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A Smart Werable Device for Vocally Challenged People Using IoT Platform

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***Abstract*— *Communication between the vocally challenged people and others has never been easy. In our system we have proposed an algorithm for accurate recognition of hand gestures. The system containing LinkIt ONE and FLEX SENSORS helps us in achieving accurate recognition and easy communication. This system eases the speech for dumb people and their location is monitored using the MEDIATEK CLOUD SANDBOX in case of emergency*.**

Keywords*— *Communication, recognition of hand gesture, LinkIt ONE, FLEX SENSOR.

I. INTRODUCTION

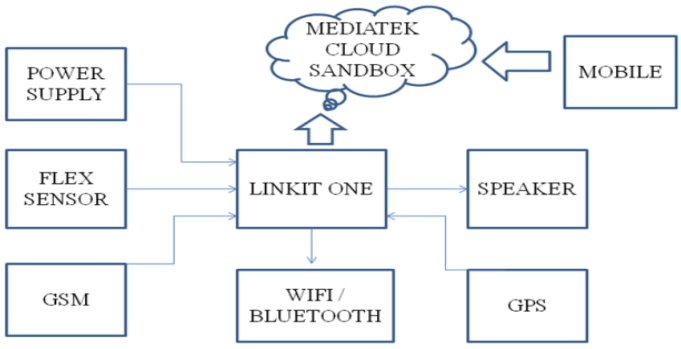
Many physically challenged people in this world are deprived of controlling things around them and they are not able to lead a normal life like normal human beings. About nine million people in the world are vocally challenged. How often we come across these people communicating with the normal world.

The communication between the vocally challenged with others poses to be a serious problem compared to communication between blind and visual person. This creates a very little room for them with communication being a fundamental aspect of human life. The blind people can talk freely by means of normal language whereas the deaf-dumb have their own manual-visual language known as sign language. Sign language is a non-verbal form of interpose which is found amongst vocally challenged in the world. The languages do not have a common origin and hence difficult to interpret..

Communication with the vocally impaired people requires the listener to be familiar with the sign-language, to perceive the information conveyed by them. This increases the complexity in communication and refrains the vocally impaired from approaching normal people. The aim of this project is to design a portable embedded system to provide a simple solution for detection of hand gestures, by reliable signal acquisition. Recognizing the hand gestures, the algorithm will convert them as audio signals. This eases the speech for the vocally challenged by translating hand gestures to auditory speech.

II. SYSTEM MODELLING

BLOCK DIAGRAM OF THE SYSTEM



The above block diagram explains the sequence of actions involved in converting hand gestures into its equivalent audio signals. The FLEX SENSORS are connected to the analog pin of the LinkIt One. Flex sensors change in resistance depending upon the amount of bend on the sensor. They produce electrical when it is bended, the more the bend- the more will be the resistance value. They are usually in the form of a thin strip from I "-5" long that vary in resistance from approximately 10 to 50Kn. They are frequently used in gloves to sense finger movement. The flex sensors are used as input and are placed inside the glove that is to be worn. The sensor is so flexible that it bends easily even with a small bend. As it is very thin and light weight so it is also very comfortable. These sensors are highly sensitive and can detect even a small movement made in the muscles. So, when an action is made, the muscles either expands or contracts, developing a potential difference in them. The resistance value is identified from the sensors. Later, these resistance values are converted into its equivalent electrical parameters and are transferred through to the LinkIt ONE board. The board already has certain voltages and audio output signals corresponding to the voltages, in-built in it. When the board receives an input voltage from the FLEX SENSOR, comparison is done between the in-built voltage and the input voltage and the signal corresponding to the voltage that closely match, is given as audio output. The GSM is connected with the LinkIt One board to send a text message to the parent's mobile in case of emergency. The device is also connected with GPS antenna, so it helps in tracking their location by connecting the device with the MEDIATEK CLOUD SANDBOX.

III. DATA ACQUISTION

To start with our research, on obtaining a bio-signal from the Fingers, which require obtaining a signal proportional to the movement of the fingers. Fingers are able to interpret different hand gestures, research showed that many haptic devices used in prosthesis utilized the conventional method of using EMG signals. Following is the list of possible methods which could be used to sense the hand's movements

- EMG (Electromyography)
- MMG (Mechanomyogram)
- Load cell
- Deterioration of fiber optic cable
- Sliding fiber optic cable
- Strain gauge tactile sensor
- Flex Sensor

After analyzing all of the above methods for signal

acquisition the best solution to use flex sensor in this project as it is comparatively reliable and a cost effective solution.

IV. FLEX SENSOR

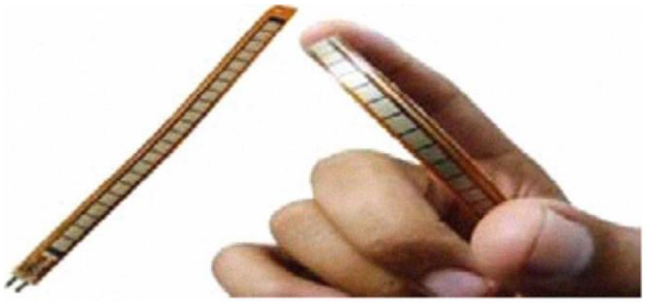


FIG. FLEX SENSOR

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Flex sensors change in resistance depending upon the amount of bend on the sensor as shown in Fig. They produce electrical when it is bended, the more the bend- the more will be the resistance value. They are usually in the form of a thin strip from I "-5" long that vary in resistance from approximately 10 to 50Kn. To sense finger movement they are frequently used in the gloves.

The flex sensors are used as input and are placed inside the glove that is to be worn. The flex sensor is very flexible and it bends easily even with a small bend. As it is very thin and light weight so it is also very comfortable. Its characteristics are described

- Size- approx 0.28" wide and 1"/3"/5"long
- ResistanceRange-1.5-40K ohms depending on sensor. Flex point claims a 0-250K resistance range.
- Lifetime- Lifetime Greater than I million life cycles
- Temperature Range -35 to +80 degrees Celsius
- Hysteresis- 7%
- Voltage- 5 to 12 V

Inside the flex sensor are carbon resistive elements within a thin flexible substrate. When the substrate is bent the sensor produces a resistance output relative to the bend radius. Pragmatically deflection of 00, 200, 400, 450, 500, 700 and 900 will give 10Kn, 14.5Kn, 18.8Kn, 20Kn, 21.1Kn, 25.5Kn and 30Kn of resistances respectively.

V. LINKIT ONE BOARD

FIG. LINKIT ONE BOARD (FRONT VIEW)

The LinkIt ONE development platform is an open source, high performance board for prototyping wearable and IoT devices. It is a SoC based device that is embedded with Media Tek Aster-MT2502 combined with high performance Wi-fi-MT5931 and GPS-MT3322 chipsets, providing wide range of experimenting and access to the users. It also provides pin-out features to Arduino boards, making it easy to connect various sensors, peripherals and Arduino shields.

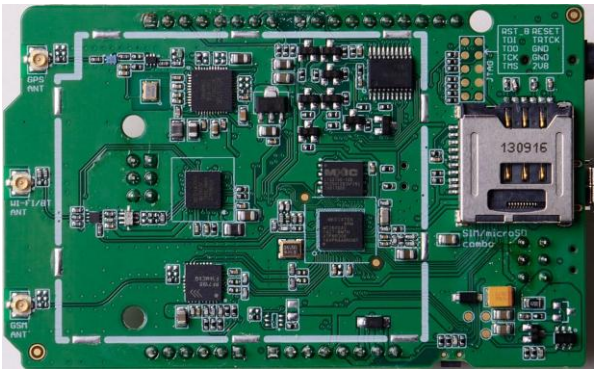

FIG. LINKIT ONE BOARD (BACK VIEW)

LinkIt ONE is an all-in-one prototyping board for wearable devices integrating GSM, GPRS, Wi-Fi, GPS and Bluetooth features into a basic Arduino form factor. LinkIt ONE board can be powered by the micro USB port or by a battery connected to the connector. LinkIt ONE also contains a headphone jack inclusive of stereo and mic, located on the top right of the board. On the back of the board there is a SIM/micro SD card slot and a metallic sheet enclosing the main components MT2502A, Bluetooth and the PMU into the single chip.

CONFIGURING LINKIT ONE

A. Install arduino ide and linkit one sdk

B. Configure the arduino ide

C. Run the test code

LinkIt ONE has been configured and tested successfully.

VI. PROCESSING THE SIGNALS

Once the signals has been transferred to the Link it One via Bluetooth, program has to be written to process the signal. Arduino code is written to program the LinkIt ONE to produce the desired output signal which are obtained from the flex sensor

VII. GESTURE RECOGNITION

A gesture is a form of non-verbal communication or non-vocal communication in which visible bodily actions communicate particular messages, in the form of speech. Gestures include movement of the fingers, face, or other parts of the body. FLEX SENSORS is one of the most efficient hardware used for gesture recognition. When any action is performed, the change in resistance value is sensed and are converted into its equivalent electrical parameter namely, voltage.

FIG. GESTURE RECOGNITION

VIII. IMPORTING AUDIO FILES IN TO THE SD CARD

The LinkIt One board can accept the audio signals in MP3, AAC, AMR and WAV formats. The most widely used format is MP3 for better voice clarity. The MediaTek *LinkIt ONE* development board supports communication with externalmemory, such as an *SD card*, for data storage.The audio signals for various gestures is stored in the SD card and inserted into the LnkIt One board

IX. VIRTUAL SPEECH

Virtual speech is obtained as output from the set of speech signals stored in the LinkIt board that is synchronized with the FLEX SENSORS. Each gesture has a resistance value associated with it, to which an audio signal is assigned and saved in the SD card storage that comes in-built in the LinkIt ONE board. So when a particular gesture is made, the audio corresponding to it is given as output to the speakers, connected in the audio jack of the LinkIt ONE board.

Media Tek Cloud Sandbox

MediaTek Cloud Sandbox (***MCS***) is a cloud based data service platform for Internet of Things. ***MCS*** facilitates fast prototyping your IoT ideation to real solution. Use RESTful APIs to collect data from the devices and view the data on a powerful web-based dashboard that offers a range of display and graphing options as well as the ability to issue commands to control your Wearable and IoT devices. In addition, a complementary smartphone app lets you review collected data and control your devices anytime and anywhere.

MediaTek Cloud Sandbox features:

- Define Wearables and IoT prototype profiles and individual devices within a profile
- Push and Pull data points between a device and the MCS such as geo-location, temperature, humidity and more
- Visualize data points graphically
- Receive email or Mobile Push notifications when data points are collected or changed
- Manage device's life cycle, in the same manner as in a live implementation
- Manage and control devices remotely, using the complementary mobile app
- Create reports about the prototypes, devices and collected data

X. LOCATION TRACKING

If the user in trouble, they send a emergency notification to their parents. Since LinkIt one device is connected to the seed studio MEDIATEK

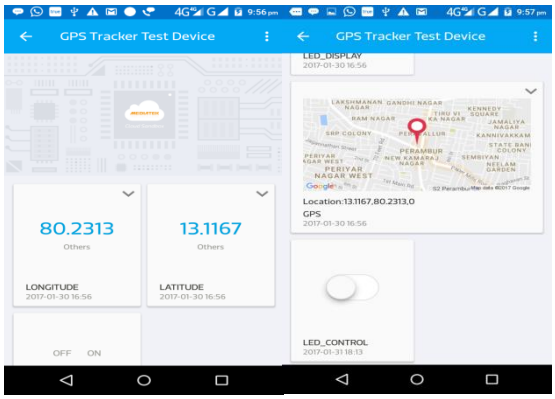

FIG. LOCATION TRACKING VIA MEDIATEK CLOUD SANDBOX

CLOUD SANDBOX, parents can easily track the location of the user by signin to the mediatek cloud sandbox website or by using the mobile application. The notification is delivered to their parents who are indicated to the user by their parents, through blinking a led which is connected to the device. The process is illustrated in the above figure.

XI. CONCLUSION

Thus our project has taken communication a notch higher where the vocally challenged people get benefited. The physically challenged people who felt deprived can see the world in a new perspective with greater confidence and feel more securable with our device. This system overcomes the difficulties faced by them every day and using this system they can get their basic needs satisfied. Many complexities like communication interruption, expressing emotions, views and ideas have been overcome in our device.

People have always been more comfortable using their mother tongue but have been restrained to use only a single language. Hence our project can be enhanced by incorporating speech in several languages that can be used by people all over the world. On a broader perspective, options can be provided to the user of the device, as to which language they prefer and communication can be made.

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