MJIT 2020 Malaysian Journal of Industrial Technology

SMART DEAF-MUTE GLOVE

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Abstract

Generally, people with speech or deafness have a problem in everyday communication with others. They can only interact with Sign Language as the main way to interact with others. Moreover, only a few people understand this Sign Language and a few others do not understand it, it is very difficult for these people with disabilities to deliver the message they want to fulfil. Somepeople will interact more strongly because they have a "deaf voice" and this attitude will make them unpopular. That is the nature of their self. Thus, the gloves equipped with flex sensors that have been created to overcome the shortcomings of these deaf and dumb people. The existence of these sophisticated tools has given a little help to the dumb and deaf. Communicating with the whole world, this tool will convert Sign Language (hand gestures) that is understood by the deaf and dumb to the Common Language that everyone understands and it can be programmed with all languages in the world as a result of the cooperation of all countries to make this tool available to all corners. The exception of the flex sensor on the glove works to stream the dataaccording to the angular or degree motion of the flex sensor itself created or moved by the finger of the wearer. The flex sensor has different resistance and this depends on the amount of angle or degree to which the wearer moves, the more the finger moves the more resistance value is produced. Then, the resulting output will be converted into digital form by the microcontroller and it responds through user's phone.

Keywords: Sign Language; Gloves; Deafness; Microcontroller, Flex Sensor

1.0 INTRODUCTION

As stated by World Health Organization (WHO), Deafness can be defined as impairment or complete loss of hearing capacity and opportunities for muteness. Individuals with hearing impairments are known as survivors. The word "deaf" is used in this paper to identify people who suffer from sordidness and bravery. Communication with others is the biggest issue for deaf people. The majority of deaf people are less educated and seldom use English as a contact tool. [1]. The daring culture has significantly increased.The number is projected to be 32000 in Malaysia itself and this number is rising annually. According to the Statistics of Malaysia Welfare, as of 2014, 5,499 people with disabilities registered with a deaf handicap [2].

Statistics show that almost 3 billion mobile phones are actively connected worldwide and the number continues to rise every now and then. Cell phones are not limited to average citizens only; they are often used by people with disabilities [3].

Communication is a difficult challenge for survivors because they are alone in the group and because trust in regular people is very low. The deaf prefer to withdraw because of their status as "slow learners." Sordid and mute people are four times slower than ordinary people and do not capture a job well.

There are many disabled people in our community, some of whom are partially disabled. The partially disabled like dumb, mute, crippled in one legor hand handles their lives with difficulties. Here, contact plays a significant role in making others feel better and indulging them as an individual person. This is how the Smart Deaf-Mute Glove project is created to enable people with disabilities to live their lives as they want.

Flex Sensor plays the biggest role in this project. The handle includes flexible sensors along each finger and thumb circumference. The flex sensors produce a voltage change which varies with the bending degree [7]. The ADC channels are supplied with this flex sensor output. It processes signals and transforms the signals analog. The processed data is also forwarded to the receiver area wirelessly. In this segment the gesture is recognized and the correct output is displayed on user's phone. This project's portability is a huge advantage.

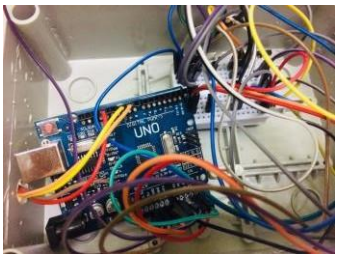
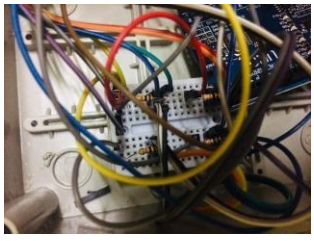
2.0 EXPERIMENTAL

System configuration refers to the configurations ofthe machine resource allocated to a specific device. By modifying these settings, many professionals will improve the system performance. All hardware devices have configuration settings that can affect the overall performance and function of the system.

A. Hardware Implementation

Table 1 below will show the implementationsof hardware and electrical parts.

Table 1: Hardware and electrical Development

Hardware Item	Electrical Development	Function
		The Arduino UNO is a microcontroller board used for this project due to its compact size and commonly used microcontroller [8].
		used to connect Arduino with phone in order to use Blynk App.
		The flex sensor or bend sensor is used in this project to measure the degree of user's bending their hand.
		The resistor is used to limits the flows of electrons through the circuit. Its only consume power and cannot generate it [9].
		The Bluetooth Module is

B. Project Flowchart

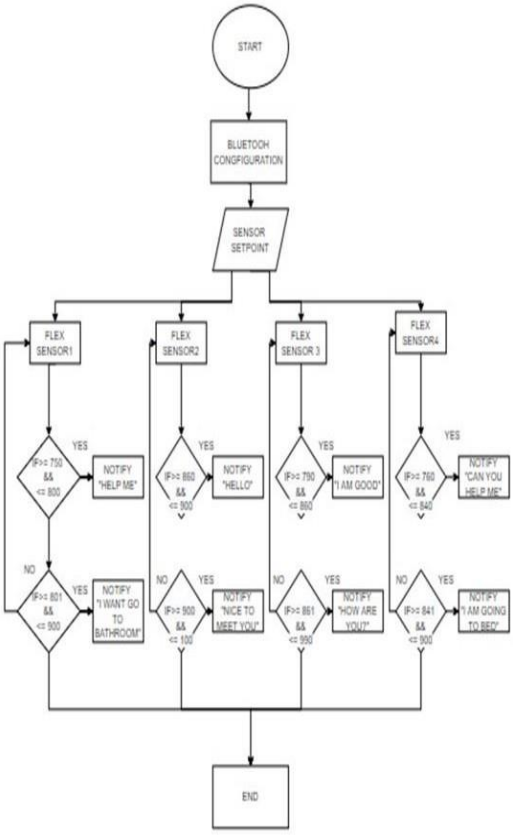


Fig 1: Project Flowchart

Fig. 1 shows the flowchart of Smart Deaf-Mute Glove. The program starts with Bluetooth configuration where user need to pair their smartphone with the system. Next, each sensor has it set point and when Flex Sensor 1 reach the bending value >= 750 <=800, a notification will pop up at user phonewith a "Help me" phrase and if the bendingvalue >= 801 <= 900, the notification will be "I want go to bathroom" phrase. Next, if user bend the second flex sensor reaching the value >= 860 <= 900, the notification will be "Hello" phrase and if the bending value >=900 <=1000, the notification will be "Nice to meet you" phrase. Moreover, if user bendthe third Flex sensor reaching bending value >= 790 <= 860, the notification will be "I am good" phrase and if the bending value is >= 861 <= 990, the notification will be "How are you" phrase. Last but not least, when user bend the fourth Flex sensor reaching the value >= 760 <= 840, the notification will be "Help me" and if the value >= 841 <= 900,the notification will be "I am going to bed" phrase. After user OFF the Bluetooth connection, the system will END.

C. Software Development

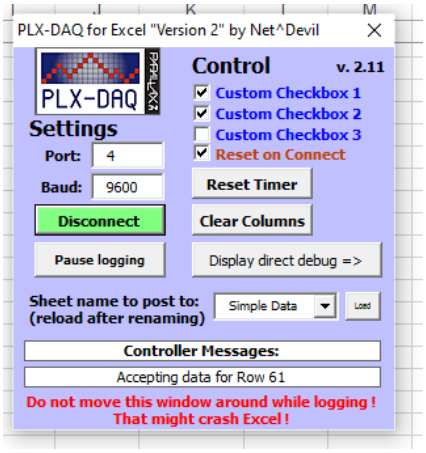
```
void loop()
{
  Blynk.run();

  value1 = analogRead(flexPin1);        //Read and save analog value from potentiometer
  Serial.print("Flexsensor1 : ");
  Serial.println(value1);//Print value
  value1 = map(value1, 700, 900, 0, 255);

  value2 = analogRead(flexPin2);        //Read and save analog value from potentiometer
  Serial.print("Flexsensor2 : ");
  Serial.println(value2);//Print value
  value2 = map(value2, 700, 900, 0, 255);//Map value 0-1023 to 0-255 (PWM)

  value3 = analogRead(flexPin3);        //Read and save analog value from potentiometer
  Serial.print("Flexsensor3 : ");
  Serial.println(value3);//Print value
  value3 = map(value3, 700, 900, 0, 255);//Map value 0-1023 to 0-255 (PWM)

  value4 = analogRead(flexPin4);        //Read and save analog value from potentiometer
  Serial.print("Flexsensor4 : ");
  Serial.println(value4);//Print value
  value4 = map(value4, 700, 900, 0, 255);//Map value 0-1023 to 0-255 (PWM)
```

Fig 2: Set Point of Flex Sensor

Fig. 2 shows one of the coding usedin this project. The coding above is a set point for each Flex Sensor. Each value of the set point was obtained from potentiometer. The value will be referring as the center valueof each sensor.

3.0 RESULTS AND DISCUSSION

This part will discuss about the result that has been achieved while completing this project. The system of Smart Deaf-Mute Glove shows that the result has been obtained by simulation from Arduino IDE and Parallax Data Acquisition PLX DAQ. It showsthe result of the project which explained on the process of the Smart Deaf-Mute Glove.



TIME	DATE	flexPin1	flexPin2	flexPin3	flexPin4)
5:40:46 PM	24/10/2020	0	0	0	Open PLX
5:40:51 PM	24/10/2020	733	823	768	739
5:40:52 PM	24/10/2020	733	823	768	739
5:40:53 PM	24/10/2020	733	823	768	739
5:40:54 PM	24/10/2020	733	823	769	739
5:40:55 PM	24/10/2020	733	823	769	739
5:40:56 PM	24/10/2020	733	823	769	739
5:40:57 PM	24/10/2020	733	823	771	739
5:40:58 PM	24/10/2020	733	823	772	739
5:40:59 PM	24/10/2020	733	823	769	739
5:41:00 PM	24/10/2020	733	823	770	739
5:41:01 PM	24/10/2020	733	823	769	739
5:41:03 PM	24/10/2020	733	823	768	740
5:41:04 PM	24/10/2020	733	823	768	739
5:41:05 PM	24/10/2020	733	823	768	739
5:41:06 PM	24/10/2020	733	823	768	739
5:41:07 PM	24/10/2020	733	823	768	739
5:41:08 PM	24/10/2020	733	823	768	739
5:41:09 PM	24/10/2020	733	823	768	739
5:41:10 PM	24/10/2020	733	823	768	739
5:41:11 PM	24/10/2020	733	823	768	739
5:41:13 PM	24/10/2020	733	823	768	739
5:41:13 PM	24/10/2020	733	823	768	740
5:41:14 PM	24/10/2020	733	823	770	739
5:41:15 PM	24/10/2020	733	823	769	739

Fig 3: PLX-DAQ in Excel

Fig. 3 above shows the data that were collected during the testing process. The PLX-DAQ is functioning in real time and then was compiled in Excel, so that it can be process easier.

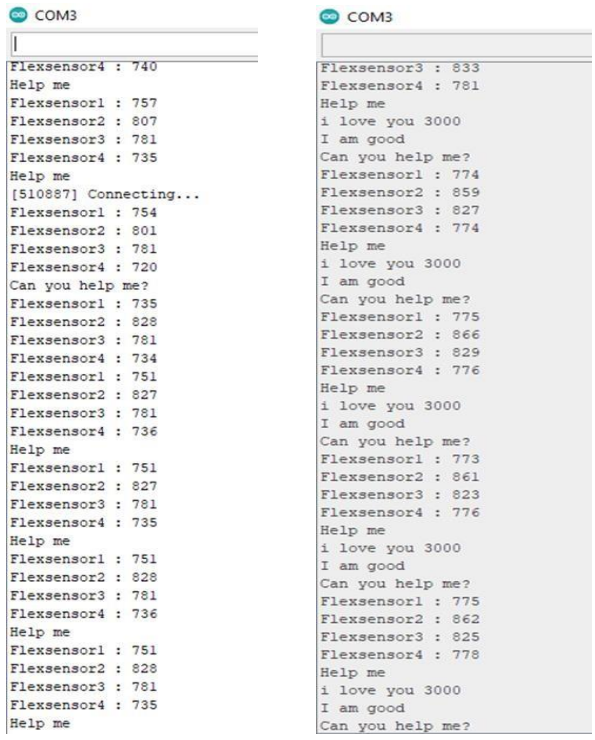


Fig 4: Serial Monitor in Arduino IDE

Fig. 4 shows the real time data gathered in serial monitor in Arduino IDE when the smart glove was tested. The serial monitor shows the bending value and the output data where it will be notifying in Blynk app.

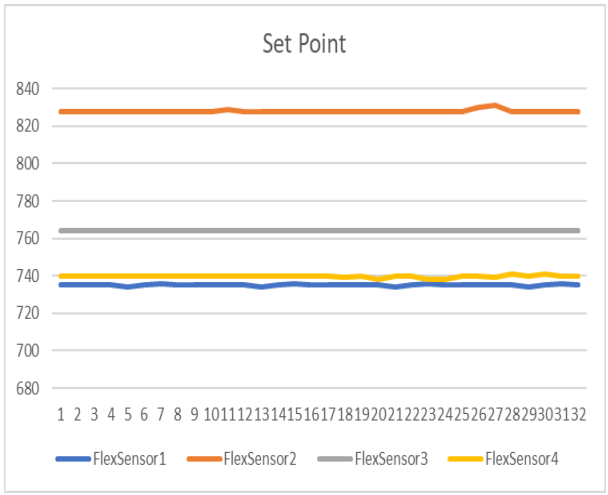


Fig 5: Set Point Value

Fig. 5 shows the graph of set point value for each flex sensor. Each value was gathered from potentiometer. Each value was considered as the center of each sensor. Hence, every flex sensor must refer to each set point in order to create command in Arduino.

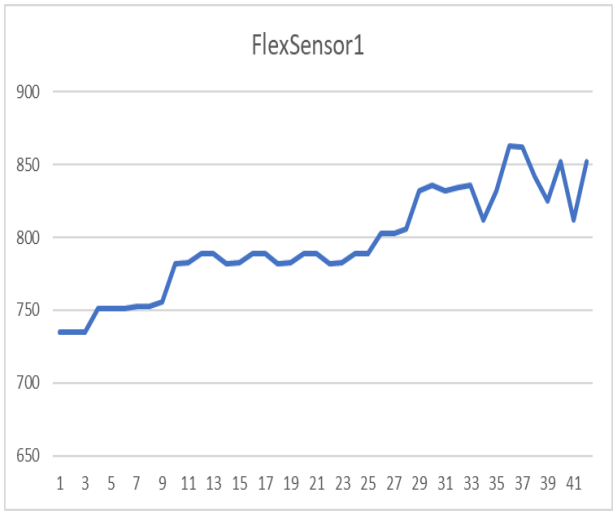


Fig 6: Graph for Flex Sensor 1

Fig. 6 shows the graph for flex sensor 1 which the range value start around 740 to 860. So that, based on the command set in Arduino which is if flex sensor pin 1 >=750 <=800, the notification will be "Help me" phrase and else if flex sensor pin 1 > 801 < 900, the notification will be "I want go to bathroom" phrase.

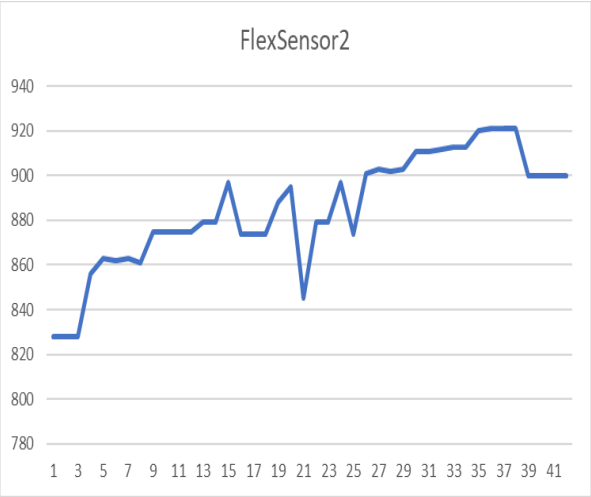


Fig 7: Graph for Flex Sensor 2

Fig. 7 shows the graph for flex sensor 2 which the range value start around 830 to 920. So that, basedon the command set in Arduino which is if flex sensorpin 2 >=860 <=900, the notification will be "Hello"phrase and else if flex sensor pin 2 > 901 < 1000, thenotification will be "Nice to meet you" phrase.

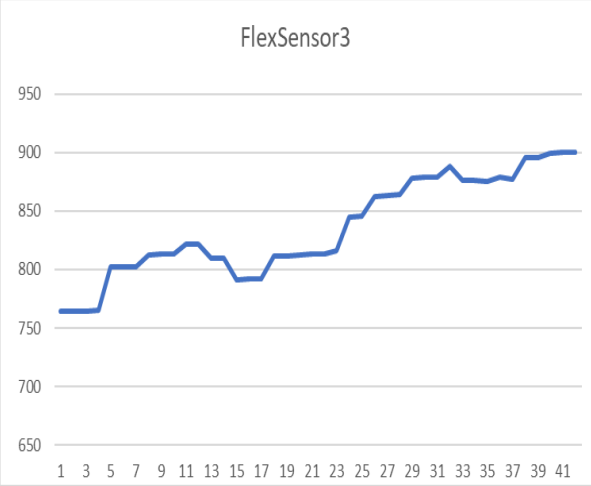


Fig 8: Graph for Flex Sensor 3

Fig. 8 shows the graph for flex sensor 3 whichthe range value start around 760 to 900. So that,based on the command set in Arduino which is if flex sensor pin 3 >=790 <=860, the notification willbe "I am good" phrase and else if flex sensor pin 3
> 861 < 990, the notification will be "How are you" phrase.

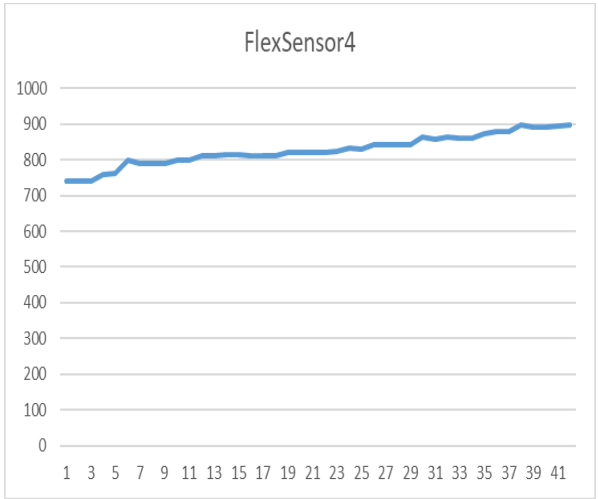


Fig 9: Graph for Flex Sesnor 4

Fig. 9 shows the graph for flex sensor 4 which the range value start around 750 to 900. So that, basedon the command set in Arduino which is if flex sensorpin 4 >=760 <=840, the notification will be "Can youhelp me" phrase and else if flex sensor pin 4 > 841 < 900, the notification will be "I am going to bed" phrase.

4.0 LIMITATION AND RECOMMENDATION

Every project has its own limitation in the process of completing the project such as the selection of hardware or components to be used. For this project, the selection parts take some times due to find the most suitable items to be used.

Besides, some difficulty faced with the flexibility of the flex sensor. This is because it is quite difficult to find the accurate midpoint value. The Bluetooth module connection also cannot be connected with IOS and only paired with Android. Lastly, overall cost of this project is quite high because the flex sensor is pricey.

Hence, for future research, the Smart Deaf-Mute Glove can be improved by adding gyro sensor which can help to stabilize the flex sensor value and get accurate value of the bending movement [6].

Moreover, the project is recommended to use ESP 8266 Wi-Fi module to replace HC-06 Bluetooth module. This is because Wi-Fi module is more reliable component due to easier connection process compared to Bluetooth and the connection is more saver because user must provide password to activate the system. Wi-Fi modules also have long range accessibility than Bluetooth modules [4].

In addition, this project could add speaker so that other people can hear the command which is a

Iot more convenient because before this the command only can be read by user's phone.

Lastly, it is recommended if this project used Lily Pad Board as the microcontroller due to its compact size and it can be sewn to fabric which suitable for glove [5].

5.0 CONCLUSION

This project was designed to help deaf and mute people in Malaysia in order to be able in communicating and interact with normal people. This is because sometimes normal people did not know and understand sign language. This project is fully functional prototype because user can where the glove and used every command that have been set. Moreover, the objectives of this project which is to develop the Smart Deaf-Mute Glove and to control the system by Bluetooth Module HC-06 were successfully achieved.

The important part of this project is the implementation of hardware and electrical components which is the flex sensor to ensure it canbe bend and produce correct value. Lastly, the Bluetooth module also play vital role to allow user control the system as demand.

Hence, for future research, this project can be upgraded to become more functional. For example, instead of using Bluetooth module, it is better to use Wi-Fi module for a better and wide coverage.

Acknowledgement

In the name of Allah, most merciful, most gracious,the Lord of the universe and prayer upon the Prophet and His Messenger who gave me chances to live and continue my studies until the last part of my degree. I feel grateful and thankful for this big opportunity in my life. I am also grateful to Allah for giving me the strength to finish my final year project on time. I would like to give all my appreciation and thank you to my family for their support in my life especially in my education background, moral support and financial support. They always give me the motivation to continue my study to degree level and successfully completing my project. I would like to thank my FYP supervisor DR REMANUL RENAN and my co-supervisor DR SITI NOR ZAWANI BINTI AHMMAD for their never-ending support and patience through guidance. They give me suggestions and guidance until I came out with this project. I would like to thank Mr. Azizan, technician of Instrumentation and Control section for his advice and help in the warehouse. I am making this project not only for the requirement needed to score Final Year Project subject but also to contribute to UniKL MITEC.

References

[1] World Health Organization (WHO), (2011) Disability: World Report on Disability.

[2] Department of Statistics Malaysia Official Portal, (2018), Statistics of Malaysia Welfare.

[3] S. O'Dea, (2020), Statista, Smartphone Users Worldwide 2016-2021

[4] Mikotaj Skawinski, (2019), Netguru, Bluetooth vs Wi-Fi Comparison for the IoT Solutions

[5] Leah Buechley, (2018), LilyPad Arduino: How an Opened Source of Hardware Kits is Sparking New Engineering and Design Communities

[6] Charles Pao, (2018), CEVA, Exploring the Application of Gyroscopes

[7] Nazrul H. Adnan, Khairunizam WAN, Shahriman A.B. SK Zaaba, Shafriza nisha, BASAH, Zuradzman M. Razlan, D. Hazry, M. Nasir Ayob, Rudzuan M. Nor, Azri A. AZIZ (2012), Measurement of the Flexible Bending Force of the Index and Middle Fingers for Virtual Interaction

[8] Ismail Sarwar, (2016), Advantages and Disadvantages of Using Arduino

[9] Kim Lewis, (2020), SCIENCING, Uses of Resistors