaces and switch ssh to enabled.

For getting the pi's ip address: open command line and type "hostname -I". Mark down the values in the form ___.___.___.___ ex: 192.168.0.144. These values will be used many times later on in the document.

For getting microphone card/device number: open command line and type "arecord -l". If the card and device numbers are not 1 and 0 respectively, then changes will have to be made to the source code as explained below.

Running the code

The code can be downloaded from here: makerepo. To run the code the ips must have been properly set up for the Wi-Fi. The group used ssh to run both programs from one computer to ease the process. This was done by opening 2 command lines, doing "ssh pi@192.168.0.___" for each pi ip, and running "python main.py/portable.py" in the command line for the respective devices ("python main.py" being for the main unit and likewise for the portable unit). If it was found that the microphone card/device number did not match, then at this point open the main.py file ("sudo nano main.py") and make the following change:

Line 35:

subprocess.call(['arecord', '--device=plughw:1,0', '-d', '5', '-f','S16_LE', '-r' ,'44100','-c1'

,filename],shell=False)

-> With X and Y being the microphones card/device numbers.

subprocess.call(['arecord', '--device=plughw:X,Y', '-d', '5', '-f','S16_LE', '-r' ,'44100','-c1'

,filename],shell=False)

Running the code on start-up was done using this method: https://howchoo.com/g/mwnlytk3zmm/how-to-add-a-power-button-to-your-raspberry-pi

However, using the method described to run on start-up, should be done at the user's discretion. Improperly performing this type of functionality could potentially brick one's device. For that reason, the methodology is not explained in this document to prevent misguiding the user.

3. Hardware

3.1. Features and Functionality

Main Unit

The main unit has a reset button in the top right corner and a large red confirm button that when pressed makes the portable unit stop buzzing. It also has 2 LEDs one is for power the other is for connection. The main unit has an external microphone that can be attached to the client's bed frame. It has a removable bottom that allows for the changing of components if necessary. The main unit is plugged into a simple wall outlet.

Portable Unit

The portable unit has a power button in the top right corner and a large red confirm button that when pressed. Like the main unit the portable unit has 2 LEDs one is for power and the other is for internet connection. The portable unit is powered by an external battery bank.

3.2. Build Instructions

Main Unit

The development of the main unit began with the design in OnShape the original dimensions of the main unit were 3'x2'x3' those were later expanded to 4'x3'x4' in order to fit the electrical components. For the circuits in the main unit, you will need 2 perfboards one is 3.1’x0.8’ the other is 1.6’x2.4’. The 1.6’x2.4’ one will have 3 LEDs soldered in parallel with each LED being in series with a 150-ohm resistor, this is the top LED. The other perfboard will have 2 LEDs wired on separate circuits each LED should be in series with a 150-ohm resistor it also has a button wired on it. Follow **Figure 1** for connecting the circuits, the pi grounds can be connected to any of the ground pins on the pi.

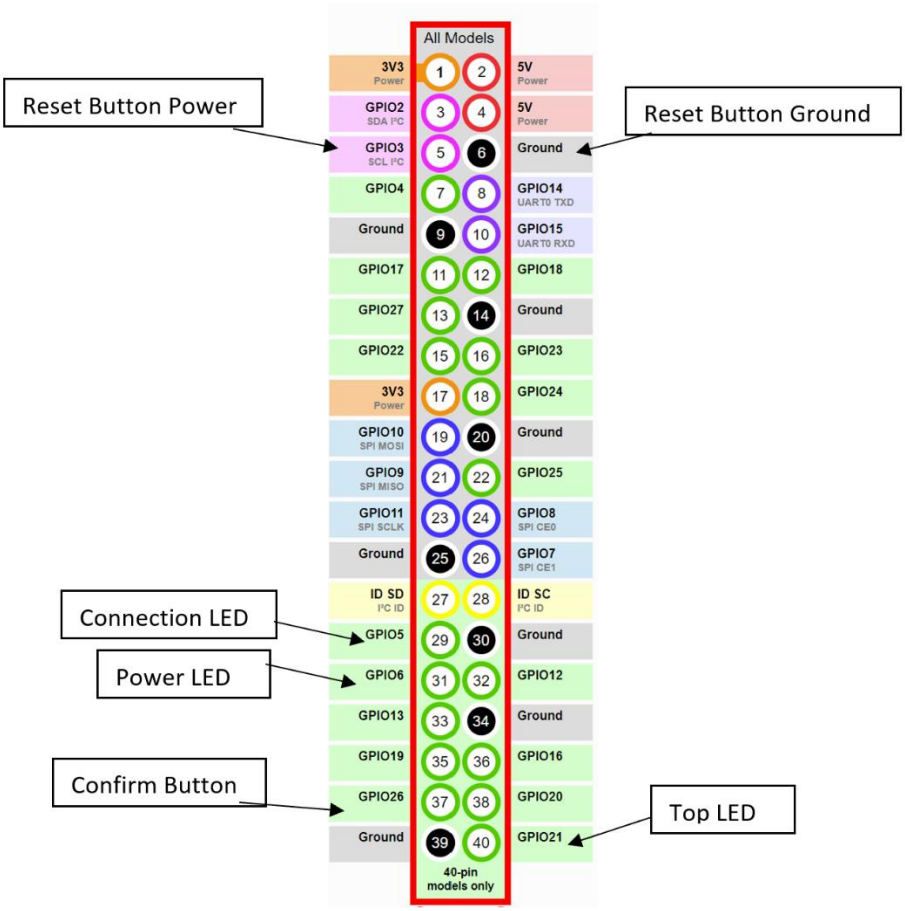

Figure 1: Main Unit Pi Pin Locations

The top LED should be attached to the 3D-printed casing using clear epoxy. In order to mount it you should epoxy one side of the perfboard apply pressure to that side for 10 minutes while blowing with a fan and then let sit for 24 hours to fully cure. The other perfboard should be attached to the side using epoxy. In order to mount, put the LEDs in the holes and epoxy around them and apply pressure for 10 minutes while blowing with a fan and then allow 24 hours to cure. Attach the red cap of the button using super glue. Attach the reset button in the top corner using super glue.

Portable Unit

The development of the portable unit began with the design in OnShape the original dimensions of the main unit were 3'x2'x1' those were later expanded to 4'x3'x1.5' in order to fit the electrical components. For the circuits in the portable unit, you will need a perfboard 3.1'x0.8'. On this board there will be 2 LEDs on separate circuits, a button, and a speaker. Follow **Figure 2** for the pin locations on the Pi and **Figure 3** for the motor controller, grounds can be attached to any ground pin on the pi.

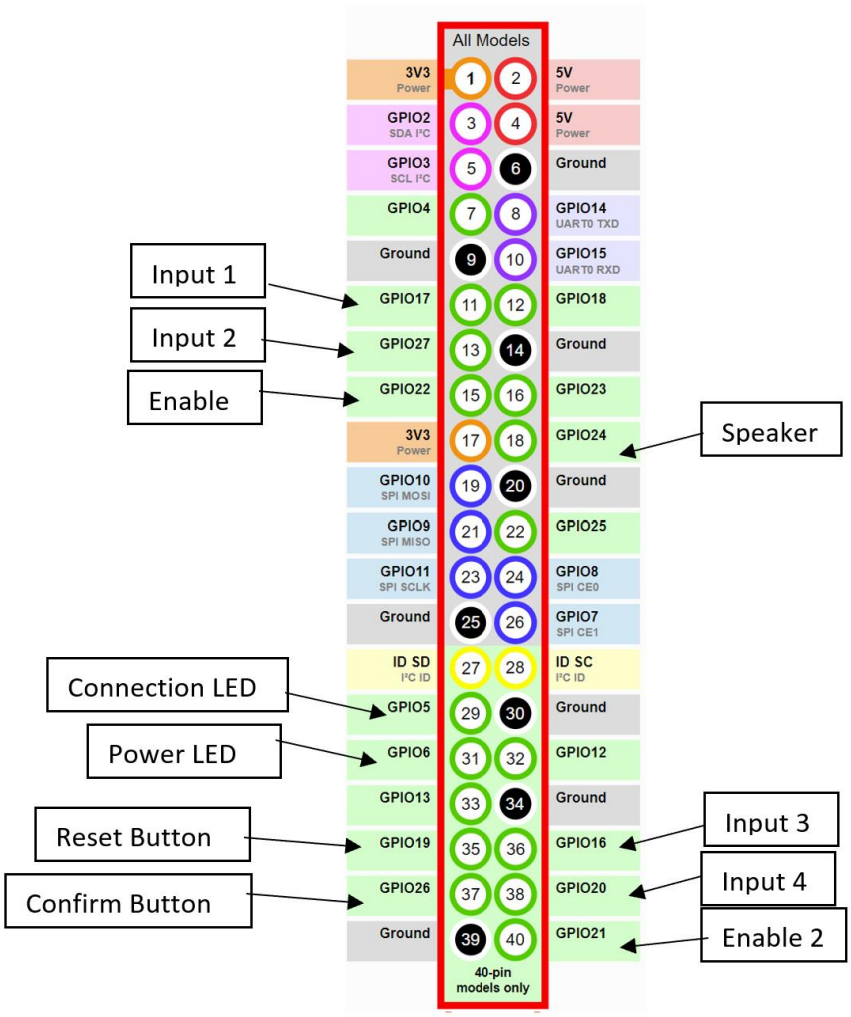

Figure 2: Portable Unit Pi Pin Locations

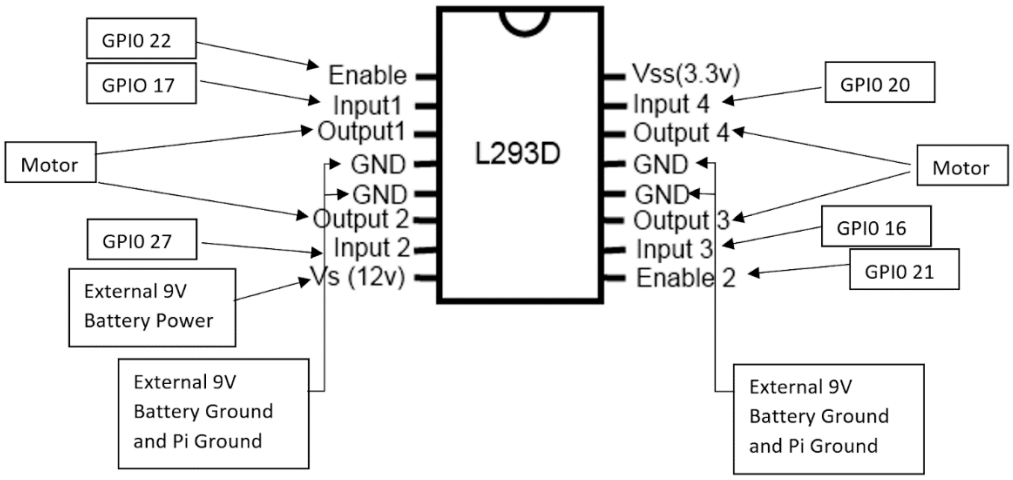

Figure 3: Motor Controller Pin Locations

The perfboard should be attached to the side using epoxy. In order to mount epoxy around the speaker and put the LEDs in the holes and epoxy around then allow 24 hours for the epoxy to cure. Attach the red cap of the button using super glue. Attach the reset button in the top corner using super glue.

Maintenance

Portable Unit

Ensure that the portable unit's battery is charged.

2 Health and Safety

Mission Statement

Team A2 is committed to protecting the health, and safety of their employees, customers The team recognize that by integrating health, and safety management practices into all aspects of their business, the team can offer technologically innovative products and services. Team A2 strives for continuous improvement in their health and safety management systems and in the quality of their products, processes, and services.

Guiding Principles

The team meets or exceed all applicable health and safety requirements for CSA C22.1. They maintain the safety for thier products to meet the standards every three years when updates are needed. The product is also certified by CCPSA as seen with the other labels on the product that contain the ISED certification number, HVIN and PMN.

Safety Precautions

- When Handling the product keep in mind any open wires or loose components as it's dangerous to use a broken product make sure its unplugged at all times. If this happens call The NiCa Bell support line or use their website to contact them.
- The product can survive a drop from waist height, but the team doesn't recommend dropping or moving the product too much as it may damage internal wiring and or the external shell.
- The team also doesn't recommend putting the device near any water as if it spills it will short circuit the Pi zero board.

Team A2 strives to create products that are safe in their intended use, throughout the product life cycle including design, manufacture, use, and end-of-life management.

3 Trouble Shooting

Turning the device ON or OFF:

→ Press and release the ON button to turn on the device. If the device does not turn ON, check if the battery is properly connected.

→ Press and release the OFF button to turn off the device.

Installing and replacing the battery:

→ Please remove the isolation sheet from the battery contact before first use.

→ To replace the battery, open the battery case on the back of the device.

→ Take out the used battery and install a new by putting one side of the battery in the compartment and then pressing down the other side.

→ In the situation where the device is not responding to the commands, please the following steps:

→ If the device is not working properly, turn the device OFF for a few seconds and then turn it back ON. Allow it to reset properly.

→ If the device does not turn ON, make sure the battery is properly connected and fully charged.

→ If the device does not turn OFF, remove the battery, and let the device cool down before reusing it.

→ If the microphone is not working, make sure it is plugged in correctly.

Note: Keep the device in a ventilated area to prevent the heating up of the device.

4 Design Files

Deliverable	Description	Location
A	Team Contract, Client Meeting Preparation and Project Management Skeleton	MakerRepo
B	Needs, Problem Statement, Metrics, Benchmarking and Target Specifications	
C	Conceptual Design and Project Plan	
D	Detailed Design and Prototype 1 and BOM	
E	Project Progress Presentation	
F	Business Model	
G	Prototype 2 and Customer Feedback	
H	Economics Report and 1-Minute Video	
I	Design Day and Final Prototype	
J	User Manual	
K	Final Project Presentations	
L	Intellectual Property	

Table 5: Table of Deliverables and Location

File Name	Description	Location
main.py	Python file/code for main unit	MakerRepo
portable.py	Python file/code for portable unit	

Table 6: Table of Other Design Files

5 Future Recommendations and Conclusion

Future Recommendations:

Although the design shown here in this document is the latest iteration produced by the team, it is the furthest from the last. Due to the current circumstances with COVID-19 there were limitations to both what and the quality of what the team could produce and so following are a list of future recommendations or improvements:

- → Replacing the rechargeable battery pack with a different power supply.
- → Adjust component sizes in the portable unit to make it smaller.
- → A more compatible mic.
- → Replace the raspberry pi zeros with a more versatile and powerful board.
- → Higher RAM to run the code faster.
- → Pink coloured case for both units.
- → Replace the speech to text if the pi cannot be upgraded enough to run the given speech to text fast enough.
- → If the pi has been upgraded, upgrade the python version so that more socket functions are available. Then, add socket.gethostbyname functionality so the ip no longer has to manually be adjusted.
- → Modify filteraudio function so that it can function with any keywords given.

Conclusion

Team A2 has learned a lot while designing and producing The NiCa Bell, furthermore, working digitally whilst in a pandemic has taught them invaluable skills. By working digitally, they learned the importance of planning ahead and really allowing room for failure. With COVID-19 there were shipping issues with receiving components in time for their second prototype. This taught them to be more

versatile with their production, they pivoted their production in order to progress in the software portion even if the development of the hardware had to be paused. The team also learned the importance of comprehensive team meetings, as each meeting would often orient them for the week to come. All in all, despite their struggles Team A2 was able to create a functioning system of devices that can effectively demonstrate their design to the client. The NiCa Bell is a system which is discreet, easy to use, voice activated and versatile, thus, effectively fulfilling the client's needs.

6 Bibliography

[1] "Cerebral Palsy," [Online]. Available: https://braininstitute.ca/research-data-sharing/cerebral-palsy#:~:text=More%20than%2034%2C000%20people%20in%20Ontario%20live%20with%20cerebral%20palsy, common%20childhood%2Donset%20physical%20disability..

[2] "ACCESSIBILITY LEGISLATION IN ONTARIO," [Online]. Available: https://accessibilityconsultants.ca/resources/legislation#:~:text=Disability%20impacts%20the%20lives%20of, That's%20one%20in%20seven%20people..

[3] "Long-term care homes in Canada: How many and who owns them?," 19 November 2020. [Online]. Available: https://www.cihi.ca/en/long-term-care-homes-in-canada-how-many-and-who-owns-them.

[4] "Electronic Product Regulations in Canada: An Overview," Compliance Gate, 2020 June 2020. [Online]. Available: https://www.compliancegate.com/electronic-product-regulations-canada/. [Accessed December 2020].

Appendix A: Important Tables

Bill of Materials

Retailer	Item name & description	Cost per Unit (CAD$)	Number of Items	Total Cost (CAD$)
Makerstore	Microphone	9.00	1	9.00
Alessandro	Vibrating Motor	Free	2	Free
Makerstore	PCB Mount Mini Speaker	4.00	1	4.00
Ethan	Battery Connector	0	1	0
Makerstore	LEDs	0.60	5	3.00
Makerstore	Protoboard	--	1	--
Walmart	Batteries (9V)	4.98	1	4.98
Makerstore	Resistors	--	3	--
CanaKit	Raspberry Pi Zero W board	12.95	1	12.95

CanaKit	Raspberry Pi Zero W Kit	32.95	1	32.95
CanaKit	Sd card	9.00	1	9.00
Makerstore	Buttons (Tactile button switch)	5.00	3	14
	Total Cost			**89.88**

Table 7: Bill of Materials

Tests and Results

Test Number	**Test Conditions**	**Test Results**
1	The main unit does not connect to the server.	If the main unit does not connect to the server, then, based on the pseudocode: the unit will attempt to connect three times, if the problem persists, then, the large indicator on the unit will turn red and the small indicators will flash red. Therefore, it passes the test.
2	Both units connect to the server, but for some reason a signal can't be sent to the portable unit.	If the signal isn't sent to the portable unit, the main unit will then attempt to send it a max of three more times. If the problem persists then the main unit will check to see if the unit is still connected to the server. If not, then turn the large indicator red and the small indicator a flashing red. Therefore, it passes the test.
3	The main unit successfully sends a signal to the portable unit, but the vibration keeps increasing and doesn't stop.	If the vibrations keep increasing and do not stop, the current model doesn't account for this, i.e., there is no fail safe as far as the software is concerned. (there is a reset button on the portable device itself, but that doesn't apply here) Therefore, it fails the test.

Table 8: Prototype Test Results

Decibels	Google	Python
30	100%	75%
40	100%	75%
50	100%	100%
60	100%	100%
70	100%	100%

Table 9: Protype 1 Speech to Text Test Results

Appendix B: Project Plan

ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1			**Initiation**					
2			PD A: Team Contract	5 days	Wed 20-09-09	Tue 20-09-15		Alessandro
3			**Planning**					
4			Setting Project Scope & Goals	4 days	Wed 20-09-16	Sun 20-09-20		Ayesha
5			Budget	21 days	Sun 20-09-20	Fri 20-10-16		Aunonto
6			Communication plan	12 days	Wed 20-09-16	Thu 20-10-01		Ethan
7			Risk Management plan	12 days	Thu 20-10-01	Fri 20-10-16		Dieudonne
8			Project plan (PD A & PD C)	16 days	Wed 20-09-09	Wed 20-09-30		Alessandro
9			**Execution**					
10			PD A: Client Meeting preperation	5 days	Wed 20-09-09	Tue 20-09-15		Ayesha
11			Client meet 1	1 day	Tue 20-09-22	Tue 20-09-22		Aunonto
12			**PD B**	**0 days**	**Thu 20-09-24**	**Thu 20-09-24**	**2**	**Ethan**
13			Needs identification and metri	1 day	Wed 20-09-23	Wed 20-09-23	11	Dieudonne
14			Benchmarikng and specificatio	1 day	Wed 20-09-23	Wed 20-09-23		Alessandro
15			**PD C**	**1 day?**	**Thu 20-10-01**	**Thu 20-10-01**	**12**	**Ayesha**
16			Introduction	1 day	Wed 20-09-30	Wed 20-09-30		Aunonto
17			Project Plan Update	4 days	Fri 20-09-25	Wed 20-09-30		Alessandro
18			Conceptual design	4 days	Fri 20-09-25	Wed 20-09-30		Ayesha
19			Feasibility Study	4 days	Fri 20-09-25	Wed 20-09-30		Ethan
20			Lifelong Learning	4 days	Fri 20-09-25	Wed 20-09-30		Dieudonne
21			Conclusion	1 day	Wed 20-09-30	Wed 20-09-30		
22			Client meet 2	1 day	Tue 20-10-06	Tue 20-10-06		Alessandro
23			**PD D**	**1 day?**	**Thu 20-10-08**	**Thu 20-10-08**		**Ayesha**
24			Project Plan Update	1 day	Tue 20-10-06	Tue 20-10-06		Alessandro
25			Summarize Client Feedback and Critical Product	1 day	Tue 20-10-06	Tue 20-10-06		Aunonto
26			Bill of Materials	1 day	Tue 20-10-06	Tue 20-10-06		Dieudonne
27			Introduction	1 day	Tue 20-10-06	Tue 20-10-06		Ethan
28			Conclusion	1 day	Tue 20-10-06	Tue 20-10-06		Ayesha
29			Detailed design	0.5 days	Fri 20-10-02	Fri 20-10-02		Aunonto
30			**Prototype 1**	**3.5 days?**	**Fri 20-10-02**	**Wed 20-10-07**	**29**	

Page 1

Figure 4: Final Project Plan Pt.1

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
31		**Software**	**3.5 days?**	**Fri 20-10-02**	**Wed 20-10-07**		
32		Wifi Module	2 days	Fri 20-10-02	Mon 20-10-05		Ethan
33		Messaging Module	2 days	Fri 20-10-02	Mon 20-10-05		Ayesha
34		Speech to Text Module	2 days	Fri 20-10-02	Mon 20-10-05		Aunonto
35		**Housings**	**3 days?**	**Fri 20-10-02**	**Tue 20-10-06**		
36		Main Unit	1.5 days	Fri 20-10-02	Mon 20-10-05		Alessandro
37		Portable Unit	1.5 days	Mon 20-10-05	Tue 20-10-06		Alessandro
38		Testing	1 day	Wed 20-10-07	Wed 20-10-07	30,31,32,33,34,35	Ayesha
39		**PD E: Project progress presentati**	**1 day**	**Thu 20-10-15**	**Thu 20-10-15**		**Ethan**
40		Project Plan Summary	0.2 days	Fri 20-10-09	Fri 20-10-09		Alessandro
41		Client Feedback Summary	0.5 days	Fri 20-10-09	Fri 20-10-09		Aunonto
42		Summarize Previous Deliverabl	1 day	Mon 20-10-12	Mon 20-10-12		Ayesha
43		**PD F: Buissness Model**	**1 day**	**Thu 20-10-22**	**Thu 20-10-22**		
44		Choosing Our Buisness Model	0.2 days	Fri 20-10-16	Fri 20-10-16		Ethan
45		Creating Buisness Canvas	1 day	Mon 20-10-19	Mon 20-10-19		Dieudonne
46		Update Project Plan	0.5 days	Tue 20-10-20	Tue 20-10-20		Alessandro
47		Client meet 3	1 day	Thu 20-10-01	Fri 20-10-02		Dieudonne
48		**PD G**	**1 day?**	**Thu 20-11-05**	**Thu 20-11-05**	**23**	**Alessandro**
49		Summarize Client Feedback	0.5 days	Mon 20-10-05	Mon 20-10-05	47	Ethan
50		Based on Client Feedbak Develop a New Dessign	0.5 days	Fri 20-10-30	Fri 20-10-30	49	Alessandro
51		Project Plan Update	1 day	Tue 20-11-03	Tue 20-11-03		Alessandro
52		**Prototype 2**	**4 days?**	**Fri 20-10-30**	**Wed 20-11-04**	**38,50**	
53		**Software**	**10 days**	**Mon 20-10-19**	Fri 20-10-30		
54		Wifi Module	5 days	**Mon 20-10-19**	Fri 20-10-23		Ethan
55		Messaging Module	4 days	**Mon 20-10-19**	Thu 20-10-22		Ayesha
56		Speech to Text Module	4 days	Mon 20-10-26	Thu 20-10-29		Aunonto
57		**Hardware**	**10 days**	**Mon 20-10-19**	Fri 20-10-30		
58		Electronics	6 days	Fri 20-10-23	Fri 20-10-30		Alessandro
59		**Housings**	**4 days**	**Fri 20-10-23**	**Wed 20-10-28**		
60		Update Housing Design	1 day	Fri 20-10-23	Fri 20-10-23		Dieudonne

Page 2

Figure 5: Final Project Plan Pt.2

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
61		Manufacturing	3 days	Mon 20-10-26	Wed 20-10-28	60	Alessandro
62		Testing	1 day	Wed 20-11-04	Wed 20-11-04	52,53,57	Dieudonne
63		**PD I**	**1 day**	**Thu 20-12-03**	**Thu 20-12-03**	**48**	**Alessandro**
64		Design Day Pitch	2 days	Tue 20-12-01	Wed 20-12-02		Alessandro
65		Project Plan Update	1 day	Mon 20-11-30	Mon 20-11-30		Alessandro
66		**Final prototype**	**19 days**	**Fri 20-11-06**	**Wed 20-12-02**	**62**	**Ayesha**
67		Sub-task related to final prot	10 days	Thu 20-11-05	Wed 20-11-18		Aunonto
68		Sub-task related to final prot	10 days	Wed 20-10-21	Tue 20-11-03		Ethan
69		Design day	1 day	Thu 20-12-03	Thu 20-12-03		Dieudonne
70		**Monitoring and Control**					
71		**Project objectives**	**61 days**	**Thu 20-09-17**	**Thu 20-12-10**		Dieudonne
85		**Quality of Deliverables**	**61 days**	**Thu 20-09-17**	**Thu 20-12-10**		Ayesha
99		**Project performance and cost**	**61 days**	**Thu 20-09-17**	**Thu 20-12-10**		Ethan
114		**Schedule Status**	**61 days**	**Thu 20-09-17**	**Thu 20-12-10**		Alessandro
128		**Closing**					
129		**PD J: User manual**	**0 days?**	**Thu 20-12-10**	**Thu 20-12-10**	**63**	**Alessandro**
130		Title Page, Table of Contents, List of Figures, List of Tables, Bibliography, and Appendices	1 day	Wed 20-12-09	Wed 20-12-09		Aunonto
131		Main Body	2 days	Tue 20-12-08	Wed 20-12-09		Dieudonne
132		Conclusion	1 day	Tue 20-12-08	Tue 20-12-08		Ayesha
133		Introduction	1 day	Tue 20-12-08	Tue 20-12-08		Ethan
134		**PD K: Final Presentation**	**0 days?**	**Wed 20-12-30**	**Wed 20-12-30**	**129**	**Aunonto**
135		Design Choices	1 day	Fri 20-12-11	Fri 20-12-11		Alessandro
136		Trials and Tribulations	1 day	Fri 20-12-11	Fri 20-12-11		Ethan
137		Project Summary	1 day	Fri 20-12-11	Fri 20-12-11		Ayesha
138							
139							
140							
141		AYESHA's TEST					

Page 3

Figure 6: Final Project Plan Pt.3