

Text Entry System for Visually Impaired- GESTAKSHARA

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ABSTRACT: Across the globe 285 million people are visually impaired, of whom 246 have moderate to severe visual impairment and 39 million are blind (WHO, 2011). One of the most important limitations for those people is the inability to do text entry to any computing devices like PDA, mobiles, laptop and computers etc. However, all the recent technologies developed do not consider these people while designing, hence its necessary to develop electronic accessibility tools in order to fulfill their day to day needs. In this paper, we are using an accelerometer and ARM microcontroller to convert GESTURE to AKSHARA(word) i.e., GESTAKSHARA and converted word is transmitted to any computing device using GSM network. It is believed that our system can help them to do text entry to any computing devices, and with practice they can do it really fast and accurately.

KEYWORDS: accelerometer, GESTAKSHARA, microcontroller, GSM.

I. INTRODUCTION

Most of our social and technological infrastructure are designed and developed for normal person in mind [10]. Many countries maintain costly transportation system depends mainly on the ability of sighted car owners to drive through a vast and strategic road network, while urban and rural regions are kept adequately lit all throughout the night for the whole and sole benefit of sighted inhabitants.

One of the most important limitations for people with visual impairment is the inability to do text entry to any computing devices like laptops, mobile phones, PDA etc. and in this paper we are proposing to make a system which will help them to overcome this obstacle using technology [5], there was a time when disabled people had no option other than asking help [2] [3]. But in modern times they can use technology to assist them. We hope our proposed system will greatly assist visually impaired to do text entry with ease.

II. RELATED WORK

Interface designs for special application scenarios such as Mid-air [1] and Soap-mid-air[2] proposed to modify the objects on a large wall display by means of a handheld device. In their research work, the pointing positions are detected by built-in light sensors and mapped to the screen objects. Two Stick use a game controller to text input for video games. Touch-wheel designed for a one-handed input on a touch-wheel device. Watch-top had been tried to enable text entry with five keys on watch-like devices by enabling dictionary predictions. SCURRY designed a hand wearable device with native accelerometers and detected finger and hand movements for inputting. Foot-Step [3] used foot steps to function the user input system for music menu selection. Tooth Click [5] employed head movements to

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enable screen selections for handicapped people. All these input mechanisms have addressed special needs for unconventional user input method.

Among the input designs and developments, hand-held input devices have been broadly studied to support the demands of invasive computing. Many of these designs have been focused on mobile phone applications. Text input on mobile phones is mandatory for text messaging. Non-texting users would still need to input text for instance, while recording names with phone numbers. On the mobile phone keypad, the English letters, numeric digits, and special symbols are chosen using only 12 keys. The keys are branded with four or five characters, e.g., key 3 is labelled with `3', `d', `e', and `f', which uses consecutive taps to designate the specific character. Hence each character input needs one to five keystrokes i.e., the performance is between 1 to 5 keystrokes per character. Alternative methods to disambiguate keypad input are Tilt Texting, which employs the combination of keys and phone tilt angles and T9 which uses the sequence of keystrokes for the prediction of user input. These techniques illustrated that fewer key input is possible and performance can be improved by using dictionary predictions.

III. PROPOSED SYSTEM

In the proposed system, the important part of the system is MEMS based accelerometer [9], this accelerometer is capacitive based. It uses MEMS technology, it can measure accelerations in 3-axis, from these accelerations, various information like hand motions, tilt and various orientation can be derived and to each orientation and the way it is achieved we can designate a letter to it [1].

Accelerometer output is analogue. Microcontroller acquires the data from accelerometer using internal ADC [6] [7]. Once data is acquired for all 3 axes, then it starts processing it and tries to find of letter from sequence of motion derived from accelerometer output. It requires, some manual input for mode change and final trigger for processing the complete text message [4].

All text and triggers are transmitted to application part/receiver wirelessly, for this we will do encoding of digital data and then transmit it with low cost ISM band 433 MHz RF transmitter or low cost 2.4 GHz based RF module.

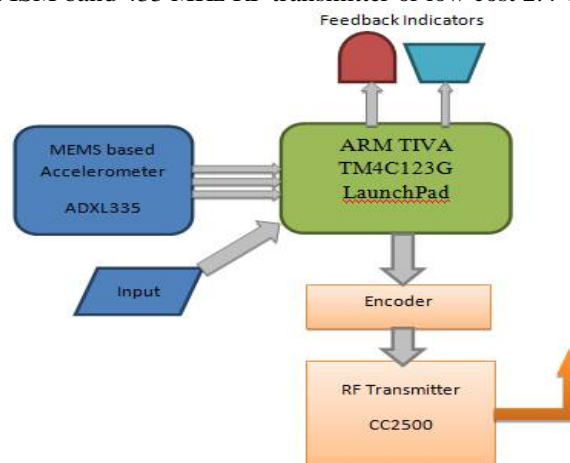


Fig. 1 Proposed Transmitter Block Diagram

In Application part/ receiver, the first step is to receive the text and triggers, this is done by RF receiver of same frequency, after receiving we do decoding and final output data is fed to application micro controller which is running application for text entry[3] and trigger sense, it will show text entered on LCD for debugging purpose and once trigger is received it will communicate with GSM modem using AT commands via Max232, and SMS will be sent to fixed number, if possible we will try to give options for entering mobile number too.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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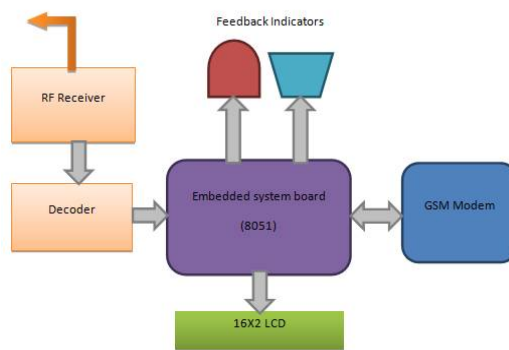


Fig. 2 Proposed Receiver Block Diagram

IV. DESIGN OF GESTAKSHARA SYSTEM

Accelerometer output is analogue, so before processing we need to digitize it, we can use I2C based ADC convertor or we can go for a micro controller which is having in built ADC. If micro controller is not having ADC then we can use PCF8591 which is 4 channels ADC with I2C interface, so we will have small form factor.

Micro controller acquires the data from accelerometer using external or internal ADC once data is acquired for all 3 axes then it starts processing it and try to find of letter from sequence of motion derived from accelerometer output[4]. It required some manual input for mode change and final trigger for processing complete text message.

All text and triggers are transmitted to application part/receiver wirelessly, for these we will do encoding of digital data and then transmit it with low cost ISM band 2.4 GHz RF transmitter.

Table 1: Main state and sub states with various click or final states.

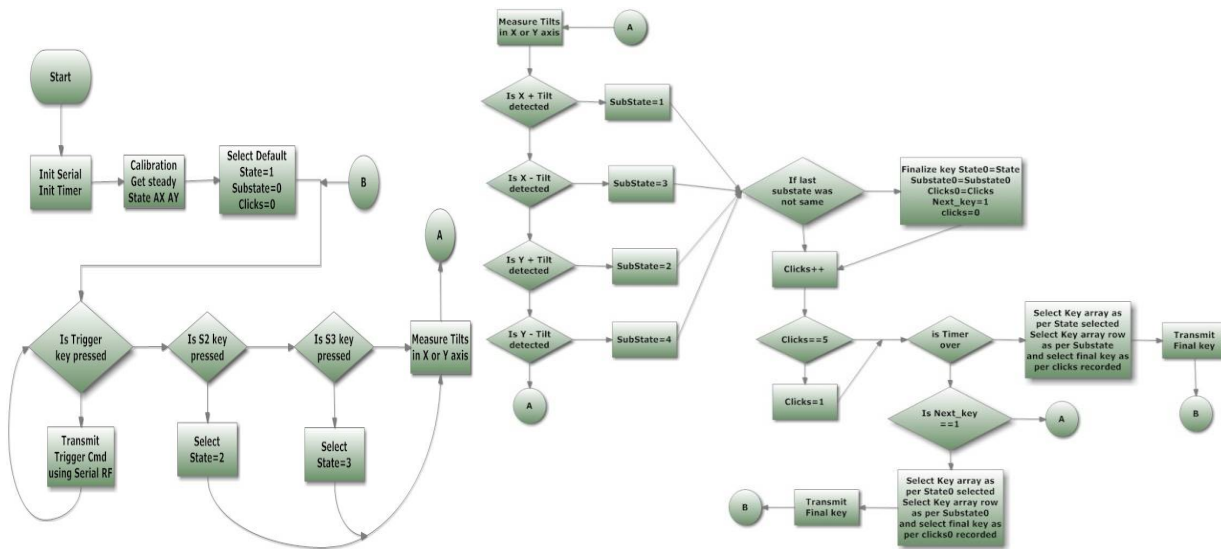
	Main state 1	Main state 2	Main state 3
Forward	A B C D	Q R S T	0 1 2 SP
Left	E F G H	U V W X	3 4 5 .
Backward	I J K L	Y Z ,	6 7 8 ,
Right	M N O P	SP @ ␣ ←	9 + % -

SP space ␣ Enter ← Backspace

V. FLOW CHARTS

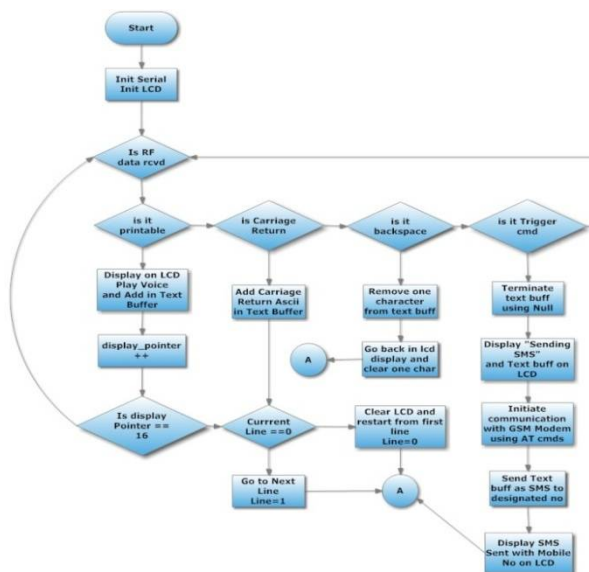
A) For Working of Accelerometer:

Once a character is entered using text entry system using various combinations of tilts and state keys, the final character is transmitted using low cost 2.4 GHz CC2500 transceiver or transmitter in our case.



B) For Working of Text Entry Part:

At the text application part which is sms construction and sms send system using GSM modem receives the characters one by one from the transmitter part and displays that cumulatively on the LCD screen, here LCD screen is only for R&D and debugging later it's not required. Text is also stored in transmission buffer [8]; backspace for error correction is also implemented. For adding this feature extra code was added. For each character receiver voice can be played back and/or beep sound can be given using buzzer. Once trigger is received complete store characters in buffer are send as sms to the required mobile no. GSM modem is connected serially to MCU board and interfacing is done using AT commands.



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(An ISO 3297: 2007 Certified Organization)

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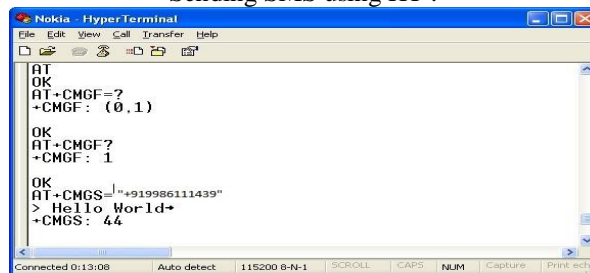
VI. RESULTS

AT commands are used to control MODEMs. AT is the abbreviation for Attention. These commands come from Hayes commands that were used by the Hayes smart modems. The Hayes commands started with AT to indicate the attention from the MODEM. The dial up and wireless MODEMs (devices that involve machine to machine communication) need AT commands to interact with a computer. These include the Hayes command set as a subset, along with other extended AT commands.

The Hayes command set can subdivide into four groups:

1. Basic command set - A capital character followed by a digit. For example, M1.
2. Extended command set - An "&" (ampersand) and a capital character followed by a digit. This extends the basic command set. For example, &M1. Note that M1 is different from &M1.
3. Proprietary command set - Usually starting either with a backslash ("\") or with a percent sign ("%"); these commands vary widely among modem-manufacturers.
4. Register commands - Sr =n where r is the number of the register to be changed, and n is the new value that is assigned.

Sending SMS using HT :



```
Nokia - HyperTerminal
File Edit View Call Transfer Help
AT
OK
AT+CMGF=?
->CMGF: (0,1)

OK
AT+CMGF?
->CMGF: 1

OK
AT+CMGS="+919986111439"
> Hello World+
->CMGS: 44

Connected 0:13:08 | Auto detect | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print-ctrl
```

Reading SMS:

The following command to read the list of all messages on the phone:

```
AT+CMGL="ALL"
+CMGL:123,"REC READ","+123456789"
Hello World
OK
```

The following command to read a message with has index of 3:

```
AT+CMGR=3
+CMGR:"REC READ","+919986111439", "02/04/14,17:46:49-12" Hello World
```

VII. CONCLUSION

We found accelerometer is a new technology which has much potential application in text entry system. We started studying accelerometer and learnt its working and application. We designed a complete low cost portable system with accelerometer and embedded controller, it was initially designed to determine tilt orientation. Our approach in this research has three phases. First, we developed an automation model as the base of the single key input system so that individual characters are input without requiring context information. Secondly, we analysed the tri-axial accelerometer readings during tilting and used these tilts readings to implement the GESTAKSHARA system. These characters which were recognized by the GESTAKSHARA system were transmitted wirelessly to Text SMS application part.

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