

SMART GLOVE: A WEARABLE DEVICE FOR DISABLED PERSON

¹Deekshitha R.U, ²Mamatha V

¹Student, ²Assistant Professor

¹Computer Science and Engineer,

¹Bangalore Institute of Technology, Bengaluru, India

Abstract: Communication is one of the activities which are considered as crucial issues at the basis of daily activities of the people with disabilities. According to the World Health Organization, about 285 million people in the world are blind, 300 million are deaf and 1 million are dumb. Today's technology has innumerable wearable solution in order to support the disabled people. The solution presented here is for the blind, deaf and dumb people. In the proposed system we are going to develop an assistive system exploiting a wearable device that uses embedded system technology and natural language processing(NLP) for data input functionalities in a hand glove. The glove acts as a prototype which enables the user to have the all functionalities of the glove that is attached with alphabets, numbers and special characters. It is used for the deaf and dumb people in communication, they can use the buttons from the glove to communicate with one another and the typed text will be converted into text to speech using google API. Blind person can send messages and make call using the glove and they can operate home appliances using the dedicated buttons. If there is any fire occurs, fire sensor detects the fire and automatically buzzer alarm will be on by that time they can use the safety button to send the location to family members. This multi-functionality glove is to provide a convenient method for disabled people to overcome their difficulties in daily life.

Index Terms- Embedded Technology, Text to speech API, Bluetooth Module, Wearable device

I.INTRODUCTION

Communication has a key role in our daily life and in particular in daily activities of people with disabilities. In this world millions of deaf and dumb, blind and physically handicapped people are there. In their day to day life they face many difficulties like to communicate or to control the home appliances inside the home. It is very difficult or impossible for blind people to send SMS or to make calls using a mobile phone. It is very difficult for handicapped people to move around and do their work.

.According to world health organization there were 285 million visually impaired people in the world, of which 246 million had low vision and 39 million were blind. Of those who are blind 90% live in the developing world. Deaf-dumb, blind people can communicate in different ways, according to their actual conditions and to the actual resources available to them. The most commonly used methods to communicate include the use of tactile signing, sign language, and manual alphabets. In two-handed alphabets, the letters are typed onto the palm and/or fingers of the receiver by using the dominant hand of the speaker as the communication tool. The British alphabet interaction gestures are characterized by touches on a finger or on the palm, movement of fingers along the palm or between fingers, holding a finger.

In order to overcome these problem, research on the assistant devices for the deaf-dumb, blind has been done by many people to help reduce the limited ability of the disabled people. The assistive glove for the blind is a device that can help disabled person to perform daily activities without relying too much on others.

The main objective is to design and implement a low cost and open source assistive system exploiting a wearable device in order to support disabled people in communication using the wearable device. Its aim at evaluating its feasibility and its performance.

II.RELATED WORK

“Wearable Messaging Device for Visually Impaired Person”

The solution presented here is for the visually impaired persons and proposes to develop a wearable device that uses embedded system technology for data input functionalities in a hand glove based keyboard. The hand mounted keypad is easily adaptable by the user and provides flexibility as no prior knowledge is required to handle the hand mounted wearable device. The key glove acts as a prototype which enables the user to have the total functionality of a keyboard in one hand. Key glove[1] is attached with alpha numeric keypad buttons that are mounted on the gloves.

Advantage:Efficient to use because message can be converted into text to voice using Robo voice shield

Limitation:This can be implemented in wireless communication using Bluetooth device.

“Fitting like a GlovePi: a wearable device for deaf-blind people”

In this paper, the authors presented GlovePi, a open source assistive system, developed employing low costs hardware components. In particular, the system architecture is composed by three main components: (i) a glove; (ii) a Raspberry Pi; (iii) a MPR121 capacitive touch sensor module with expansion board. Moreover, an android app has been developed to communicate with the server (the Raspberry Pi) and display and listen the phases created by the deaf-blind user, using the glove, during the typing of the Malossi alphabet[2].

Advantages: The proposed system is costs efficient, Simple & ease to use.

Disadvantages: Doesn't provides two-way communication of data, the data flow only from the glove to the mobile app.

“Using Multiple Sensors for Mobile Sign Language Recognition”

Build upon a constrained, lab-based Sign Language recognition system with the goal of making it a mobile assistive technology. We examine using multiple sensors for disambiguation of noisy data to improve recognition accuracy. Our experiment compares the results of training a small gesture vocabulary using noisy vision data, accelerometer data and both data sets combined.

Our goal is to offer a sign recognition system as another choice of augmenting communication between Deaf and hard of hearing people and the hearing community[3]. We seek to implement a self contained system that a Deaf user could use as a limited interpreter. This wearable system would capture and recognize the Deaf user's signing. The user could then cue the system to generate text or speech.

Methods: The most commonly used methods to communicate include the use of tactile signing, sign language, and manual alphabets.

Drawback: Everyone does not understand sign language. Interpreter is needed.

“IoT based Wireless Alert System for Deaf and Hard of Hearing”

Deaf and people with hearing impairment face everyday challenges in identifying the occurrence of household sounds like door bell, child crying or phone ringing. The objective of this paper is to design and implement a low cost stand-alone device for deaf people to notify doorbell ringing who live alone in their house. The system is based on Raspberry pi which includes camera, vibrator, wireless GSM and Bluetooth [4]. When the visitor presses the doorbell, captured image is transferred to the wearable device which helps to know the right person at the door or intruder. After transferring image, wearable device vibrates to notify. Also, the message is sent to the owner through GSM. Visitor's image along with the date and time is sent to the server for retrieving information later. The system is reliable, effective, and easy to use and also enhances the security of the user.

Methods: The objective is to design and implement a low cost stand-alone device for deaf people to notify doorbell ringing who live alone in their house.

Drawback: Not possible to retrieving the captured image stored on server.

III. EXISTING WORK

There are about millions of people around the world who are partially or totally blind. As they lack vision, they face many difficulties in their day-to-day life. In the existing system normal person face problem in communicating with disabled people because they cannot understand sign language. There are not many sign language institutions in our society. So, many of dumb people use usual sort of sign language to communicate and they do not have a customized sign language. It is also not possible for the masses to learn sign language. Therefore, a large communication gap still exists between dumb, deaf and normal people. There are some drawback in the existing system everyone does not understand the sign language interpreter is needed. There are not many sign language institutions available.

IV. PROPOSED METHODOLOGY

In this paper, we propose Glove, a wearable device which acts as an assistive technology for disabled people. The proposed Glove is a low-cost solution supporting to users to autonomously communicate with the rest of the world, letting them directly interact with other persons, without the need of an assistant or of an interpreter.

The proposed Glove is mainly composed by a glove equipped with sensors, connected with an Arduino Uno microcontroller, and connected to the mobile phone via Bluetooth. With the same glove user can control the lights and fans in the home. The glove is fitted with 16 buttons each button has a specific functionalities has shown in the below figure 1. Each button is used for either alphabets or digits for other special purposes.

We have used 9 buttons for alphabets and digits. Out of these 9 buttons each button can be used for four alphabets or digits. For example, if we press once the first button represents character 'a', if twice then 'b', if thrice then character 'c' and if four times the button is pressed than represent 'd'. One button is for space and delete the current character. 10th is dedicated for home automation that can help of controlling the lights and the fan or any other home appliances. 11th button is used spell out some preloaded voices. 12th button is used for space, clear the current text and delete the text. 13th button is used to make call. 14th button is used to send a message. The 15th button is dedicated to read out the sentences typed from the glove. The last 16th button is dedicated for safety purpose. If the button is pressed then the current location will be sent to the predefined numbers.

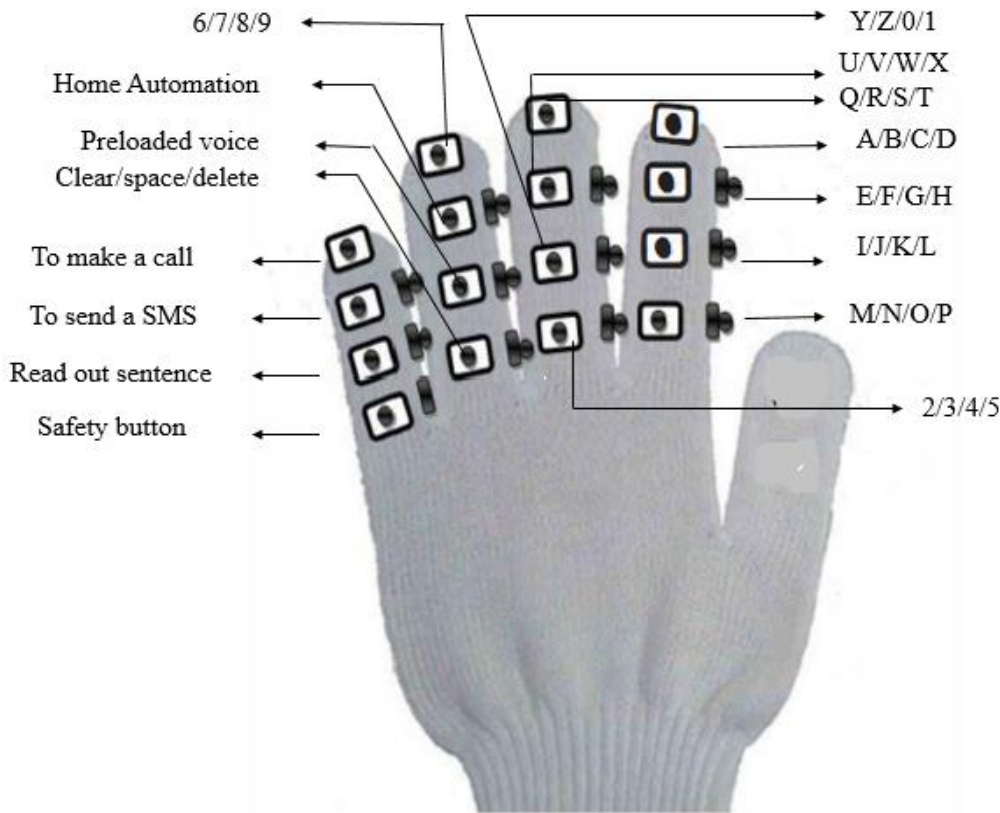


Figure 1: Glove Designs

A. Architectural Diagram

This block diagram shows the methodology of wearable device for blind, deaf and dumb. The proposed hand mounted key glove can be worn in hand. Key buttons are attached with glove that is used by the disabled people in communication.

Basically this keypad aligned in alphabetical order. Input can be provided by typing characters from the glove which are displayed in mobile phone. After pressing the button, it generates a signal that can be passed to Arduino microcontroller. Using Bluetooth HC05 android app will receive the text entered by the user from the glove. Thus the one user can type message, and they can make a call and also type whatever they want to speak with any other person.

In the proposed system, Blind person can send messages and make call using the glove and they can operate home appliances using the dedicated button. If there is any fire occurs, fire sensor detects the fire and automatically buzzer alarm will be on by that time they can use the safety button send the location to family members.

For Deaf and dumb person they can't speak so that they can use the buttons from the glove to communicate with one another the typed sentence will be converted into speech using google API.

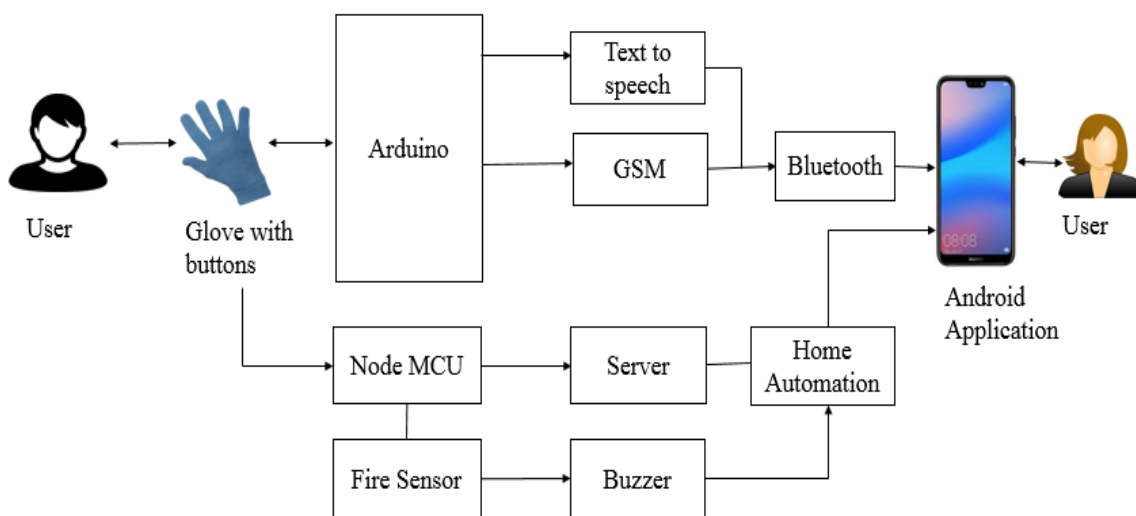


Figure2: Architecture diagram

V. IMPLEMENTATION

Smart glove have been proposed for reducing the disease impact because of improving the usability of technological devices for blind, deaf and dumb people. In order to create a glove prototype a glove, without any sewing's between the fingers and the handbreadth has been purchased. Glove has been mapped with the alphanumeric buttons and different charters to perform different operations. In order to show the output it is separated has glove part and home automation part.

In glove part we equipped the each finger with four buttons, each button performs 4 operations suppose if you press the button once it is 0, twice it is 1, thrice it is 2, if you press the button fourth time it is 4 like that the glove is designed total 16 buttons are attached with the glove except the thumb finger, we are using this finger to operate the glove. Arduino is attached with the glove and proper connection has been done it works using the embedded system technology. Bluetooth is also attached to the glove it is used to send a signal from glove to mobile application.

In home automation part the board is attached with three bulbs connected with the Node MCU and relay. To make connection from glove to home automation we are using node MCU as a Wi-Fi module.

Arduino UNO

Arduino Uno is the main part of this project which it act as microcontroller. The price also cheap and easy to use, it is good for the development of new interesting projects. Arduino Uno is microcontroller based on ATmega328, this board need just to connect to computer using USB cable or using adpoter to connect with battery to get started. It has 14 digital input/output pins, 6 analog inputs, 16 MHz crystal, a USB connection. It contains everything needed to support the microcontroller. All the buttons in the glove is connected to Arduino UNO.

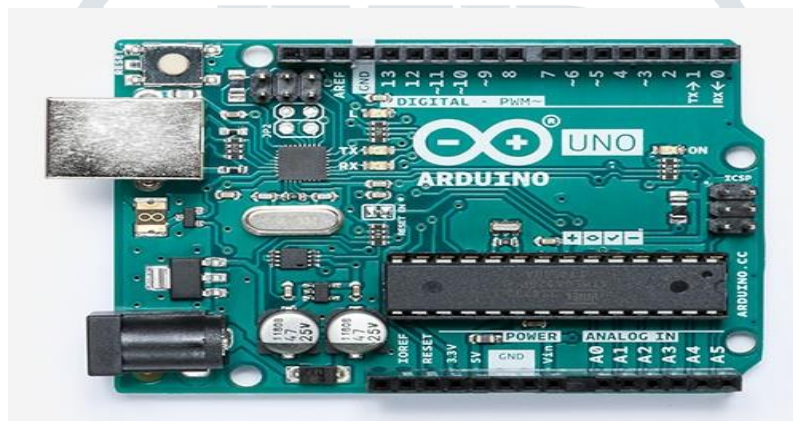


Figure 3: Arduino UNO

Bluetooth HC-05

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. In this project Bluetooth device is used to connection between glove and mobile phone whenever any button is pressed from the glove, it is reaching mobile phone via Bluetooth.



Figure 4: Bluetooth HC-5

Fire Sensor

A fire detector works by detecting smoke or heat. These devices respond to the presence of smoke or extremely high temperatures that are present with a fire. After the device has been activated, it will send a signal to the alarm system and the buzzer will be on. The fire sensor is attached in home automation board when any fire occurs fire sensor detects the fire and the buzzer will be on which is attached in the glove.



Figure 5: Fire Sensor

Node MCU

In order to help the disabled person to operate home appliances, required buttons are fixed in the glove. Here, you will learn to make a Wi-Fi home automation system where can automate your home appliances using glove via Wi-Fi connection. The knowledge gained in this project will benefit you in making other Wi-Fi based or IOT based projects. We will be using an ESP based development board i.e. NodeMCU ESP8266 12E, which is the cheapest and the most useful dev board for this project.

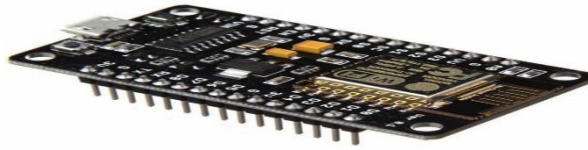


Figure 6: Node MCU

Home Automation

The arduino uno is connected with the Bluetooth HC-05. Connected Relay at D0, D1, D2 and D3 in nodeMCU. Whenever Power is ON the NodeMCU it blinks for a second. When the user wants to control the home appliances using the glove, they can use dedicated buttons to control the home appliances.

Android application

After having generated, stored the data in the Arduino UNO. We have the necessary to get them in an easy way. For this reason android application has been created. Glove send a signal to mobile phone via Bluetooth, once a button is pressed from the glove Android app will receive the text and converted as text to voice.

VI. SNAPSHOTS

The proposed glove is fitted with 16 buttons, out of that nine buttons for alphabets, numbers and remaining 7 buttons with special character performing different operations such as call/SMS and to operate home appliances etc. by using this glove blind, deaf and dumb can communicate between one another.

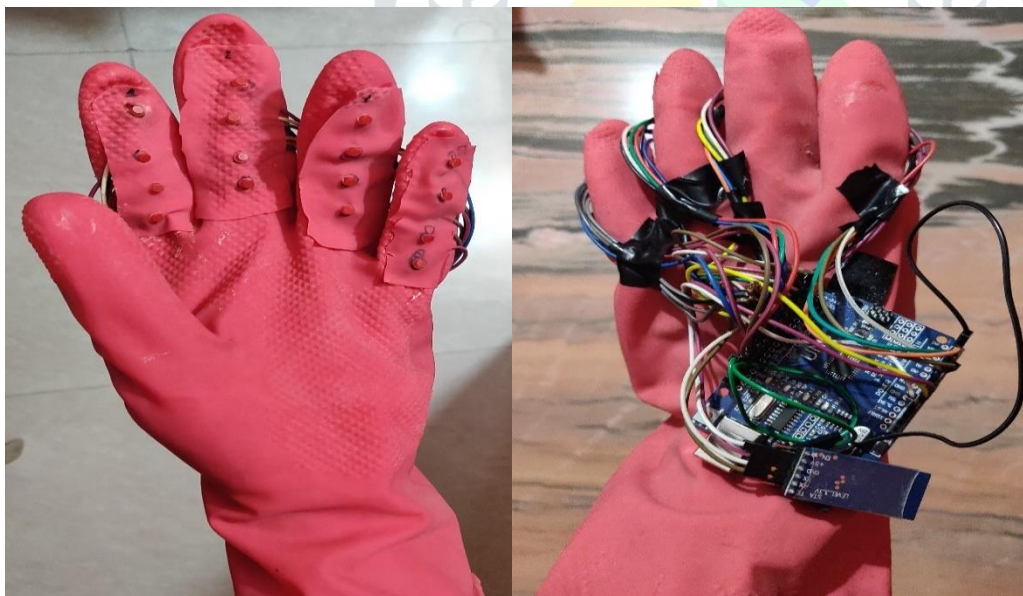
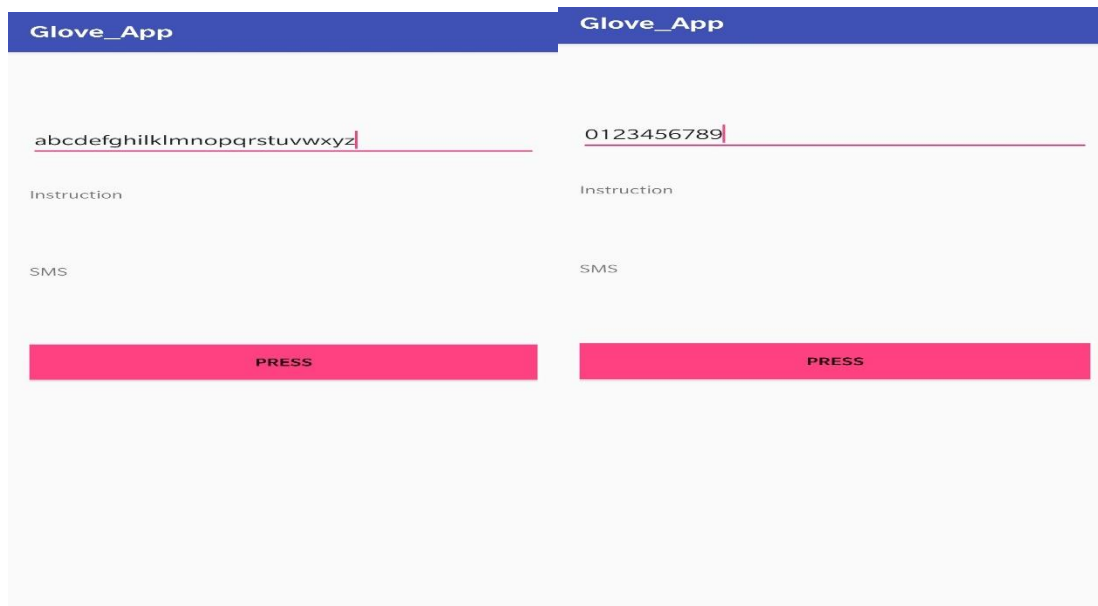


Figure 7. (a)Glove with buttons

(b)Glove Prototype

The figure7(a) and 7(b) shows the proposed glove with buttons and the figure 7(c) and 7(d) shows the glove app for the project.



(c) Glove App with characters (d) Glove App with numbers

VII. CONCLUSION

This paper presents a cost effective wearable technology for blind, deaf and dumb people. With the simple circuit consisting of Arduino, Bluetooth, buzzer, node MCU and fire sensors. The designed glove prototype gives the multifunctional operations in the same glove. By using this glove disabled person can communicate easily and also they can operate home appliances using the button provided in the glove. This design gives better in performance through the introduction of glove attached with buttons, sensors higher in quality. The use of Arduino UNO may also increase the exportable.

VIII. REFERENCE

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