ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
(An ISO 3297: 2007 Certified Organization)
Vol. 5, Issue 6, June 2017

Meri Awaaz – Smart Glove Learning Assistant for Mute Students and teachers

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ABSTRA
Meri Awaaz – (Dumb Assistor) is an electronic gadget that acts as an auxiliary device to make interpretation of communication via gestures into content or discourse as indicated by American Sign Language. This glove has been implemented with the assistance of flex sensors; accelerometer and the Atmega328 based Arduino Uno. It is primarily aimed as a mouth-piece for the mute (dumb) and as a generic device to assist instructors in universities. This venture comprises of a glove that distinguishes the development and transmits information to the cloud. Information stored in the cloud is visualized utilizing portable application and shown to the next client (student / teacher) upon their demand. Smart Glove will act according to the motion of American Sign Language. The message imparted by the speaker can likewise be displayed on an LCD screen. We have developed the product effectively in two principal domains – personal domain and university domain. This paper elucidates the use of smart glove in the educational domain to assist mute teachers and mute students to communicate effectively in a classroom environment in the most natural way as possible.

KEYWORDS
Smart Glove, Flex Sensor, Arduino Uno, American Sign Language, Cloud Storage.

I. INTRODUCTION

A large proportion of mute students are denied from fundamental right to education on account of their perceived inadequacy at effective communication which is quintessential in a classroom environment. The American Sign Language (ASL) Figure 1 is an effective tool that allows mute people to communicate with their non-mute counterpart. However, hand gestures are still not the most natural mode of communication and non-mute people still find it difficult to adapt to audio-less communication. This product is primarily aimed at enabling mute people to effortlessly communicate information to others, thus allowing for their seamless incorporation in classroom environment. Smart Glove will go about as medium of powerful correspondence amongst them and will help them to learn new things effectively. In this paper, diverse way to deal with perceive motion are talked about, an as of now proposed an outline of a hand glove for motion acknowledgement into discourse appears. Albeit a few smart gloves are accessible in the market yet they are utilised for gaming and other virtual reality applications and there is no such entire framework accessible in the market for the interpretation of communication via gestures into discourse for the advantage of understudies and educator [1].

There are two primary ways to deal with gesture recognition:

1. A machine-based approach which comprises of taking the test-set through a solitary / arrangement of cameras

2. A haptic-based approach which comprises of utilizing a tangible gadget, for example, flex sensors to take in physical qualities for preparing.

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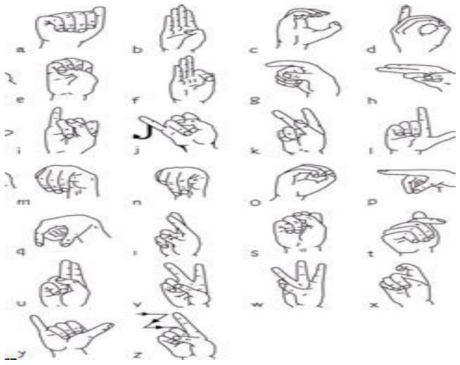

Figure 1: ASL gestures.

II. RELATED WORK

There has been a considerable measure of work in the field of correspondence of hard of hearing and unable to speak individuals. With the assistance of flex sensors level of fingers, thumb and arm are ascertained in voltage terms utilising voltage divider run the show. The microcontroller is utilised for different capacities like simple to computerised change of information from flex sensors [2]. At that point, digitized information is encoded in the encoder and transmitted. Gotten information is decoded by decoder and motion acknowledgement framework coordinates the approaching information with pre-nourished information. PIC microcontrollers can be customised in Assembly, C or a blend of the two. Other abnormal state programming dialects can be utilised however implanted frameworks programming is basically composed in C. All yield signals created from flex sensors are in simple frame and these signs should be digitised before they can be transmitted to the encoder. Consequently, microcontroller ATmega 16 is utilised as the fundamental controller in this venture. It has inbuilt ADC module, which digitises every single simple flag from the sensors and an inbuilt multiplexer for sensor flag choice. It bolsters both serial and parallel correspondence offices [3].
Utilising the idea of signals, few endeavours have been made in the past to perceive the motions made utilising hands yet with confinements of acknowledgement rate and time which include:

1. Utilising CMOS camera
2. Leaf-switches-based glove
3. Copper-plate-based glove

Utilising CMOS Camera CMOS camera transmits picture information by means of UART serial port. The UART performs serial-to-parallel transformations on information gotten from a fringe gadget (CMOS camera for this situation) and parallel-to-serial change on information gotten from the CPU (Microcontroller for this situation). Hand signals were identified utilising CMOS camera by 3 stages:

1. Capturing the picture of the motion.
2. Edge identification of that picture.
3. Peak identification of that picture.

Burden: Highly costly, inertness and each picture possess 50KB of recollections.

2.1 Leaf switches based glove: These are like ordinary switches however these are outlined such that when weight is connected to the switch, the two finishes come into contact and the switch will be shut. These leaf switches are set on the fingers of the glove with the end goal that the two terminals of the switch come into contact when the finger is bowed. Impediment: After delayed utilisation, the switch as opposed to being open when the finger is straight, it will be shut bringing about the inappropriate transmission of motion [4].

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2.2 Copper Plate Based Glove: In this model, a copper plate is settled on the palm as ground. The copper strips demonstrate a voltage level of rationale 1 in the rest position. Be that as it may, when copper strips interacted with the ground plate, the voltage related with them is depleted and they demonstrate a voltage level of rationale 0. However, the bulk of copper plates make it an unfeasible solution [5].

III. PROPOSED WORK

In this project, we propose the following product as a solution to the problem statement. We have used raspberry pi with which we have connected the flex sensors. Now as the flex sensors give us analogue input, we have used an Arduino which help us in taking the analogue input from the sensors. On obtaining the sensor values, all the values are sent to the cloud. The routes for sending the data to the cloud is created using node JS. After receiving the values at the cloud. Figure 2 Computation takes place in the cloud which recognized what the gestures meant. And the result in text output format is send to the android device. The text data is converted into speech through the android device only, by using the API provided by the Google [6].

IV. PROPOSED SYSTEM ARCHITECTURE

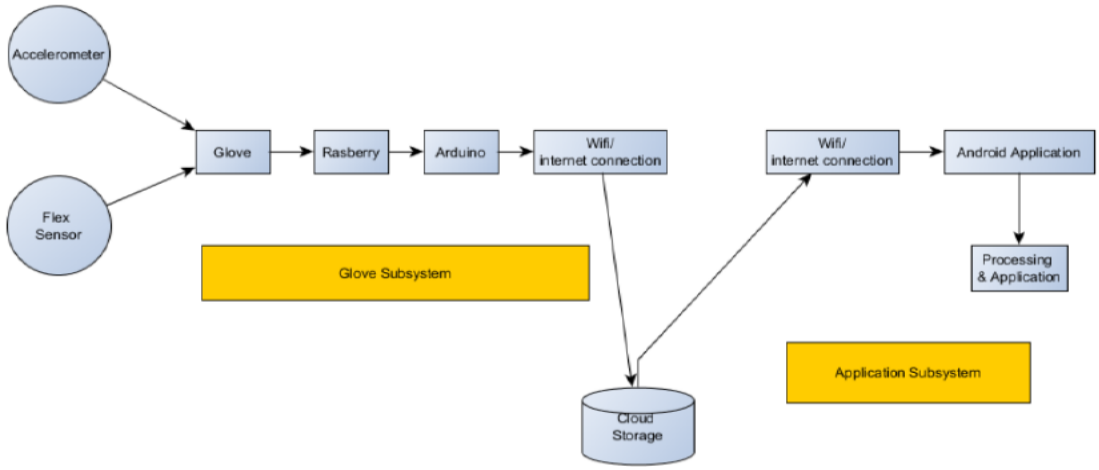

Figure 2: System Architecture and Design.

V. IMPLEMENTATION AND RESULTS

We have dubbed the application segment of this product as ‘Meri Awaaz’ which literally translates as ‘My voice’ as it acts a voice for the mute.
The application acts as an instrument of showcasing the sensor-gathered information. Figure 3 we have made use of standard Google APIs to for text-to-speech and speech-to-text functions in the app. The app is intended to behave as not just an extension for the mute but also as a tool for the non-mute to communicate with their mute counterparts [7].
A centralized solution for the intended domain along with general purpose usage is the core intention of the application. In order to increase the reach potential of the product we have developed the application in an Android environment. Figure 4 Using Raspberry Pi, we have connected the flex sensors. Now as the flex sensors give us analogue input, we have used an Arduino which help us in taking the analogue input from the sensors (I2C) Figure 5. On obtaining the sensor values, all the values are sent to the cloud. The routes for sending the data to the cloud is created using NodeJS. After receiving the values at the cloud. Computation takes place in the cloud which recognized what the gestures meant. Figure 6 and the result in text output format is send to the android device [8] Figure 8.

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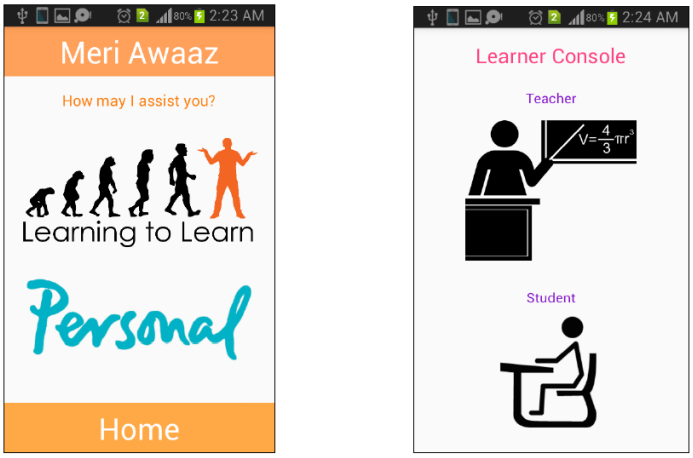

Figure 3: Domain selection interface, the first screenshot is the initial interface to select the domain of usage. The second interface-selector is a sub – menu of the learner console.

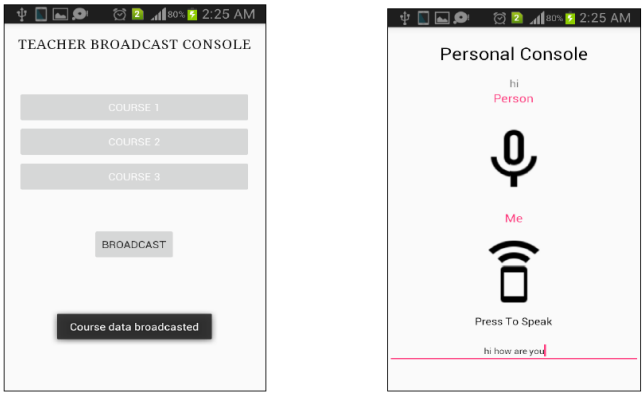

Figure 4: The personal Console has a two way operational interface to facilitated real-time communication.

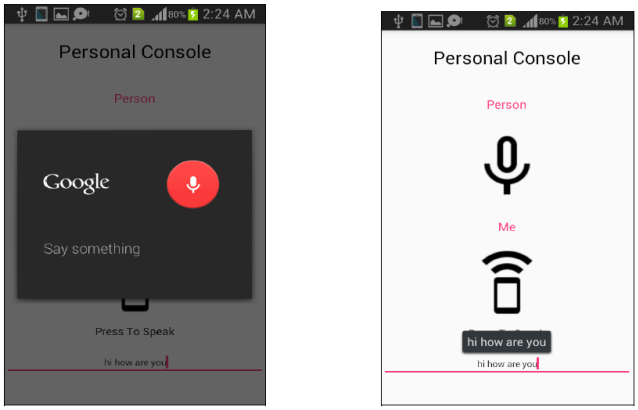

Figure 5: Google API used to recognize speech (from non-mute people) and converts it int text and reads it out loud.

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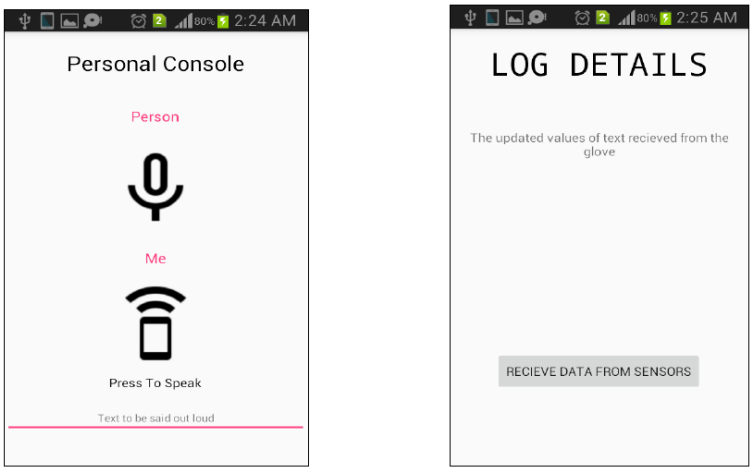

Figure 6: The data / gesture from the glove are sent as a JSON which the app displays in a readable format and reads out loud.

Figure 7: Meri Awaaz - Smart Glove.

VI. CONCLUSION

Sign language recognition system for deaf and dumb people using flex sensors was successfully executed with high accuracy. The method gives output in text and speech format that helps to reduce the communication gap between mute and non-mute people. Thus, the implementation of system output is done through Raspberry Pi, Arduino and various sensors like flex sensor or accelerometer.

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