GESTURE TO SPEECH WEARBLE GLOVE FOR PARALYSIS PATIENTS

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***Abstract*—The intention behind proposing this project is to help the paralyzed people ask for assistance with mere hand movement. The device proposed in this project could convert hand gestures to voice commands and also notify the caretakers who are some distance away when the patient is in need. This project is a novel idea because there is no room for error since they are hard coded messages. The patients may or may not be speech impaired. The target audience is the people with Paralysis and needs to bring the attention of the caretakers whenever they are not nearby. The proposed project promises high reliability and speed.**

***Index Terms*—paralyzed, hand gesture, voice commands, patients**

I. Introduction

Paralysis is a loss of strength in and control over a muscle or group of muscles in a part of the body. Most of the time, this is not due to a problem with the muscles themselves. It is more likely due to a problem somewhere along the chain of nerve cells that runs from the body part to your brain and back again. These nerve cells deliver the signals for your muscles to move. Gesture recognition is the process by which gestures made by the user are used to convey the information. In everyday life, physical gestures are a powerful means of communication for a paralyzed person. A set of physical gestures may compose an entire language, as in sign languages. They can efficiently convey a rich set of facts and feelings. This project makes the modest suggestion that gesture-based input is such a beneficial technique to convey information.

The novelty of our project is in the fact that our proposed system is a hybrid of the previously quoted techniques. It has simplicity and definite results. This device helps paralysis patients. Due to paralysis, patients are not able to move their body parts, and also it is very difficult for them to talk with other people for their need for help. When in need, hand movements will pass on the information to the caretakers. Hence our project will help them to convey their messages to doctors or family members. This project is the solution to the problem because the message is conveyed with the least effort of the finger movement. This project can also be extended for an instance of an emergency. Here we propose a smart speaking system that helps them in conveying the message to regular people using hand motions or gestures.

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II. Methodology

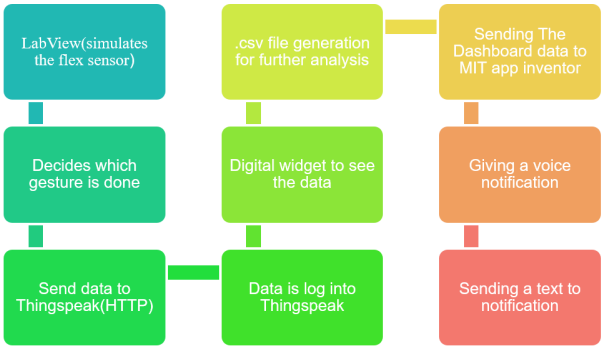


Fig. 1. Block Diagram

III. Working

FLEX SENSOR is a variable resistor whose terminal resistance increases when the sensor is bent. So this sensor resistance increases depending on surface linearity. So it is usually used to sense the changes in linearity

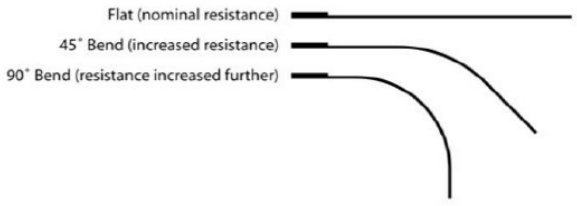


Fig. 2. Different Linearity with flex sensor

As shown above figure, when the surface of FLEX SENSOR is completely linear it will be having its nominal resistance.

When it is bent 45º angle the FLEX SENSOR resistance increases to twice as before. And when the bent is 90º the resistance could go as high as four times the nominal resistance. In this project the usual voltage divider is simulated using a case structure , taking into consideration only 3 angles (0,45,90).

A. LABVIEW

LabVIEW is a framework plan stage and development environment for a visual programming language. Instead of using a Voltage divider in the hardware, the software substitute is summation. According to the Sensor Datasheet 45KOhms and 90º is encoded to be 125KOhms.

Fig. 3. a) The gesture to ask for food. B) The gesture to ask for medicines c) The gesture to ask to go out d) The gesture to ask to use the restroom e) The gesture for an emergency

In this project, we initially simulate the five flex sensors for all the fingers in LabVIEW. In this software, we have given the input controls as angle values. We have done this project currently for five gest little and thumb fingers are at 90 and 45. The second gesture is for “Medicines” when the ring and thumb fingers are at 90 and 45. The third gesture is for the “Restroom” when the middle and thumb fingers are at 90 and 45. The fourth gesture is for “To go out” when the index and thumb fingers are at 90 and 45. The fifth gesture is for “Emergency” when the thumb is at 90 while all other fingers are at 0. The data is sent at the rate of 1 data point per second. We have coded the LabVIEW block diagram and sent the data to Thingspeak using the HTTP protocol.

B. Thingspeak

IoT application platform that offers a wide variety of analysis, monitoring and counter action capabilities is ‘ThingSpeak’. ThingSpeak is a platform providing various services exclusively targeted for building IoT applications. It offers the capabilities of real time data

collection, visualizing the collected data in the form of charts, ability to create plugins and apps for collaborating with web services, social network and other APIs. The data reaches the ThingSpeak Channel. Here there is a Digital Numeric Widget that shows the last passed on value. The .csv file is also generated from the Channel. This can be used for the further usage to train a Machine Learning Model.

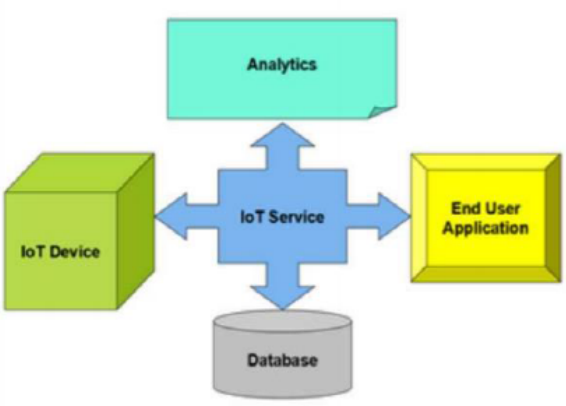


Fig. 4. The ThingSpeak architechture

C. MIT App Invertor

MIT App Inventor is an intuitive, visual programming environment that allows everyone to build fully functional apps for smartphones and tablets The data is sent from the ThingSpeak Channel to the MIT App Inventor. The IOT Dashboard is displayed to the App using a WebView. The TextToSpeech Module is used to give an Audio Output. This is implemented into the project because it requires an immediate reaction. Text messages may go unnoticed , but a Voice Message with high pitch and repetition is hard to miss. Texting MIT App Inventor is used to send Text messages to a given number.

IV. Circuit and Code

A. LABVIEW

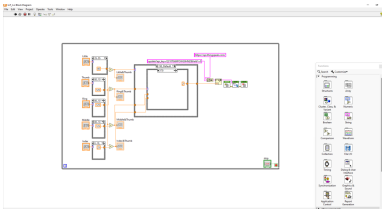
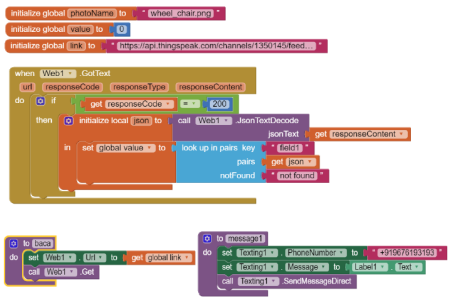
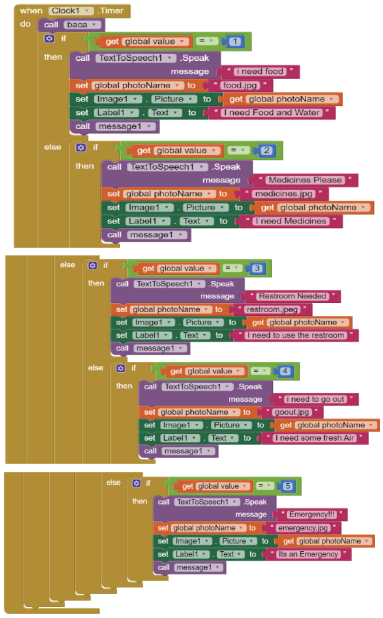


Fig. 5. LabVIEW Circuit

B. MIT App Invertor





V. Result

A. LABVIEW

For instance giving 45 in RING and 90 in THUMB, generates 150 in the combination of LITTLE and THUMB, MIDDLE and THUMB, INDEX and THUMB and 170 in the combination of RING and THUMB

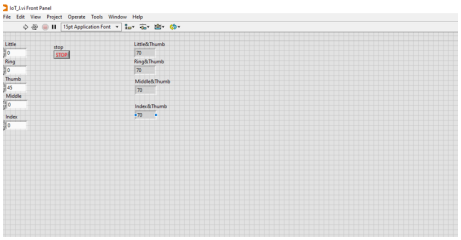


Fig. 6. The Input given to the LabVIEW in the form of degrees

This is the output in the front panel of LabVIEW. The fingers are the angle inputs that are given manually. If the project is to be done in hardware the movement of the fingers at a particular angle is taken as the input. These mapped values are summed to give a result. This resultant is again passed on to a case structure to recognize the gesture made by the user

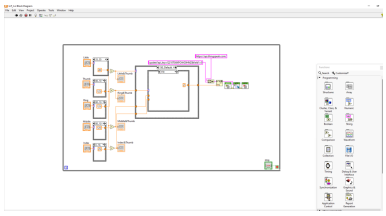


Fig. 7. The Case Structure Predicting the gesture value to be 2, since the summation of RING angle and THUMB angle is 170

This generates the value 2 in the case structure, denoting that the user needs to have his/her “Medicines”. These actions are run inside a while loop with a delay of 1 second. The latency was set to be that because in real time a person can react at least with a time difference of a second. This is sent using the HTTP Protocol to the ThingSpeak Channel.

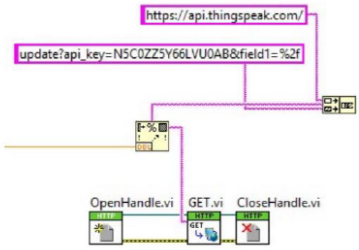


Fig. 8. The HTTP protocol in play to send the data to the respective ThingSpeak Channel

B. Thingspeak

This reaches the ThingSpeak channel and is logged into chart

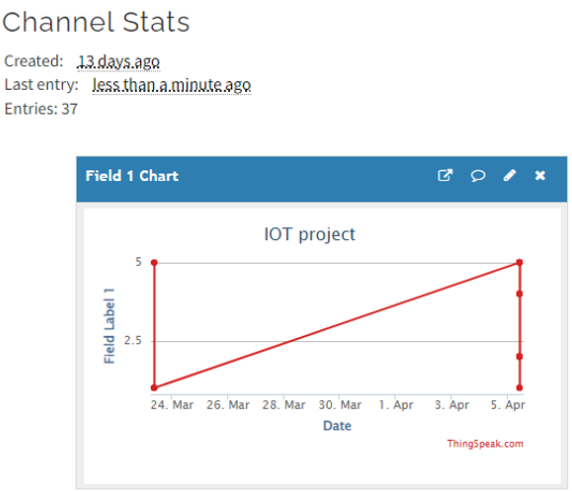


Fig. 9. Data Logging graph

From the export option, the .csv file can be downloaded in an interval. When the app is used by many users, this data comes in handy to get the.csv file to do data analysis on which action is being done frequently.

C. MIT APP INVERTOR

HOMEPAGE AND SCREENSHOTS OF THE ALERTS:

The Home Page of the App looks like this with the IOT Dashboard that is previously stored. The Outputs from the App looks like this. Here each time the dashboard gets from the App updated.

Whenever the ThingSpeak channel is updated with the gesture, this is captured by the MIT APP Inventor.

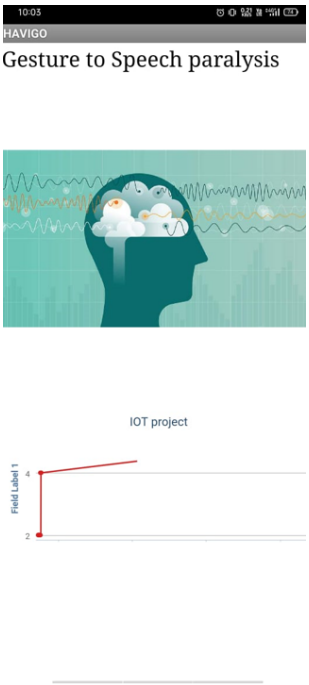


Fig. 10. Home Page of the App created using MIT App

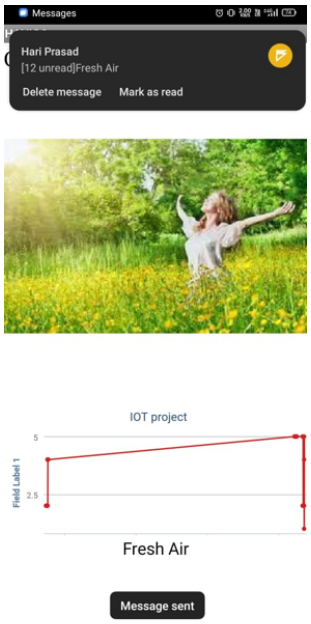


Fig. 12. Medicines alert

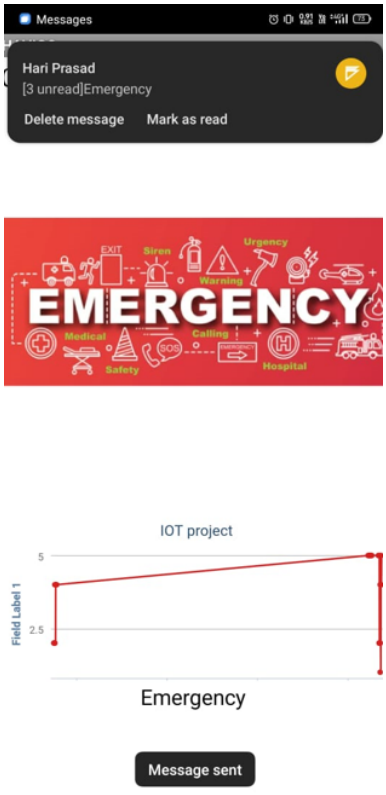


Fig. 11. Emergency Alert

Fig. 13. Need Fresh air alert

Along with the speech output, there is a message alert also sent using the Texting Module. The module has been updated by the MIT APP Inventor according to the Google Play Store rules. The message output is included into the project because the caretaker can check on it it even with the requirement of intenet connectivity. He/She can have a log of data of the requirements of the patients.

VI. Conclusions and Recommendations

ThingSpeak can allow data logging for every 15 seconds. This is an allowable latency in real time, because a need can be sent as an alert with 15 seconds of reaction time. It can be concluded that the project achieves in successfully delivering the message of a paralyzed person to a remote caretaker. This is a useful project because 0.6 percent of the Indian population alone suffers from Paralysis (Movement disorder) according to 2011 statistics [8]. This will be of great help to them as well as an additional help to Women Safety. If in danger mere movement of hand will send the emergency alert and we can also encorporate the Location data, that will be of extreme help.

Recommendation can be made to use MQTT Protocol instead of HTTP because the speed of Data Transfer. This can be converted into a hardware project using the real flex sensors with any microcontroller to give the same results. But there the angles may not be accurate as the software simulation, thus an offset of +/- 5 to 10 degrees should be set (according to the datasheet). The .csv file generated from ThingSpeak Channel can be used to apply any ML algorithm to do data analysis on the obtained information. The app being used by many users, will generate a lot of data. This can then be logged to analyse the most required action at a particular moment of time. The number of gestures is currently limited to 5, though it can be incremented to about 10, if the person to extend this project wishes to have the same hard coded outputs. Else if the person wishes to have dynamic output, then he/she needs to add an IMU sensor to get the spatial coordinates of the hand movement, and can have different movement for each alphabet. This will increase the efficiency and versatility of the current project. We will to take this up as the future work to enhance our project and publish a paper on the same.

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