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Assisting System for Deaf and Mute Using Arduino Lilypad and Accelerometer

Rakesh N. S
National Institute Of Engineering, Karnataka
nejanthirakesh95@gmail.com

Rachamadugu Saicharan
National Institute Of Engineering, Karnataka
saicharan.rachamadagu@gmail.com

Praveen Kumar
National Institute Of Engineering, Karnataka
praveensimpi@gmail.com

Harish N. G
National Institute Of Engineering, Karnataka
harishnghari@gmail.com

Aneeta S. Antony
National Institute Of Engineering, Karnataka
aneetaantony_ece@nie.ac.in

Abstract*: In our daily life most of the task we carry out involves speaking and hearing. The deaf and mute people have difficulty in communicating with normal people who doesn't know sign language and misinterprets. In this paper, we have designed a system based on sign language which uses accelerometer through which change in coordinates is measured and is further processed using two microcontrollers at transmitter and receiver side. Text to speech converter and LCD is placed at the output to convey the message of deaf and mute people. Arduino IDE is the software used for compiling and simulating the design. This is one of the fastest responsive systems in this category.

Keywords: Arduino Lilypad, Conductive Threads, Accelerometer, Power Module, TTS 256, Sign Language.

1. INTRODUCTION

In order to communicate between deaf and mute people and normal people, Sign language is used. Sign language relies on sign patterns, i.e., finger position, orientation and movements of the arm to facilitate understanding between people.

In all around the world, about 9.1 billion peoples are deaf and dumb. In their day to day life, they faced lot more problems on their communication. In this project is used to reduce the communication gap between the normal people and disabled people. We have used a glove which consists of an accelerometer which gives the change in coordinates and sent to Arduino lilypad (ATMEGA 328), where further processing is done. An RF transmitter is placed at the transmitter (gloves), the data processed is sent wirelessly to RF receiver at the receiver side, where another Arduino UNO is present for processing of received data. LCD's and Speaker are connected at the output to convey the message of deaf and mute people to normal people.

Through our research, we have made special attention to the design specifications for the circuits designed previously.

The first design [1] was made using flex sensors which are comparatively slower when compared to the accelerometer. Also Bulk ATMEGA circuit board is used in the first design. In our design we have to use ARDUINO Lilypad which is mainly used for fabrication purpose, thus making more compact. As wireless approach is used, it is easily portable.

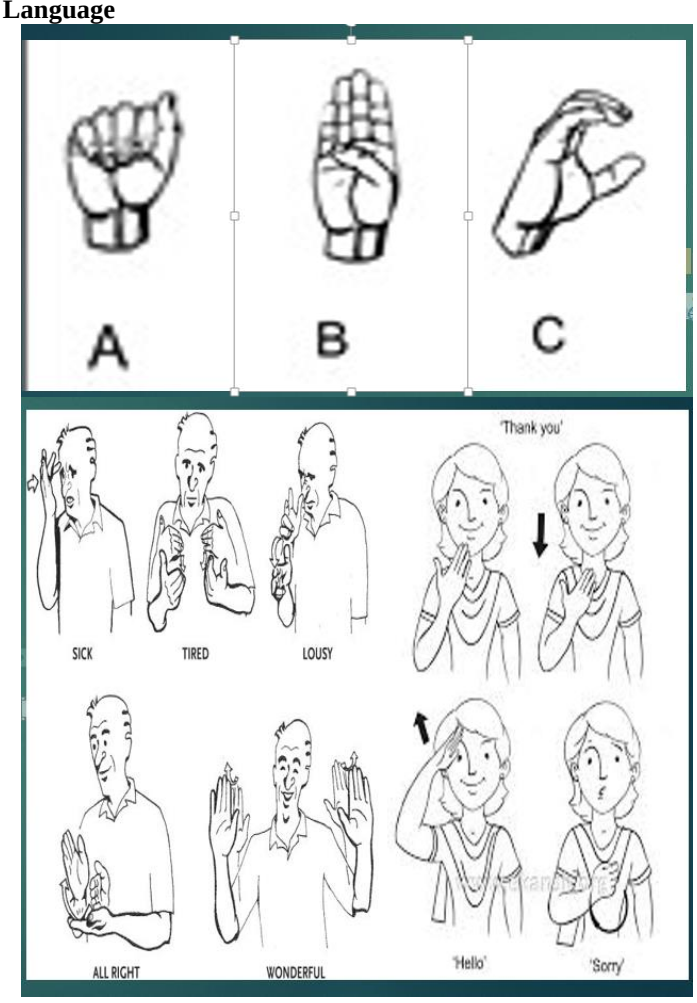
This project helps to build the confidence of the differentially abled people.

2. TOOLS and SOFTWARE USED

- **Arduino IDE**: The open-source **Arduino** Software (**IDE**) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.
- **Arduino Uno**: The **Arduino Uno** is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.
- **Arduino Lilypad**: The **LilyPad Arduino** is designed for e-textiles and wearables projects. It can be sewn to fabric and similarly mounted power supplies, sensors, and actuators with conductive thread.

- **Lilypad compatible accelerometer**: This is a three axis accelerometer for the LilyPad system. Based on the ADXL335 MEMS accelerometer from Analog Devices, the LilyPad Accelerometer can detect joint movement as well as inclination and vibration.
- **Lilypad Power Module**: A small, but the very mighty power supply. This board was designed to be as small and inconspicuous as possible. The nice thing about LiPower is the ability to use rechargeable Lithium Polymer batteries. These batteries are smaller, flatter, and last much longer than an AAA battery. Attach a single cell LiPo battery, flip the power switch, and you will have a 5V supply to power your LilyPad network. Good up to 150mA. Short circuit protected.
- **Conductive threads**: Conductive thread can carry current the same way that wires can, which means it can be used to create a circuit. This allows the user to sew a circuit together, creating flexible circuits that require no soldering. In some textile-based projects, this is the most practical tool to maintain the hang of the fabric. Educationally, it's a very safe and unintimidating way to learn how to use embedded electronics.
- **LCD: LCD** (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, **LCDs** allow displays to be much thinner than cathode ray tube (CRT) technology.
- **TTS 256:** The TTS256 is an 8-bit microprocessor programmed with letter-to-sound rules. This built-in algorithm allows for the automatic real-time translation of English ASCII characters into allophone addresses compatible with the Magnevation Speak Jet Speech Synthesizer IC.
- **Speaker:** For audio amplification and audio output

3. Sign Language

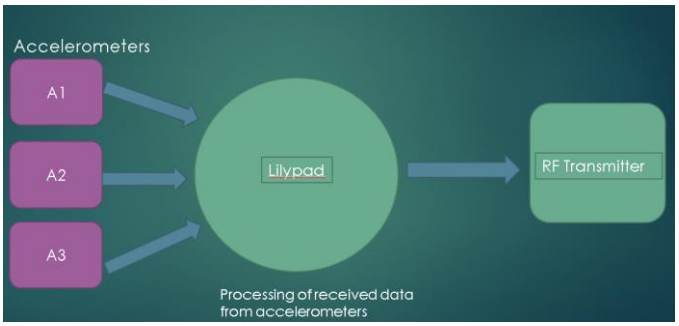


Sign language is used by the deaf and mute people to communicate between them and normal people. There are different sign languages all over the world, just as there are different spoken languages. ASL and British Sign Language are different, mutually unintelligible languages. The discovery that sign languages are languages in their own right has led to the blossoming of literary culture in sign. With a new sense of pride in their language and culture, and rooted in Deaf people's strong story-telling tradition, a new generation of Deaf writers, playwrights, and poets has begun to explore the ways sign languages can be used to create works of art. They have produced literary works in sign languages—stories, plays, and poetry—performed and disseminated on videotape. Sign language has taught us that human language can use either channel— speech or sign. It is a living testament to the fact that language is what we all need to be human.

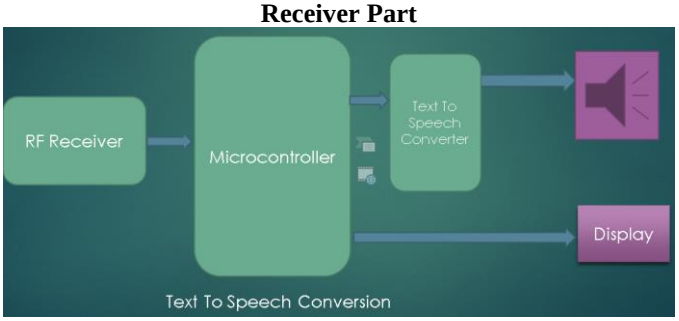
In our project, we use sign language to communicate between deaf, mute people and common people.

4. BLOCK DIAGRAM

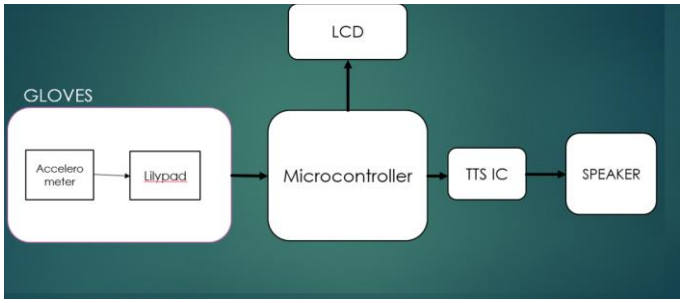
Transmitter Part



Receiver Part



Overall Block Diagram



5. WORKING AND ANALYSIS

Hand gloves should be worn by deaf and dumb people. Gloves are attached with five accelerometers. For every gesture in sign language, there is a change in finger position. This change corresponds to change in coordinates of accelerometer. This data from the accelerometer is processed in Arduino Lilypad.The accelerometer used is Arduino compatible and it is connected to lilypad through conductive threads. Arduino Lilypad is powered with power module which supplies 5V.This data is wirelessly transmitted and received by RF module. At the receiver side, Arduino Uno is used to processing the data received. For the corresponding change in coordinates, the code is written in Arduino IDE to display the character corresponding to sign made and also corresponding audio is also produced. At the receiver, side LCD is placed to convey the message of deaf, mute people to common people. TTS 256(Text To Speech) which takes in text and gives out corresponding audio. This is then given to speaker for amplification of sound.

6. BENEFITS OVER EXISTING TECHNOLOGY

- **Accelerometer v/s Flex Sensors**

The accelerometer is faster when compared to flex sensors because the change in coordinates can be easily recognized when compared to recognition of the change in voltage.

- **Compact v/s Bigger**
  As Arduino lilypad is used which is mainly fore- Textile purpose, design is more compact. Also as Arduino compatible accelerometer is used handling is easy.
- **Sensors v/s Image Processing**
  As accelerometer is used data can be easily processed, whereas if flex sensors used, for analyzing data image processing should be used, which makes the performance slower.
- **Portability v/s Stationary**
  As wireless approach is used design is portable.
- We can convert some gestures into words, unlike only other projects which convert only alphabets.

- A programmable mode can be employed to enable the user to register own gestures for ease of communication.

7. RESULTS AND CONCLUSION

This paper proposes an electronic design that can be used for communication between deaf, mute people and normal people. The following remarks could be the summary of the findings from this work.

- The design is more compatible and faster responsive when compared to existing design using flex sensors.
- A responsive time of 2 to 3 seconds.
- More Compact and portable.
- Efficient communication between differently abled (deaf in this context) and normal people.
- Assign language involves different gestures and hand movement, improves small motor skills of differently abled people.

- ZigBee can be used in place of RF transmitter and receiver for efficient wireless communication.
- A mobile application can be built for the efficient use of the design and to make it user-friendly.

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