Project Deliverable G: **Prototype 2**

GNG 2101 – Intro. to Product Dev. and Mgmt. for Engineers

Faculty of Engineering – University of Ottawa

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Objective:
Define the design solution you intend to present on Design Day and develop new prototypes on
your way to creating your final product.

1. Summarize the client feedback that you received during your third client meeting for your first product prototype and clearly state what needs to be changed or improved in your design.

During our Third client meeting, we presented our first voice controller prototype to our client Bocar. We tried to demonstrate to him how the voice remote would work. Specifically, how using the voice recognition API software installed in the microcontroller is able to pick up any voice from the microphone connected.During our demonstration, the usb microphone that we are using was not very effective in picking up any voice and had connectivity (hardware) issues with the microcontroller. As a result,Bocar advised us that for the voice remote to work smoother and to pick voice better, our group should acquire a better quality microphone..He also advised us that we should also try to test the voice remote with other voice recognition software.

Therefore what needs to change in our prototype design, is using a higher quality and bigger microphone such that it has good compatibility with the microcontroller and still have good reception distance with the user's voice.

We need to try to use a different voice recognition software to test the microphone and lastly to successfully integrate all the other components together, the IR receiver/transmitter with the microcontroller. Finally ,to ease the integration of the components, a new casing will be required.

2. Based on the feedback, develop a second prototype (or more) which will help you on your way to creating your final product.

The second prototype will be able to control the tv with the keywords developed.It will consist of the following added and removed components:
Added:

- Professional Cardioid Condenser Microphone With Tripod Stand
- 38KHz IR Infrared Control Expansion Board Transceiver Receiver Transmitter Shield
- 3D printed casing with roof removed.

Removed:

- Canakit Case for raspberry Pi
- Usb microphone.

This new prototype will have the IR transceiver shield attached on top of the microcontroller pins and will be placed inside a new case with no lid on top compared to the canakit case. This is important because the current canakit case top and middle pieces do not provide room for the transceiver schield to be connected to the microcontroller.Secondly, the usb microphone will be replaced with the condenser microphone which will provide a better accuracy, range and compatibility with the microcontroller.

3. Document your latest prototype(s) using as many sketches/diagrams/pictures as required and explain the purpose and function of your prototype(s).

The first prototype that we built was related to the voice recognition of the project, we were able to train the software and the prototype was able to recognize the keywords that were spoken to the microphone, however we were having many issues with the USB microphone because it did not have very high sensitivity and so the user had to speak very close to it.

For the second prototype our goal was to being able to control the TV with keywords, in order to do that we needed to build the IR receiving/transmitting module and integrate it to the product.
We also wanted the second prototype to have a better quality microphone. Bellow we will explain and show the steps taken to achieve the goal for the second prototype.

Figure 1 displays the first prototype built, we took this prototype and modify it and build on it. As stated before the first prototype was in charge of the voice recognition module and it did not integrate any infrared transmission signaling.

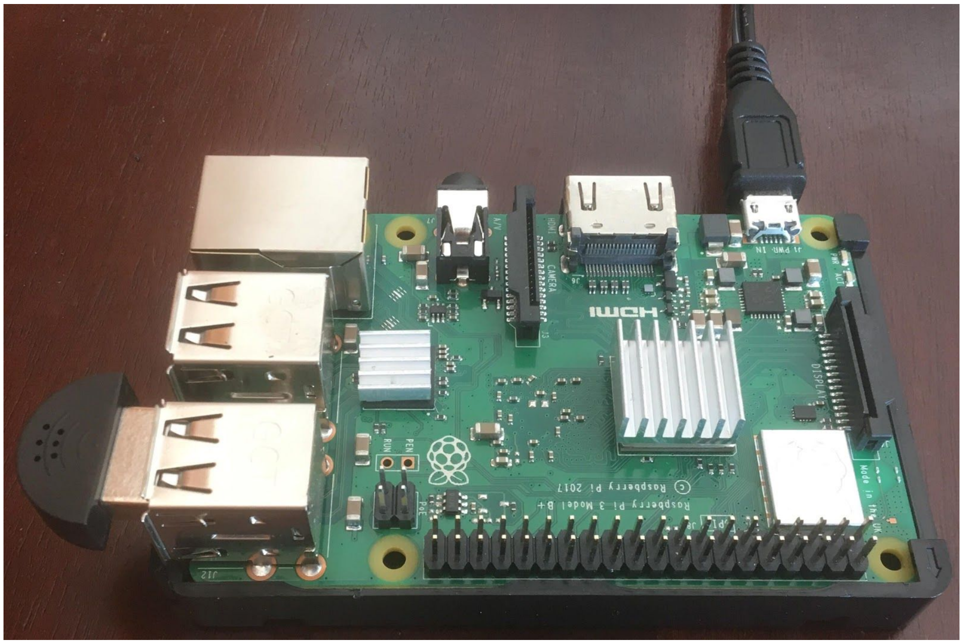

Figure 1.

<u>IR Transceiver Module</u>

We started building the circuit for the transceiver module, it was composed of a receiver (TSOP38238 38 KHZ), emitter (IR 940NM) and a transistor (PN2222TA)

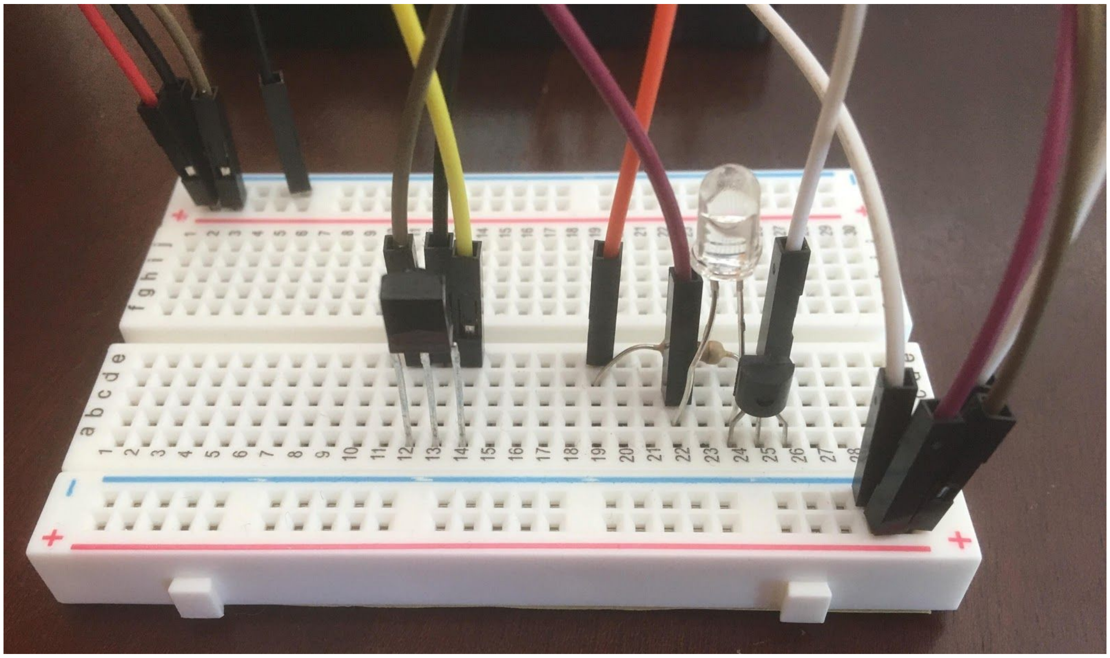

Figure 2.

The IR transceiver module is responsible for getting the TV codes and store them in memory to latter send those codes through the transmitter to control the TV.
Basically we take the remote control of the Tv we want to control and start pressing the buttons of the remote, the remote will send and IR signal to the receiver and we will get that signal and store it. After we have collected the codes for every single button of the remote we can create a .conf file with all the codes and then we will give this file to the transmitter so that it can control the TV.
Figure 3 displays the protoboard IR transceiver connected to the Raspberry pi.

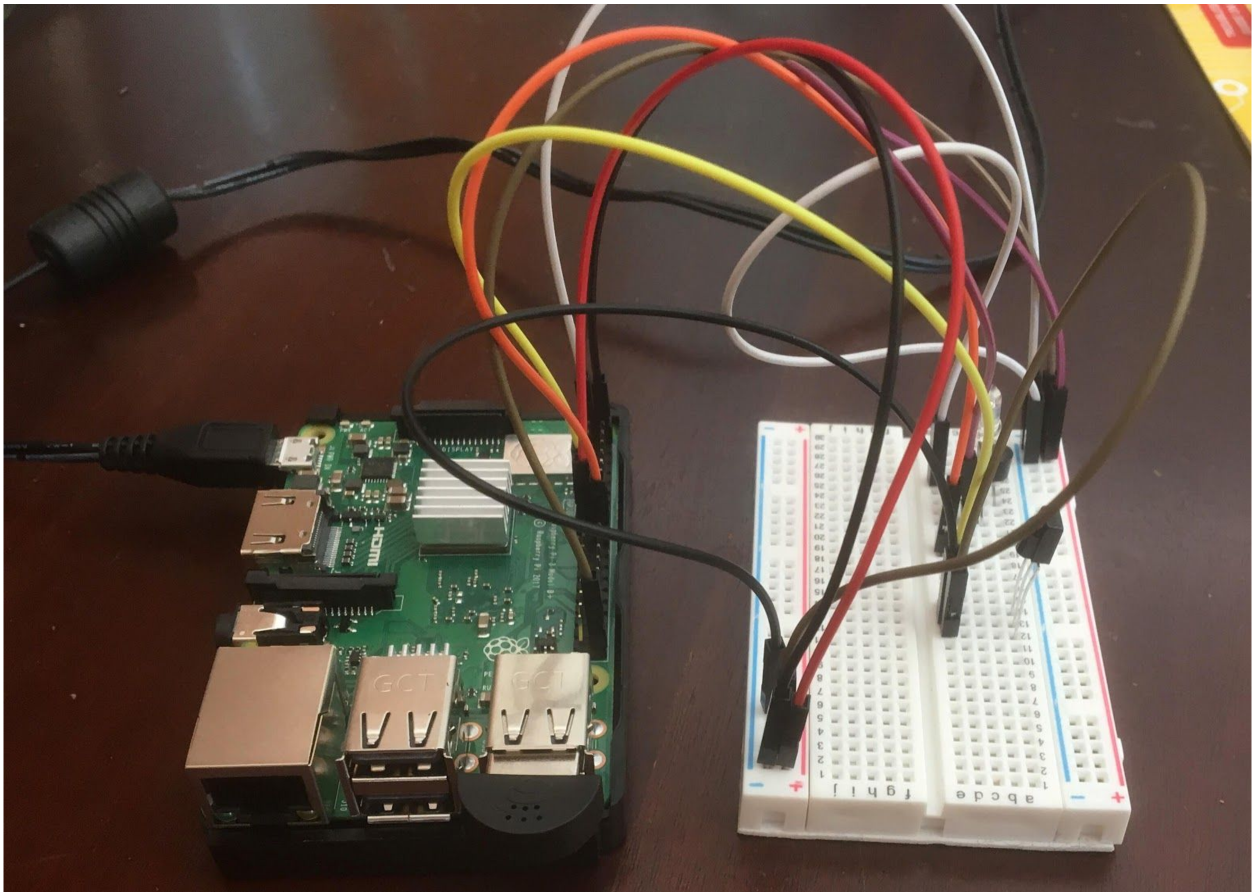

Figure 3.

We were able to control the TV from the terminal of the raspberry pi. That means that our codes were received perfectly and that the file created will work to control the TV. Since we tested our software and hardware and we were getting good results, we decided to order a transceiver board in order to replace the protoboard that we had built for testing. Figure 4 displays the IR transceiver board that we order.

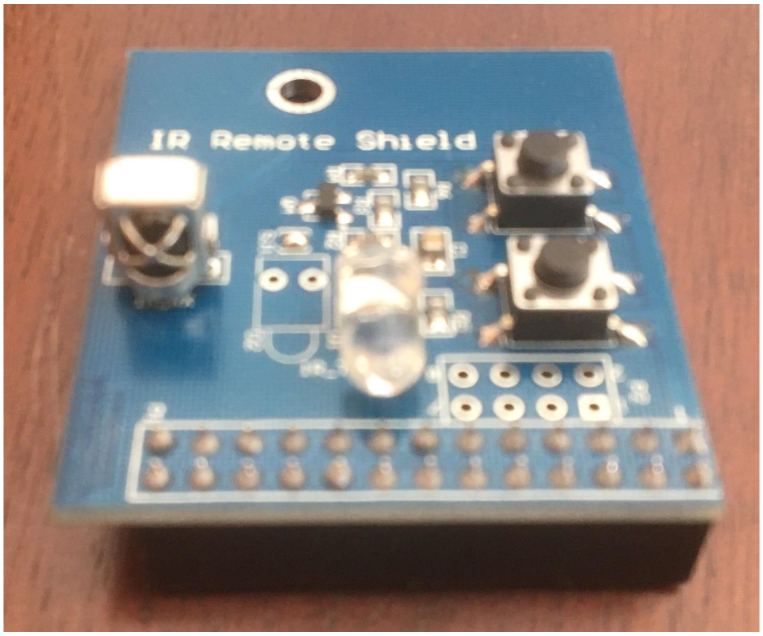

Figure 4.

We installed the Transceiver board to our raspberry pi and we tested the functionality, we got very good results and the IR transceiver module was completely done. Figure 5 displays the prototype with the transceiver board.

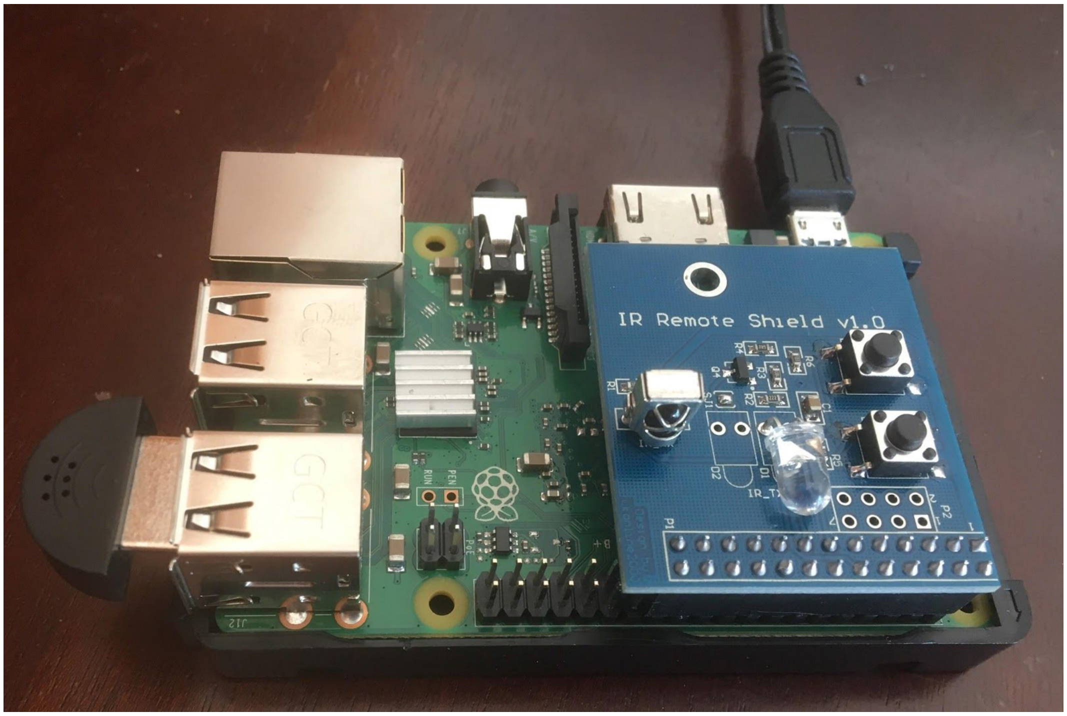

Figure 5.

The prototype displayed in Figure 5 was capable of receiving voice commands through the microphone and convert those commands into IR signals that were then sent to the TV to control it.

Professional Cardioid Condenser Microphone With Tripod Stand

The IR transceiver module of the prototype was working very well and the voice recognition system was performing at an acceptable range, however we needed to get a better performance from the voice recognition module. We ordered a better quality microphone which is displayed in Figure 6.

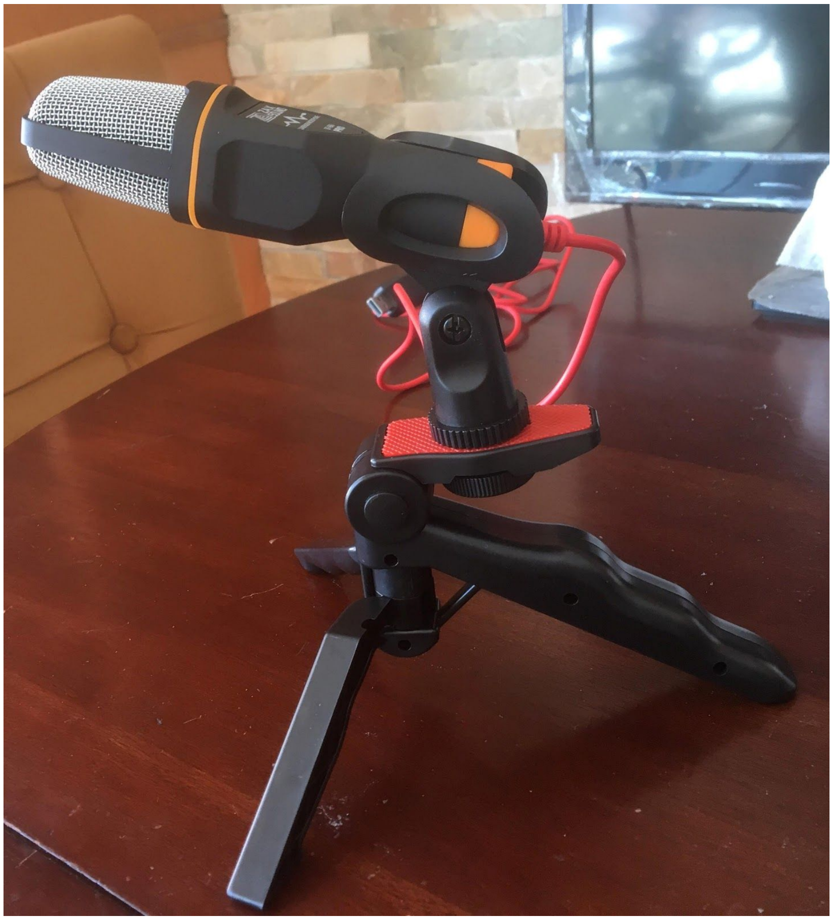

Figure 6.

We brought the new microphone and we integrated it to our raspberry pi and to the IR module. The microphone was very sensitive and so it was able to pick up little noises that would activate the voice recognition system and occasionally send signals to the TV when no command was given.

We also built a 3D casing for the raspberry pi Figure 7 displays the final prototype until now.

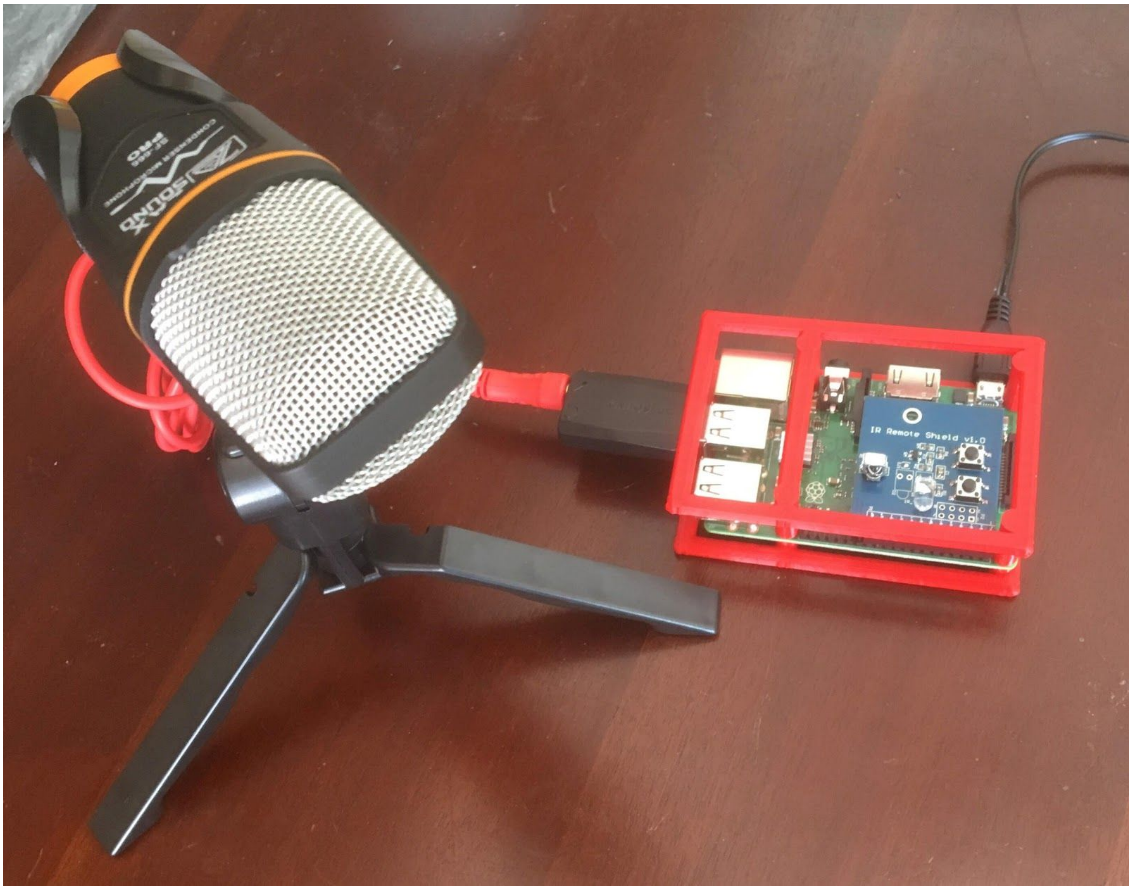

Figure 7.

We expect to have a better looking 3D case for the final prototype and we also expect to configure the microphone to its best performance. In order to achieve that, we will need to test the voice recognition in several ambients and environments.
The IR transceiver module is 100 percent done, the voice recognition need further testing and the 3D casing is under development.
As of now our prototype is able to control the TV with voice commands.

4. Carry out prototype testing, analyze and evaluate performance compared to the target specifications developed in Project Deliverable B and document all your testing results and prototype specifications. Present your testing in an organized, tabular format that shows expected versus actual results.

Target specification	Expected Result	Actual Result
Word recognition distance	6m	2-4 m
Word recognition	10 words	6 words
Ir Transmission distance	10 m	10 m
IR Receiver commands	Receiving all commands from remote control	Receiving all commands from remote control
Voice recognition with noisy ambient	80%	50%

5. Outline what your team intends to present on Design Day and how you intend on verifying that your "Solution Works Really Well"

During the Design Day we will present the our prototype in following:

- The voice recognition and the system output after the recognition
- The intense of the voice that the remote can receive
- How the voice will be transferred to signal and be transmitted to the TV
- The remote can be functional in at least 5m distance
- The remote can actually control the TV

To verify the work, if the condition is allowed, we will represent a function test during the presentation because the showing to audiences what our product can do is the best way to prove the solution work smoothly. If not, we will represent some video footages and pictures to audiences the functions that we are going to present.