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An IoT Based Device for Communication among Deaf, Dumb and Blind People

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Abstract: In daily life, for the people who are deaf, dumb and blind, the communication for them is difficult. They can only communicate in sign language which is very difficult to communicate among them and also with normal individuals. To avoid the obstruction, a glove is taken along with a MEMS Sensor attached to it.

The Deaf, Dumb and Blind People only communicate in sign language accordingly. This becomes difficult when comes to communication with normal individuals. So, to prevent this, an electronic framework is developed with two switches and a glove with MEMS Sensor. When the glove is tilted or moved, the sensor detects and is fed into Arduino Uno and the pre-loaded command is played on the speaker through the voice IC and is displayed on the LCD. The Switch consists of four commands each. When the switch is swapped the respective commands will work.

Keywords: MEMS Sensor, Arduino Uno, APR 9600Voice IC, LCD, Speaker, Glove.

I. INTRODUCTION

The Internet of Things (IoT) is the major significant trend in recent years. There is an explosive growth of devices connected and controlled by the internet. The wide range of applications for IoT technology mean that the specifics can be very different from one device to the next but there are basic characteristics shared by most. The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, reduced human exertions. The number of IoT Devices is increased by 31 % since last year and is estimated that there will be nearly 30 billion devices by the end of 2020.

For every person communication is the main task for a conversation. So, the primary point of taking this IoT based electronic framework is to prevent the corresponding issue since these individuals use gesture based communication which is very difficult. The Device enables the communication among the people with the impairment of vision, hearing and speaking and also with the normal individuals. The major part of the device is the Arduino Uno which is the fundamental control unit. The Device has a switch and a glove with a MEMS Sensor. A voice IC named APR 9600 Voice IC is used in the device for processing the output. This Device provides an easier communication among these physically impaired persons and with the normal individuals.

II. LITERATURE SURVEY

A)[9] Nikolas Bourbakis explained the challenges problem in human interaction is the communication process between blind and deaf individuals. The challenge here involves several cases like: Deaf person usually does not speak, When a blind person speaks a deaf person cannot hear, When a deaf person makes sign language, a blind person cannot see them. This paper presents a study on multi-modal interfaces, issues and problems for establishing communication and interaction between blind and deaf persons. Tyflos- Koufos is proposed in an effort for offering solutions to these challenges.

B) [10]Netchanok Tanyawiwat and Surapa Thiemjarus presented a new design of a wireless sensor glove developed for American Sign Language Finger spelling gesture recognition. Glove was installed with five contact sensors. 3D accelerometer on the back of the hand in addition to five sensors on the fingers. In order to save number of channels and installation area into the same input channel on the BSN node, each pair of flex and contact sensors were used. The signal is analysed and separated back into flex and contact features by software. The glove design is thinner and more flexible with electrical contacts and wirings made of conductive fabric and threads. ASL finger spelling gesture recognition experiments have been performed on signals collected from six speech-impaired subjects and a normal subject for validation. The experimental results have shown a significant increase in classification accuracy with the new sensor glove design.

C) [14]M. Mohandas, S. A-Buraiky, T. Halawani and S. Al-Baiyat explained about the interfaces in sign language systems which can be categorized as direct-device or vision-based. Direct-device use measurement devices, those are in direct contact with the hand such as flexion sensors, styli and position-tracking devices and instrumented gloves. The singer's hand using a camera, which captures vision based movement, which is sometimes aided by making the signer wear a glove that has painted areas indicating the positions of the knuckles or fingers. The main advantage of vision-based systems is that the user isn't encumbered by any complex devices. However, they require a large amount of computation just to extract the hand position before performing any analysis on the images. In this paper, the directed-devise methods were discussed.

D) [16]Kanwal Yousaf, Muhammad Altaf, and Zhang Shuguang proposed an application, named as vocalizer to mute (V2M), uses automatic speech recognition (ASR) methodology to recognize the speech of Deaf-mute and convert it into a recognizable form of speech for a normal person. In this work Mel Frequency Cepstral Coefficients (MFCC) based features are extracted for each training and testing sample of Deaf-mute speech. The hidden Markov model toolkit (HTK) is used for the process of speech recognition. The application is also integrated with a 3D avatar for providing visualization support. The avatar is responsible for performing the sign language on behalf of a person with no awareness of Deaf-mute culture. The prototype application was piloted in social welfare institute for Deaf-mute children. Participants were 15 children aged between 7 and 13 years. The experimental results show the accuracy of the proposed application as 97.9%.

E) [1]S. F. Ahmed, S. Muhammad B. Ali, S. Saqib and M. Qureshi explained that Gestures of fingers of a user of this glove will be converted into synthesized speech to convey an audible message to others, for example in a critical communication with doctors. The glove is internally equipped with multiple flex sensors that are made up of "bend-sensitive resistance elements". For each specific gesture, internal flex sensors produce a proportional change in resistance of various elements. The processing of this information sends a unique set of signals to the A VR (Advance Virtual RISC) microcontroller which is pre-programmed to speak desired sentences.

III. PROPOSED METHODOLOGY

The Proposed Methodology is implemented by using an electronic framework. It consists of a glove with a MEMS Sensor and a switch. The two switches consists of four commands each. On default, one switch will be active. If the switch is swapped, the other four commands will work. The Hand gestures are identified by the MEMS Sensor and it sends the gesture to the Arduino Uno and through the Voice IC, the output is played on speaker and is displayed on speaker. Here, we use mainly two components which are the fundamental control units of the electronic framework.

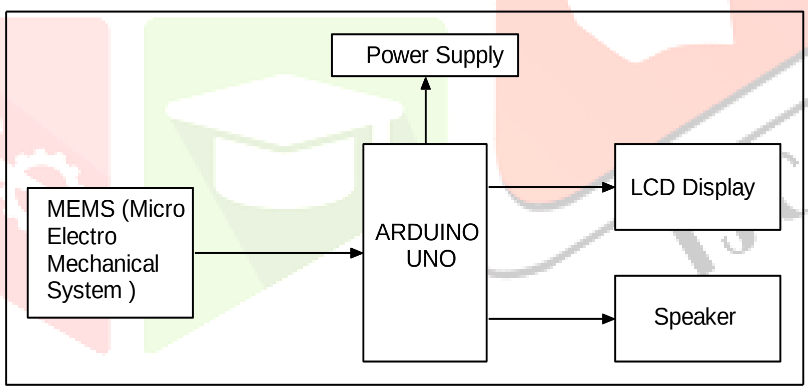

Figure 1: Block Diagram

1. Arduino Uno:

Arduino Uno is a microcontroller board based on the atmega328p.It has 14 digital input/output pins (of which 6 can be used as pwm outputs), 6 analog inputs, a 16 MHz quartz crystal, an usb connection, a power jack, an icsp header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a usb cable or power it with a ac-to-dc adapter or battery to get started. We can tinker with our Uno without worrying too much about doing something wrong, worst case scenario we can replace the chip for a few dollars and start over again. “Uno" means one in Italian and was chosen to mark the release of arduino software (ide) 1.0. The Uno board and version 1.0 of arduino software (ide) were the reference versions of arduino, now evolved to newer releases. The Uno board is the first in a series of usb arduino boards, and the reference model for the arduino platform; for an extensive list of current, past or out-dated boards see the arduino index of boards. Arduino Uno has a number of facilities for communicating with a computer, another arduino board, or other microcontrollers. The atmega328 provides serial communication, which is available on digital pins 0 and 1.An atmega16u2 on the board channels this serial communication over usb and appears as a virtual com port to software on the computer. The 16u2 firmware uses the standard usb com drivers, and no external driver is needed. The atmega328 has 32 kb (with 0.5 kb occupied by the boot loader). It also has 2 kb of sram and 1 kb of prom (which can be read and written with the rom library). See the Input and output mapping between arduino pins and atmega328p ports. The mapping for the atmega8, 168, and 328 is identical. Each of the 14 digital pins on the uno can be used as an input or output.

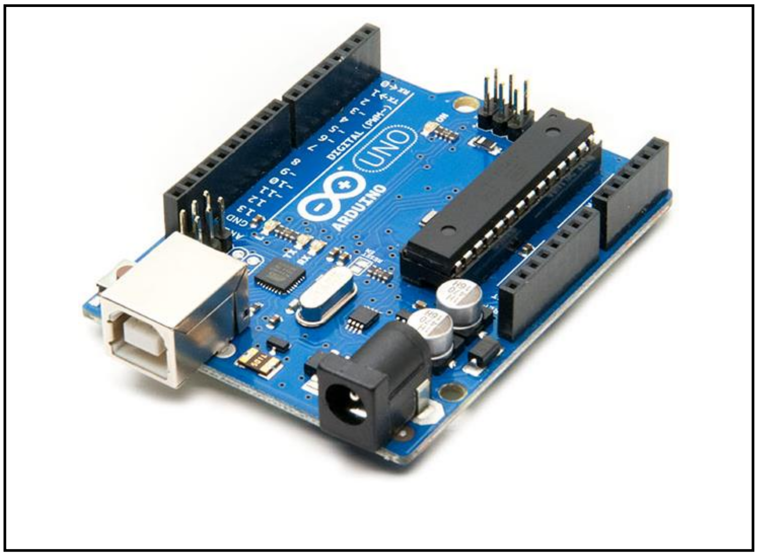

Figure 2: Arduino Uno

2. APR9600 VOICE IC:

APR9600 is a low-cost high performance sound record/replay IC incorporating flash analogue storage technique. Recorded sound is retained even after power supply is removed from the module. The replayed sound exhibits high quality with a low noise level. Sampling rate for a 60 second recording period is 4.2 kHz that gives a sound record/replay bandwidth of 20Hz to 2.1 kHz. However, by changing an oscillation resistor, a sampling rate as high as 8.0 kHz can be achieved. This shortens the total length of sound recording to 32 seconds. Total sound recording time can be varied from 32 seconds to 60 seconds by changing the value of a single resistor. The IC can operate in one of two modes: serial mode and parallel mode. In serial access mode, sound can be recorded in 256 sections. In parallel access mode, sound can be recorded in 2, 4 or 8 sections. The IC can be controlled simply using push button keys. It is also possible to control the IC using external digital circuitry such as micro-controllers and computers. The APR9600 has a 28 pin DIP package. Supply voltage is between 4.5V to 6.5V. During recording and replaying, current consumption is 25 mA. In idle mode, the current drops to 1 mA. The APR9600 experimental board is an assembled PCB board consisting of an APR9600 IC, an electret microphone, support components and necessary switches to allow users to explore all functions of the APR9600 chip. The oscillation resistor is chosen so that the total recording period is 60 seconds with a sampling rate of 4.2 kHz. The board measures 80mm by 55mm.

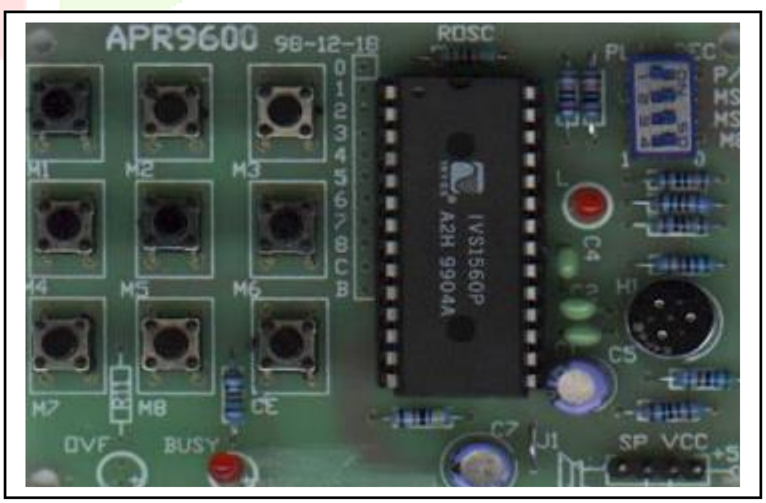

Figure 3: APR 9600 VOICE IC

3. MEMS Sensor:

MEMS are low-cost, and high accuracy inertial sensors and these are used to serve an extensive range of industrial applications. This sensor uses a chip-based technology namely micro-electro-mechanical-system. These sensors are used to detect as well as measure the external stimulus like pressure, after that it responds to the pressure which is measured pressure with the help of some mechanical actions. The best examples of this mainly include revolving of a motor for compensating the pressure change. Whenever the tilt is applied to the MEMS sensor, then a balanced mass makes a difference within the electric potential. This can be measured like a change within capacitance. Then that signal can be changed to create a stable output signal in digital, 4-20mA or VDC.

Figure 4: MEMS Sensor

3. Circuit Diagram:

In the above shown Circuit diagram, the MEMS Sensor is connected to Arduino Uno which is connected to the Voice IC. The Arduino Uno is utilized as a part of request to execute the outline and check the working of the plan i.e., schematic diagram proposed system is shown in Figure 5.2 . Ones the working of the plan is acclimated, the outline will be taken to the circuit board making so we get the equipment with no misfortune and wastage of cash is decreased. So, this framework helps the visually impaired, tragically challenged individuals to speak with each other and with the typical individuals it is more preferred standpoint with this task in which Arduino is the primary control unit. Here the code is deployed in the Voice IC using the Embedded Systems Applications.

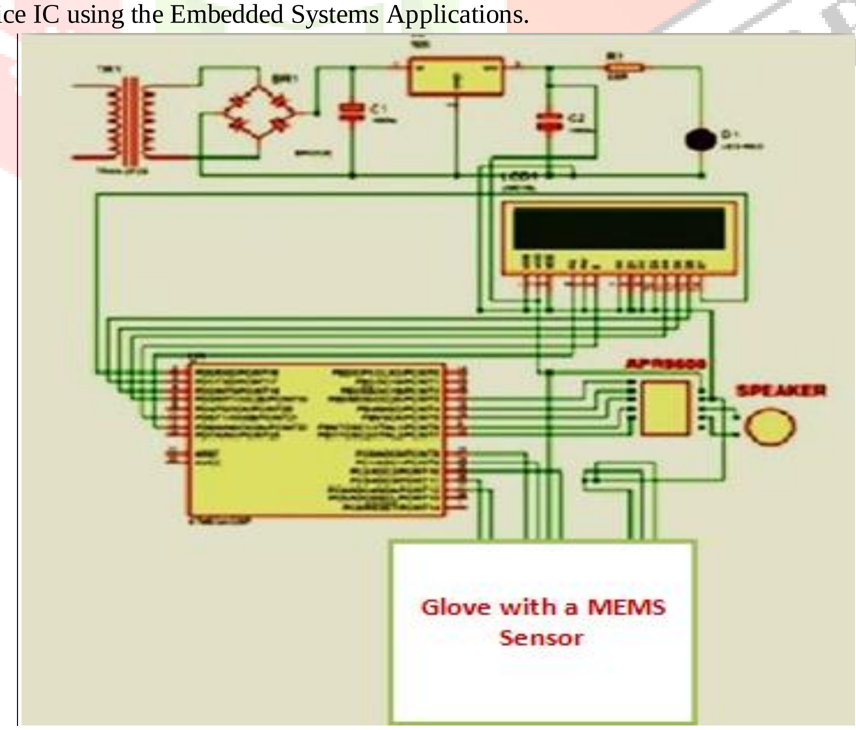

Figure 5: Circuit Diagram

4. Circuit Design:

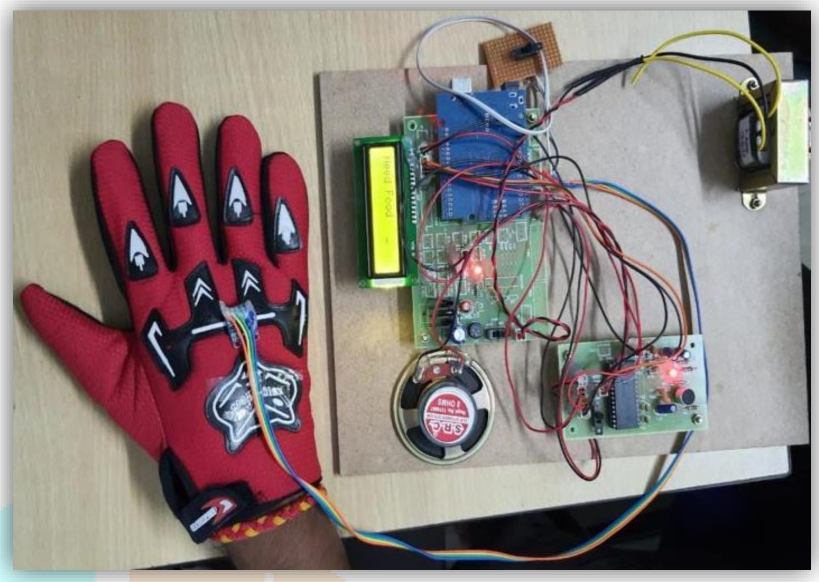

Figure 6: Main Circuit

The above figure describes the entire representation of the electronic framework that we developed. It comprises of a transformer, resistors,16x2 LCD, APR9600 Voice IC and a Arduino Uno borad which is associated with a glove and a MEMS Sensor.

IV.RESULTS

1.Screen Dislpays:

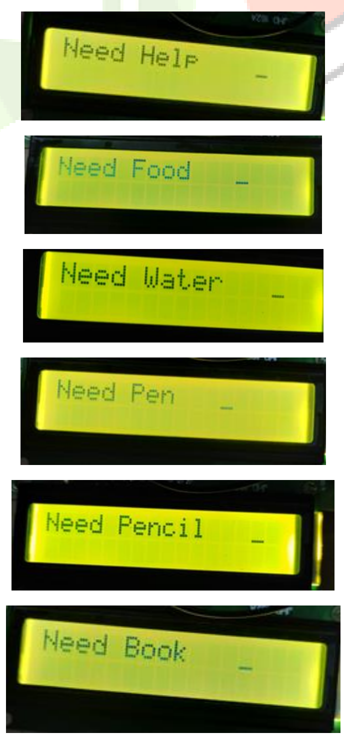

Figure 6: Displays on LCD

V.CONCLUSION

The principle reason for this task is to help the visually impaired, hard of hearing, and dumb individuals to speak with each other and furthermore with the typical individuals. This electronic framework helps the unusual individuals with typical individuals in reality. The principle control unit for this venture is Arduino. An information glove is created for the visually impaired, hard of hearing, and dump individuals. Presently they don't need to confront any issue to impart. Arduino is customized such that design settings promptly change without changing the whole code. In the wake of getting right outcomes, the equipment is actualized. Last outcomes are broke down after equipment usage. This gadget can be created more later on. The correspondence procedure of the visually impaired, hard of hearing, and moronic individuals by this electronic framework will roll out a progressive improvement.

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