GESTURE-BASED SMART HAND GLOVES FOR DISABLED PERSONS

M. Teja Sai Chand[1], D. Dilip Kumar[2], E. Sai Koushik[3], L.V.R Chaitanya Prasad[4]

[1-3]Student, Department of ECE, Sreenidhi Institute of Science and Technology, Hyderabad, India
[4]Assistant Professor, Department of ECE, Sreenidhi Institute of Science and Technology, Hyderabad, India

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Abstract - *Smart Hand Gloves help disabled persons to live with normal people. Because a deaf or paralyzed person cannot communicate, these smart gloves allow him to turn his hand gestures into text and pre-recorded audio. This also helps a normal person to understand what he is trying to say and reply accordingly. These Smart Gloves can manage home appliances, allowing a physically disabled person to live independently. The project major purpose is to generate create dependable, easy-to-use, and lightweight smart hand gloves that will remove the barrier to easy communication with others easily. We have used Arduino Leonardo in this project and used the flex sensors to detect hand movements of the person and then the data from sensors are analyzed in the Arduino and then the corresponding speech output is emitted through the speaker and also the message gets displayed on the LCD screen connected to the Arduino. In case of any Emergency, separate gestures can be used by the person so that their family members get alert messages using GSM Module and immediate action can be taken.*

***Key Words*: Arduino Leonardo, LCD Screen, GSM Module, Speaker, Hand gloves.**

1.INTRODUCTION

In our life, we meet many disabled people, some of them are partially and some of them are completely disabled. People who are partially disabled, such as the deaf and dumb, paralysis in one leg or hand lead their life with struggles and make them feel separate from others. Here communication plays a major role in making them feel better and indulging them in an activity where they may say themselves as an independent person. The concept Smart Hand Gloves for Impaired People was born from this idea, allowing disabled people to live their lives .

Flex Sensors are an important component of this research. Flex sensors run the length of each finger, including the thumb, giving the glove a total of five fingers. The flex sensors' voltage output is in the form of voltage fluctuations that vary with the degree of bend. This flex sensor output is sent to the Arduino microcontroller ADC channels. It converts the analog signal to digital signals and also processes the signals from the flex sensor. In addition, the data is received from the sensor by a wired connection. The gesture is evaluated in this step, and the resulting output is shown on the LCD while a vocal output is broadcast back through the speaker. As a result, with the help of this project, the barrier faced by these people in communicating with society can be reduced to a great extent [1].

2. BACKGROUND THEORY

Numerous smart gloves have been introduced in recent years, with the most popular technology being wired mode with many unique features, however they were unreliable, heavyweight, cheap, and difficult to use. Plug-and-play prototypes are available. It's because of typical components used in the glove's production process, such as microcontrollers, wireless transmitters, and flex sensors, which were powered by a battery that was a touch bulky and made the glove heavier than other components. As a result, these types of assemblies are large and difficult for a handicapped person to utilise. To break down communication barriers and start a conversation among persons who are deaf or have other speech disabilities, The "Sign Language Glove" is a smart glove that can read and understand sign language, The "Sign Language Glove" is a smart glove that can interpret sign language from hand gestures into on-screen visual text and aural dialogue, designed by a student at Goldsmiths University in London.

Advantages are as follow:-

- It's wireless, with displays and a voice device.
- It has a built-in Battery thus making it Portable

Drawbacks are as follows:-

- As it has large battery, It is cumbersome to wear.
- As its size is Bulky, It's difficult to use by a Disabled person.
- It's delicate, and the parts are expensive.

3. PROBLEM STATEMENT

All the Problems faced by a disabled person regarding employment can be overcome by our method. So in the implemented work an intelligent micro controller-based system using Flex sensors is developed which is able to-

- Transform gestures into speech and text.

Wireless gloves are not yet feasible in today's technology since they must incorporate an integrated battery and an electronics controller board if they are to be utilized as

wireless, which makes gloves heavier and may irritate. Thus wired equipment is preferred for patients and partially disabled people.

4. COMPONENTS

4.1 ARDUINO LEONARDO

The Arduino Leonardo is an open-source microcontroller development board that has Microchip ATmega32u4 microcontroller embedded on it and developed by Arduino. cc. The board has a large number of analog and digital input/output (I/O) pins that connect to other Shields (expansion boards) and other circuits. The board also contains 20 digital Input/Output pins of which six are capable of PWM output, a 16 MHz crystal oscillator, 12 analog Input/Output pins , and can be programmed through a type B USB cable using the Arduino IDE (Integrated Development Environment). It can be powered either by using a USB connection or by a a 9-volt battery, but only handles voltages between 7 to 20 volts.

It's comparable to the Arduino Uno and Nano. The ATmega32u4 has 32 KB of memory which consists of 4 KB used for the boot loader. There's additionally 1 KB of EEPROM and 2.5 KB of SRAM onboard which can be both read and written with the help of the EEPROM library. The Leonardo has several facilities for communicating with a laptop, other microcontrollers, or other Arduino. The ATmega32U4 supports UART TTL(5v) Serial Communication, which may be accessed through digital pins 1 (TX) and 0 (RX). The 32U4 also supports serial (CDC) connection over USB and appears as a virtual com port to applications on the laptop.

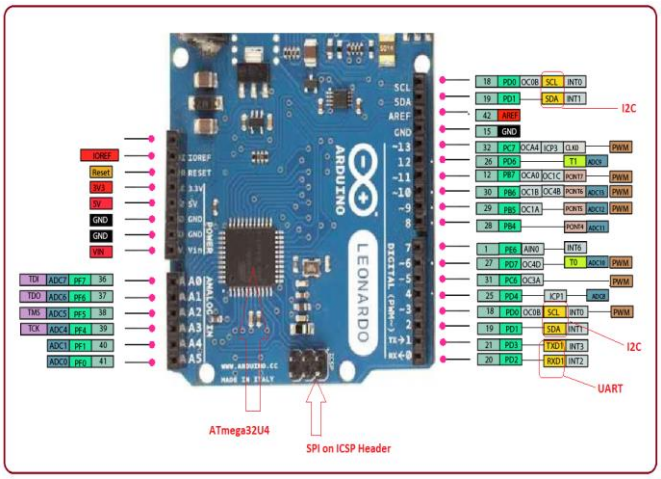

Fig -1: Arduino leonardo Pinout

The microcontroller on the Arduino Leonardo can't be detached, it's mounted on the Arduino board, while the microcontroller contained On the Arduino Uno, it is simple to remove. The Arduino Leonardo's Microcontroller offers far greater USB compatibility than the Arduino Uno, allowing developers to construct more versatile USB applications. Instead, it uses a USB-to-serial converter based on an Atmega16U2 microcontroller (Atmega8U2 up to version number R2).

4.2. FLEX SENSOR

When the sensor is bent, the terminal resistance of the variable resistor rises. As a result, the sensor resistance rises in proportion to the surface linearity. . So it usually senses the change in linearity. The Flex Sensor is regarded as a Changeable printed resistor that achieves excellent form factor on a thin and flexible substrate. When the substrate is bent forward or backward, the sensor gives a resistance output that is proportional to the bending radius of the substrate of the flex sensor, the smaller the bending of the flex sensor the larger is its resistance value. radius, the higher is the resistance value. The nominal resistance of the Flex sensor is when its surface is totally linear.

When bent at a 45-degree angle, the Flex sensor's resistance doubles when compared to its nominal state. When the bend is raised to 90 degrees, the resistance might be four times that of nominal resistance As a result, the resistance across the terminals rises in a straight line with a bending angle. In a sense, the Flex sensor transforms flex angle to resistance equivalent.

Fig- 2: Flex Sensor

4.3. LCD DISPLAY

Liquid crystal display (LCD) is the display technology used in laptops and other tiny computers. LCDs, like gas-plasma and light-emitting diode (LED) technologies, allow for significantly smaller screen displays than the Cathode ray Tubes(CRT) Technology.

The liquid crystal display screen operates by blocking light rather than emitting it. LCDs require a backlight, since they do not emit light. LCD panels have largely replaced the usage of cathode ray tubes in our daily lives. Cathode-ray tubes use more energy and are also heavier and bulkier than LCDs.

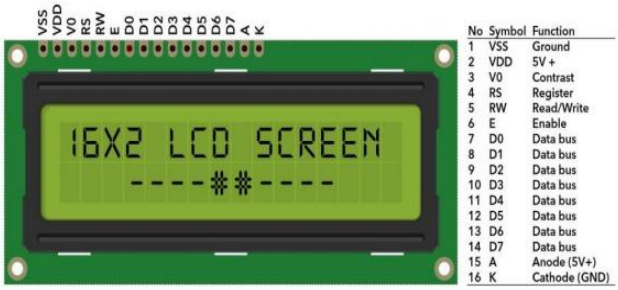

Fig -3: LCD Display

4.4 GLOVES

A glove is an item of clothing that covers the hand of a person. There are many different types of gloves available on the market. Gloves come in a variety of fabrics and materials, and they're utilised in a variety of ways..

Fig -4: Gloves

4.5 VECTOR BOARD

It's a pre-punched insulating punched board, plated copper clad or unclad, with a range of hole sizes and grid atters. All-purpose A pre-punched insulating punchboard is available in a number of grid configurations for building circuit components, as shown below. Vectorbord offers FR2 phenolic, FR4 epoxy glass, FR4 HiTg 170°C, and CEM-1 epoxy glass composite materials. Vectorbord offers unplated copper clad on one side, both sides, or unclad with no copper layer on either side.

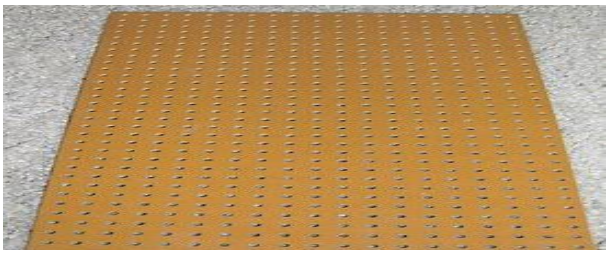

Fig -5: Vector Board

4.6 GSM 800A

GSM is an open and Universal digital cellular system that transmits data and Telephony over frequency bands such as 1900Mhz, 900Mhz, 850Mhz, 1800Mhz frequency bands. The GSM system was designed as a digital communication system that communicates using the time division multiple access (TDMA) technology.

Fig -6: GSM 800A

4.7 ARDUINO IDE

The Arduino IDE is a free software programme that allows users to create and upload code in real time. The Arduino IDE is compatible with Windows, Mac OS, and Linux. The majority of its code is written in javascript, making it simple to change and compile.

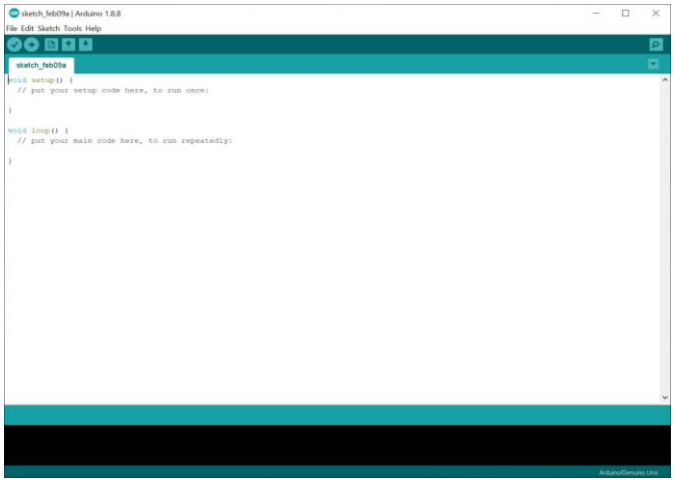

Fig -7: Arduino IDE

5. DESIGN IMPLEMENTATION DETAILS:

BLOCK DIAGRAM

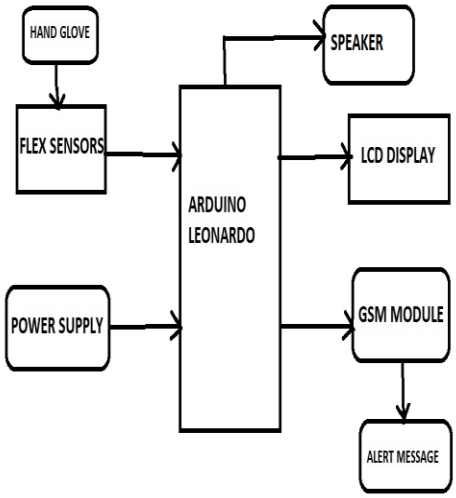

Fig -8: Block Diagram

The above block diagram depicts the entire architecture of Smart Gloves for Disabled People, which includes components like Flex Sensors, Arduino Leonardo, 16*2 LCD Screen, and APR33A3 Voice Playback Module. The Arduino Leonardo Microcontroller Board, which has interfaced with a flex sensor, speech module, transmitter, and LCD screen, is at the heart of the smart gloves device. The power supply block supplies voltages of 5 and 9 volts to the entire unit.

6. IMPLEMENTATION

The work of this project starts from the movement of hand gloves where the flex sensors are attached, and the value of the sensor changes when it experiences bending. The flex sensor is another type of potentiometer attached to the fingers when we bend the figure the value of the sensor gets changed. Here Arduino is used for programming and interfacing purpose. The LCD is used to show the message that conveys the Message from hand movements. The output is displayed on the LCD screen as well as audio output is sent through a speaker which is received from Arduino Leonardo. GSM sends the SMS and makes calls to the given phone number.

7. WORKING

The project starts working from the movement of hand gloves worn by a person where the flex sensors are attached, and the resistance value of the sensor changes when it experiences spatial bending. The flex sensor is also a type of potentiometer that is connected to the fingers and it is bending the value of the sensor get changed. The changing value of the sensor depends upon the resistance value across the sensor and the applied angle of the bending when we bend the sensor at some particular angle we can see the value of the resistance is an increase and accordingly, the output gets increased or reduced. On the other hand, we can say that it is inversely proportional when the resistance of the sensor is increased at that moment the value of output decrease and accordingly, to the resistance, we can make a project by getting the advantage of this process.

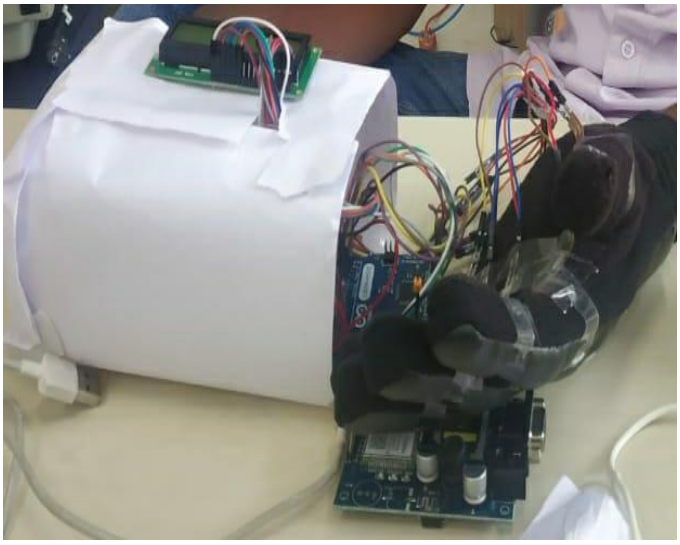

Fig -9: Implemented Design

Working of a flex sensor:-

It works on principle on voltage stopper. Here the values are been given to Arduino Leonardo through the flex moment

Working of Arduino Leonardo:-

Values are been taken from the flex sensor and the instruction are given to the LCD and GSM module accordingly

Working of LCD and GSM:-

The output is displayed on LCD screen which are recived from Arduino Leonardo. GSM send the SMS and make calls to phone number given.

8. RESULTS

Fig -10: Message display on LED screen

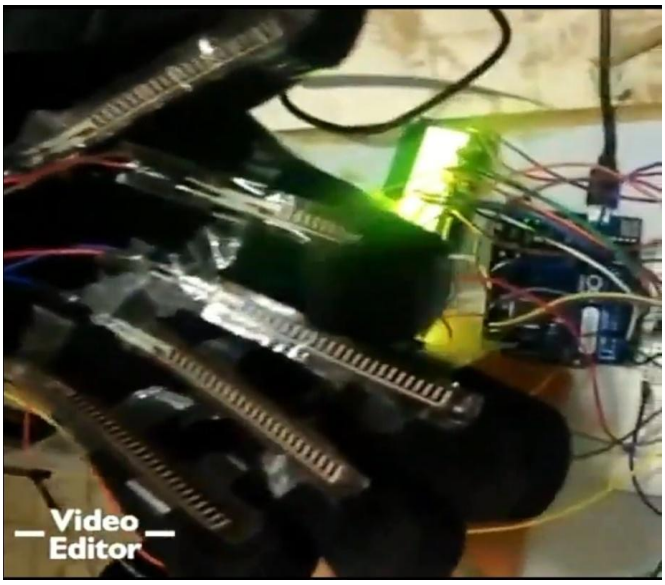

Fig -11: Hand Glove Sign Movements

The above figure shows the message that is displayed on the LED Screen for the corresponding Hand Gesture is observed.

9. CONCLUSIONS

The project consists of a glove that is worn by a person to communicate easily with others. A flex sensor is incorporated in the glove, and this sensor provides discrete values to the Arduino Leonardo each time we bend it in this way the instructions are calculated and this signal to screen and GSM module to send SMS respectively During this project, we face various challenges. We have tried to minimize the problem as far as possible. There is a problem with making it wireless. So, we observed and analyzed various research papers and products available in the market which are bulky, difficult to handle, and delicate in structure. Since this was a prototype our main focus is kept on building an efficient model, which can solve or minimize the communication problem for disabled people.

10. FUTURE SCOPE

This type of communication is very important for paralyzed persons to express their needs to others. so this is further improved by making it wireless using Bluetooth module or with Wifi module to make it comment to there user and precision of the flex sensor also will be improved. This are further can be implemented.

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