Talking Glove (Hand gesture recognition and voice conversion system) using the Smartphone

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Abstract— **Generally, a person who cannot communicate properly with others does not perceive linguistic communication. However, loudspeakers have a "deaf throat" in which they are self-aware and demoralized. According to the dumb, they have a meaning for every move. That message is set in the database. Equally, all the values/data are stored in the database. In real life, the example is delivered in the database of the microcontroller (ATmega32), and the motion sensor (Flex Sensors) in their hand is mounted. The motion sensors accelerate for every action and signal to the microcontroller (ATmega32). Sensor output could be a stream of information that varies from finger to bend. Flex sensors are among those sensors that amendment the resistance values based on the sensor's bend quantity. They convert the bend to electrical resistance, the greater the bend, the greater the resistance value. The output value from the sensor is digitally reborn and processed employing a microcontroller (ATmega32) and then responded to the voice. Use a smartphone speaker with a successful app. The system conjointly incorporates a Text to Speech Conversion (TTS) discourage that depicts organizing signals. This project tends to use Flex Sensors, microcontroller (ATmega32), and Smartphone Applications to get the output. Hardware elements embody microcontroller (ATmega32), Liquid Crystal Display (16x2), Flex sensor, HC-05 Bluetooth module, Regulator IC, power supply, and Smartphone with an application which can change over text to speech. Software tools used are Proteus, AVR Studio, and Android Studio. It is utilized in medical applications, wheelchair direction management, and artificial intelligence.** (*Abstract*)

Keywords— *Glove, Flex Sensor, Smartphone, Microcontroller (ATmega32), HC-05 Bluetooth module, TTS.*

I. INTRODUCTION

Correspondence between a visually impaired and hearing individual could be a significant weakness contrasted with correspondence between a visually impaired and past people. Language is additionally a nonverbal variety of intercourse found in deaf communities. So, our digital glove can recognize the sign made by our Hand in which we wear a glove and convert it into speech.

Ryan Patterson was the first person who designs first-hand speak glove. He began his mission together with his linguistic communication.

The main goal of this paper is to gift the matter of effectively translating gestures to the sounds of every text and sensitivity [3]. Glove-based full-fledged technology with a microcontroller (ATmega32) uses the Flex Glove interpreter.

For every hand gesture made, a feature is generated by the sensing element, compliments the hand's signal, and compares the management input to the controller gesture.

The training mode is sociable on the device. Therefore, it fits each user and will increase accuracy. The device will translate massive gestures that need one movement.

II.   BLOCK DIAGRAM OF SYSTEM:
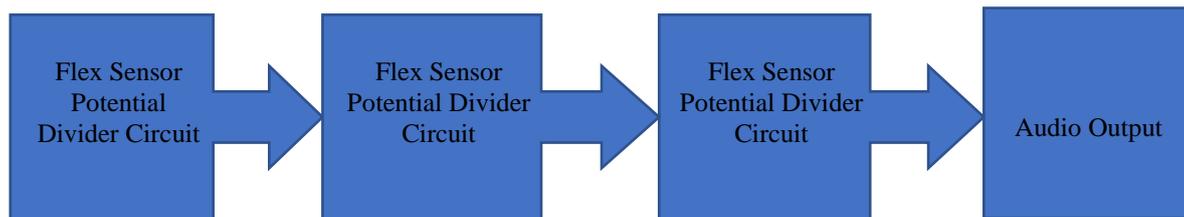
III.   WORKING OF THE SYSTEM:

At the initial stage, when our Hand is straight, i.e., when all the flex sensors in the glove are straight, then the flex sensors have the minimum value of resistance, and when we start bending our fingers at some angle, then resistance increases accordingly. Using these flex sensors, a potential divider circuit is made where the flex sensor is used as variable resistance, and another fixed value resistance is used in series with flex sensors.
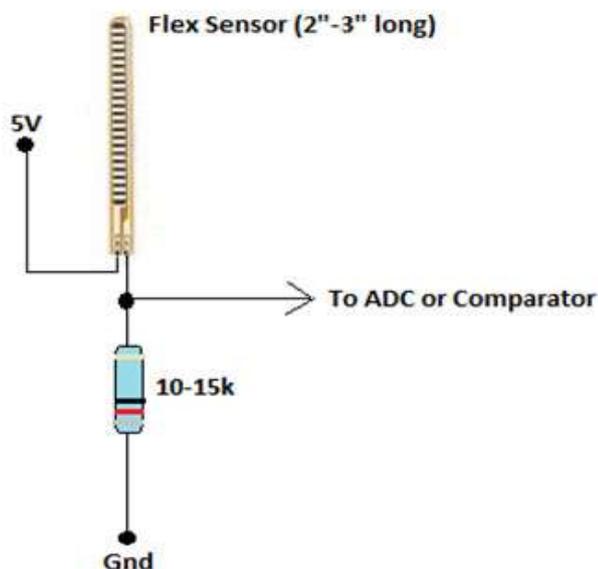

Figure: Potential Divider Circuit

On bending of fingers resistance of flex sensor changes accordingly so that voltage drop across flex sensor also changes. This potential drop across the flex sensor will be passed as an analog signal to the microcontroller (ATmega32) at port-A, which then converted into a digital signal by the ADC feature of the microcontroller (ATmega32). Now, these digital values get computed using our algorithm, which is stored in microcontroller (ATmega32), and generates an output that will be an integer value.

This integer value generated by our algorithm will be passed via Bluetooth module HC-05 to our mobile application, which is generated using Android Studio software in which we make use of some Java concepts named Collection.

In java, Collection is a Framework that has a class named HashMap, which works on key values pair (Key, Value). In our android application, we make use of this class (HashMap) in which the key is an integer value, and in place of value, we put the location of the audio file, which will be going to play.

Now, when the integer value reached to our application from Microcontroller (ATmega32), our android application will match the value of that integer with that of different values of "Key". When the match found, our application will look for the location of the audio file corresponding to that key value. When our application found the location of the audio file, it will get played via a mobile speaker or any other external speaker connected to that Smartphone.
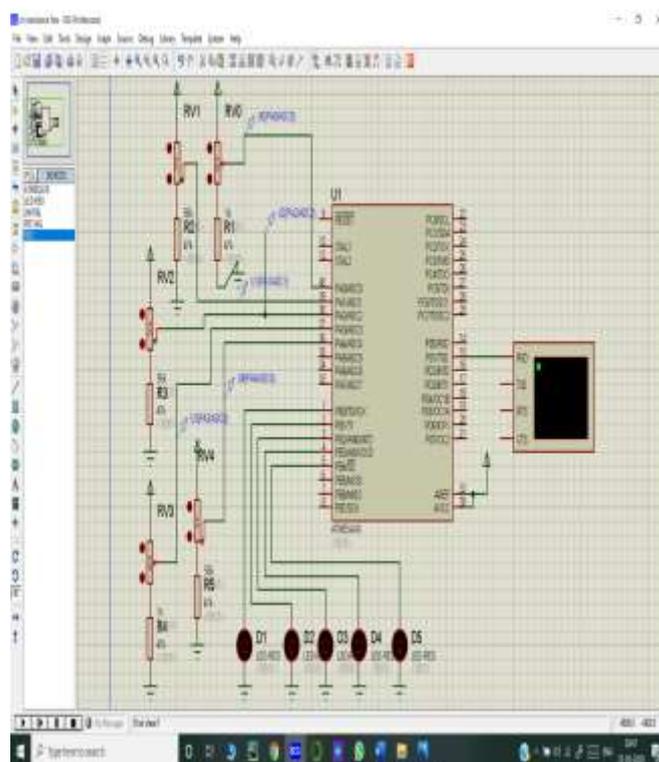

Figure: Circuit Diagram of the System

VI.   VALUES STORED IN SMARTPHONE AS A KEY VALUE PAIR :

Decimal Number (KEY)	Table Column Head		
	Binary Number	*Sentence(In Hindi) (Value)*	*Sentence (In English)*
01	00001	NAMASTE, AAP KAISE HAI?	Hi, how are you?
02	00010	AAPKA SWAGAT HAI	Welcome.
03	00011	MERA NAME TALKING HAND HAI	My name is Talking Hand.
04	00100	MAI BIMAR HU KRIPYA DOCTOR KO BULAO	I am sick, please call the doctor.
05	00101	MAI BHUKHA HU	I'm hungry.
06	00110	MUJHE PANI DO	Give me water.
07	00111	MUJHE COFFEE CHAHIYE	I need coffee.
08	01000	KYA AAP MERI SAHAYTA KR SKTE HAI?	Can you please help me?
09	01001	SHUPRABHAT	Good morning.
10	01010	SHUBHRATRI	Good night.
11	01011	AAPKA DIN KAISA RHA?	How was your day?
12	01100	MUJHE DAWA CHAHIYE	I need medicine.
13	01101	MUJHE THODA TIME DE	Give me some time.
14	01110	APSE MILKE KHUSHI HUI	Glad to meet you.
15	01111	MUJHE TOILET JANA HAI	I need to go to toilet.
16	10000	MAI ABHI BUSY HU	I'm busy.
17	10001	SHAMA KRE (PARDON)	I'm sorry.
18	10010	ISE THIK SE KRE	Do it properly.
19	10011	AAP ACHHE LAG RHE HAI	You are looking good.
20	10100	AAPNE ACHHA KAM KIYA HAI	You did a nice job.
21	10101	AAP KB AA RHE HAI?	When are you coming?
22	10110	AAP KHA REHTE HAI?	Where do you live?
23	10111	MAI BAHAR JANA CHAHTA HU	I want to go out.
24	11000	AAP KYA KRTE HAI?	What do you do?
25	11001	TIME KYA HUA HAI?	What is the time?
26	11010	VHA KHATRA HAI VHA MT JAO	There is danger, don't go there.
27	11011	MUJHE APNE BARE ME BTAO	Tell me about yourself.
28	11100	KYA AAP MUJHE VEH VASTU DE SKTE HAI?	Can you pass that item?
29	11101	APNA KHYAL RKHE	Take care of yourself.
30	11110	MUJHE NHI PTA	I don't know.
31	11111	APSE MILKR ACHHA LGA	Nice to meet you.

HARDWARE DETAILS:

A. *Flex sensors*

Flex sensors that are mounted on the glove are used to measure the amount of bending made by our Hand while wearing the glove consisting of the flex sensors. Usually, flex sensors are used to measure the resistance incurred at a different angles of the flex sensors.

B. *ATmega32 (Microcontroller)*

ATmega32 is an 8-bit AVR microcontroller that takes input from flex sensors and then computes the output by using the algorithm which is stored inside the microcontroller.

C. *PCB*

- PCB (Printed Circuit Board) is used to electrically connect the electric appliances. In our hardware also, our whole circuit connected via PCB.

D. *7805 IC*

- 7805 IC is used to maintain the voltage at a constant value. It resists the voltage fluctuations in our circuit so that we get accurate value and our equipments work properly without any damage which might

occur due to voltage fluctuation in the absence of the 7805 IC.

E. HC-05 Bluetooth Module

- HC-05 is an SPP (Serial Port Protocol) Bluetooth module. In our project is used to transfer value from the microcontroller (ATmega32) to our Smartphone.

SOFTWARE DETAILS:

   A. ATMEL Studio

- ATMEL Studio is a refined free advancement condition. It gives everything expected to consistently alter, fabricate, download, and troubleshoot applications on ATMEL microcontrollers. ATMEL Studio likewise oversees and gives an immediate interface to the ATMEL Programming System, and can legitimately get to the ATMEL Exhibition.

   B. Proteus

- The Proteus Design Suite is a restrictive programming device suite utilized basically for electronic plan computerization. Electronic structure specialists and professionals use the most part of the product to make schematics and electronic prints for assembling printed circuit sheets.

   C. Android Studio

- Android Studio is the authority coordinated advancement condition (IDE) for Android application improvement. It relies upon the IntelliJ IDEA, a Java composed headway condition for programming and merges its code changing and architect instruments.

   To help application advancement inside the Android working framework, Android Studio utilizes a Gradle based form framework, emulator, code formats, and Github reconciliation. Each undertaking in Android Studio has at least one modality with source codes and asset documents.

VII.   ALGORITHM:

Step 1: Start

Step 2: Input from all 5 flex sensors are transferred to the microcontroller as analog signal.

Step 3: That analog value gets converted to a digital signal.

Step 4: Then, those digital signal's value will get passed to if-else conditions.

Step 5: In the if-else condition, the input signal range will be matched with one of the conditions.

Step 6: After satisfying the condition from one of the if-else conditions, the value assigned in that particular condition will get passed to the Smartphone via Bluetooth.

Step 7: After getting the decimal value in the Smartphone application, then that value gets passed to the if-else condition.

Step 8: In the application, that value will match using HASHMAP, which works on key-value pairs, now the value obtained via Bluetooth will match one of the values from 31 keys.

Step 9: When that value gets matched with one of the keys, then that key has some 'Value' which contains the path of the particular audio file associated with that key.

Step 10: After getting the path of the particular audio file, the audio gets played via Smartphone speaker or some external speaker connected to that smartphone.

CONCLUSION:

Sign language is a useful sign to facilitate communication between the deaf or mute community. The goal of this project is to reduce the communication gap between a quiet society and, in addition, the standard world. In global applications, this system helps the deaf and dumb who cannot communicate with the other person. The best part of this project is assigning a complete sentence rather than words or characters with respect to each particular gesture made by the person wearing that glove. The biggest feature of this project is that the Gesture symbol may be an associate autonomous system that applies to common living spaces. It is weak, and para-lis is useful to the patient, which means they are not speaking properly and are also used for intelligent home applications and industrial applications.

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