International Journal of Engineering & Technology, 8 (1.12) (2019) 42-46

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Glove Gesture Sensor-Based Motion for Deaf and Mute People Equip with Global Positioning System (GPS)

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Abstract

The numbers of peoples with deaf-mute disability around the worlds is exponentially increased in numbers nowadays. One of the common limitation faced by deaf-mute people is to communicate with the society. Nowadays, the medium communication that used by them is 'sign language'. However, sign language is very hard to understand and required proper training to master it. With the development of hand-gesture recognition system, a large-scale of multi device or system has been designed and developed rapidly nowadays. Direct use of the hand as input device is an attractive and easy method to develop. Besides, hand-gesture can provide a complementary modality speech for expressing one idea and communicate each other's. In this project, we propose to produce a low-cost glove-gesture based motion that can convert the hand gesture into the speech that everyone can understand. In addition, Global Positioning System (GPS) tracking will be embedded into the glove for the deaf-mute person safety and monitoring. . This project will use two main components, which are Arduino UNO and Gesture-Sensor. The circuit will be design to detect the motion from the gloves-based sensor as an input and converted into the sound or voices as an output.

Keywords: *deaf-mute, sign language, glove-based sensor, Global Positioning System (GPS), Arduino UNO.*

1. Introduction

The number of peoples with deaf and mute disability around the world is exponentially increased nowadays and most of them having difficulties to attract and communicate with the surrounding society due to some limitation. Generally, deaf and mute people are use sign language to communicate but most of the times, they will face the difficulties in communicating with others who do not understand the sign language [1]. Therefore, a translator is needed to interpret the sign language and make it understand for both parties. Without the translator or helper, deaf and mute person will not able to communicate each other's. This problem also can lead to more serious problem such as lost or accidents. Hence, this project approaches a solution to convert sign language into the speech that can be understood by the surrounding society. This project will develop a glove-based sensor that sense the motion and converted it into the voice [2]. Global Positioning System (GPS) tracking system also will be embedded into the glove for the monitoring and safety purpose. The Arduino UNO unit is the main controller of the glove-gesture system [3]. The GPS (Global Positioning System) tracker and monitor will be embedded with glove-sensor. GPS tracking will be locating the current location of the deaf and mute person in case of emergence. The current location of the deaf-mute people will be send directly to their families or friend once the deaf-mute person missing or lost. The Arduino UNO unit is the main controller of the glove-gesture system [3]. The GPS (Global Positioning System) tracker and monitor will be embedded with glove-sensor. GPS tracking will be locating the current location of the deaf and mute person in case of emergence. The current location of the deaf-mute people will be send directly to their families or friend once the deaf-mute person missing or lost. The design of the glove gesture based-motion as in Figure 1 below:

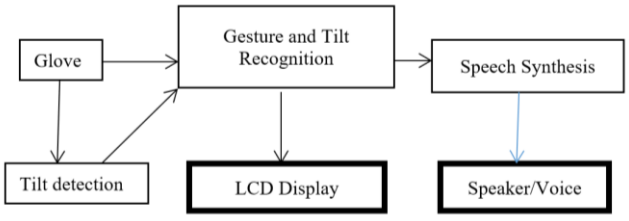

Fig. 1: Illustration of the research prototype

The Glove-sensor will be design with two types of the sensor, known as Finger Detector Sensor and Tilt Sensor. The finger-detection and tilt sensor, by the detection of the angle will be used as an input in this research [4]. Based on the proposed design glove-based gesture,

the device will work with two sensors, each of the sensors are located at people's finger the glove-sensor will detect and record the gesture of finger direction. The sensor used for the glove is known 555 timer IC the frequency, use as a detector instruction sign from gesture movement. Each of the output waveform will be separated and have own sequence signal of the module pulse output will show the result by the Arduino UNO.

2. Hand gesture recognition

Hand gesture using sign language is a different way to communicate among the deaf-mute people and sometimes, with the surrounding society. The sign language is performed by specific hand gesture. The hand gesture understanding is very important to the people with deaf-mute disabilities to prevent the communication gap between the societies [5]. The ASL sign language alphabet are as shown in Figure 2; is the international hand gesture that had been used worldwide.

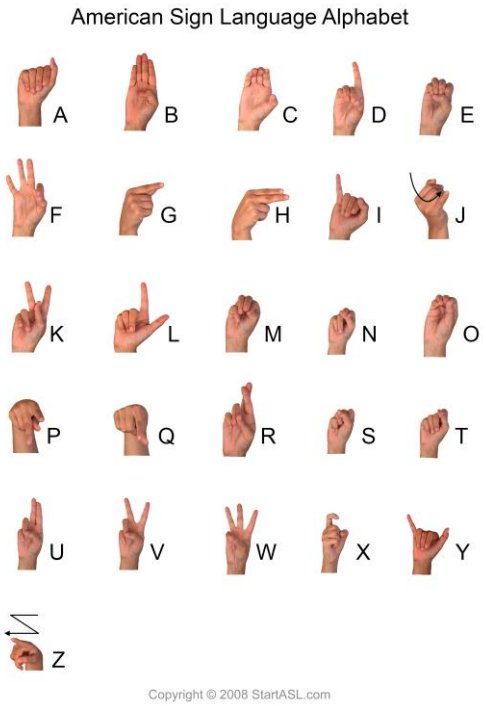

Fig. 2: ASL sign language alphabet (source: https://www.startasl.com/american-sign-language-alphabet)

Through this project we proposed to convert the hand gesture movements from sign language to the voices. In addition of that, the speech signal will be converted into the word which will be displayed in LCD screen. The tilt sensor and flex sensor will be attached to the glove's finger so that any gesture or movement will be recognised and produced the voices as the output. Besides, GPS tracking system also will be embedded into the glove-sensor to locate the location of deaf-mute people in case of an emergency. Glove-based sensor is chosen because it is relatively low-cost and we can embed the Arduino device inside the gloves itself.

3. Flex sensor to detect the gesture

Flex sensor as in Figure 3 used to detect the gesture position of the finger bend. The detection will be based on measurement of electrical current of resistance that will be converted into digital signal [7]. The components will work with two planes known as value fixed; which will be considered as (X-Y plane). The waveform signal produced from the finger flex sensor will convert the Direct Current (DC) 5V into digital signal. When the angle of the finger bend is around 40 degrees, the resistance value and the voltage will be increased. The increased in the voltage will be detected by Arduino UNO programme that can be converted into the speech or voices.

Fig. 3: Flex sensor

Recognition glove gesture method based on this technique also had been developed to produce the voice in real time [8]. The system on that sensor will be executed into superfast data with bend-sensor that can detect the gesture into many directions. The systems will be classified into two types of gesture which are static, dynamic, rotation or bend position. This gesture will be detected by signal recogni-

tion. The concept of gloves-based sensor using high-tech interface technology also had been introduced [8]. Wi-Fi signal is used to automatically converted the data receive to the devices to recognize the gesture. Each of the output waveform has their own sequence signal of the module pulse which depended on bending of the gloves. The concept about gesture glove using advances technology Bluetooth had been introduced [9]. The gesture detection based on pending position also had been introduced by using magnetic coil as the sensor [10]. The sensor can detect the angle of the bending with different degree such as 0°, 45° and 90°. The sensor works through the magnetic flux produces by the amount of coil interface. The changes in the waveform signal will be detected by the Arduino and produces the output.

4. GPS for location tracking text font of entire document

GPS stands for Global Positioning System used mainly for location tracking. The basic project of the GPS tracking is by using Android Operating System [11]. Due to disability of the deaf-mute people, they somethings will lead to accident or emergency situation. We proposed to embedded the GPS tracking inside the glove-based sensor to prevent any accident happens due to malfunctions of the device itself. The input of GPS tracking can be use by using a GPS receiver which is an additional hardware integrated in most of mobile equipment. The basic diagram of the GPS tracking system proposed as shown in Figure 4 below.

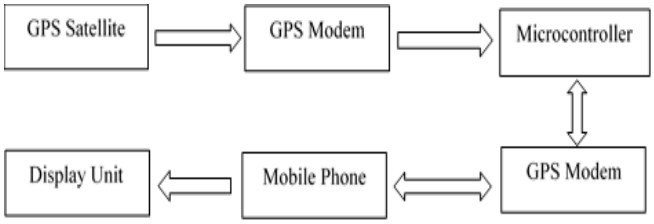

Fig. 4: Basic diagram of GPS tracking system

5. Flow chart and methodology of the project

The proposed flow of the research as per Figure 5 below:

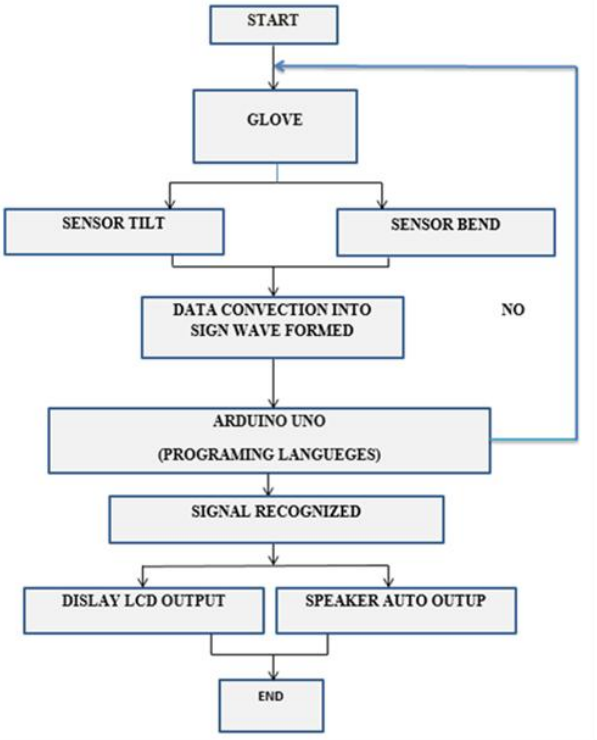

Fig. 5: Proposed flow chart of the research

The methodology of the project basically divided into four (4) parts; designing of gloves based sensor, data detection from the gloves gesture, data language programming and signal recognition. The sensor embedded into the gloves will be design to be position at finger to detect the minimum gesture received. The Arduino UNO will be programme to detect the signal from the sensor tilt and sensor bend. Then, after the signal is recognized the speaker will have produced the speech and LCD display will produce the text.

5.1. Glove sensor design

The glove-based sensor design as Figure 6 below. The sensor tilt and sensor bend will be embedded inside the gloves to detect the hand gesture.

Fig 6: Gloves-based sensor design

5.2. Gloves-based sensor circuit design

The Arduino UNO will be used as the main components with tilt sensor, Accelerometer and Flex Sensor to detect the gesture motion of the gloves. The circuit design for flex sensor as per Figure 7 below.

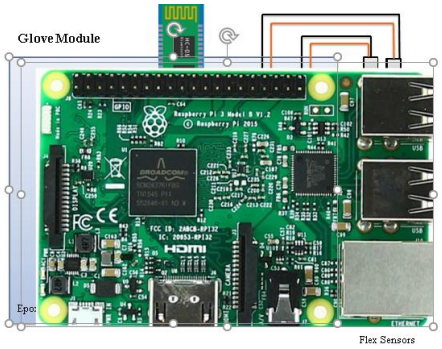

Fig. 7: Circuit for flex sensor

The detected sign language is then interpreted by the Arduino UNO and the appropriate command is delivered through the Speaker (Audio) and LCD Display (Text). The design of the circuit as in Figure 8. Furthermore, a GPS tracker will be embedded into the gloves to easily locate the current location of the deaf-mute person in case of an emergency. The circuit design as in Figure 9.

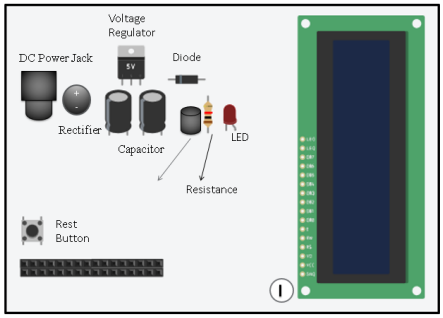

Fig. 8: Components for speaker (audio) and LCD display (text)

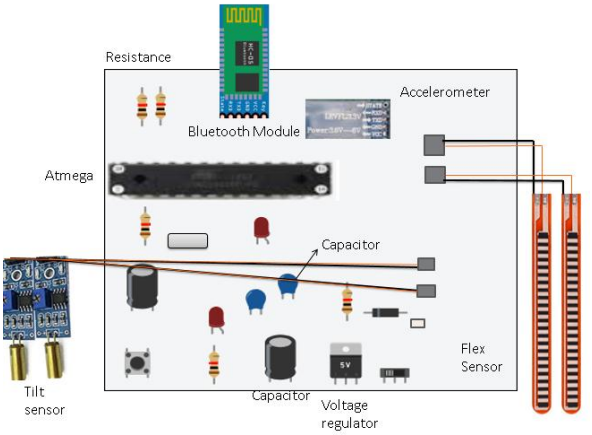

Fig. 9: Circuit for GPS tracker

6. Conclusion

Gloves-based sensor can represent one of the most important effort to improve the communication between deaf-mute people with the normal people. This project generally aims to convert the hand-gesture through sign language to the speech that can be understand by the society. Besides, this technology can improve the confident level for the deaf-mute people and they will not depend on the others in their daily lives. The GPS Tracking added into glove-based sensor to increase the safety of the deaf-mute people in case emergency or devices failure. Glove-based sensor is chosen because it is relatively low-cost and we can embed the Arduino device inside the gloves itself.

Acknowledgement

My heartiest gratitude to my esteemed Dean (Prof. Ir Dr. Leong Wai Yie) and Deputy Deans (Assoc. Prof. Khairul Salleh Bin Baharudin & Assoc. Prof. Dr. Sean Tan Koon Tatt), Faculty of Engineering and Information Technology and MAHSA University for their utmost support, advice, continuous supervision and guidance throughout this project development from the very first day.

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