Keyboard for Intellectually Disabled

Nitin Thomas[1], Shaniya Shyju[2], Elcen Ninan Zachariah[3], Ajith Mathew Jose[4], Er. Abraham K Thomas[5]

[1-4]*UG Scholar, Department of ECE, SAINTGITS College of Engineering, Kerala, India*
[5]*Assistant Professor, Department of ECE, SAINTGITS College of Engineering, Kerala, India*

Abstract - *Intellectual disability involves problems with general mental abilities that affect functioning in two areas: intellectual functioning and adaptive functioning. Using information technology in work and leisure has become an essential part of life. However, people with intellectual disabilities (ID) may have difficulties in learning the complexskills involved in IT. As modern society relies more and more on IT in daily activities, the poor computer competency of people with ID may lower their level of participation in leisure, functional and vocational aspects of life. With the appropriate support in place, students with intellectual disabilities can achieve a high quality of life in many different aspects. Thus, the basic instrument they need to master first is the keyboard. This project aims to rectify a small part of this predicament by lending assistance to the Intellectually Challenged by the construction of a keyboard, with sublime features specially customized for people suffering from ID.*

***Key Words*: Keyboard, Intellectually Disabled, PIC18F4550 Microcontroller, M031 Microcontroller, Keyboard Matrix**

1. INTRODUCTION

Differently abled people make up about 10% of the world population (600 million) according to a 2011 W.H.O. census. Among them, about 195 million people suffer from Intellectual Disability (ID). Using Information Technology (IT) in work and leisure has become an essential part of life. However, people with ID may have difficulties in learning the complex skills involved in IT, one of the main reasons being the inability to use normal QWERTY keyboards.

As modern society relies a lot on IT in daily activities, the poor computer competency of people with ID may lower their level of participation in repose, functional and vocational aspects of life. Although a major section of them possesses basic education, they have a hard time finding employment.

A well-designed ergonomic keyboard has to provide more comfort, to increase text speed entry and improved comfort but these qualities are accompanied by higher prices. A significant number of analyses focusing on the examination of keyboard layout showed that for novice users, both the QWERTY and DVORAK keyboards look like random configurations. This raises the question whether another configuration can reduce the search time that inexperienced typists need to spend in order to find the right key.

The most important drawbacks of the QWERTY keyboard are:

- Requires all key positions memorization;
- Slows down the speed of typing;
- Produces mental and physical fatigue;
- Increases the number of typing errors;

ABC style keyboard is beneficial for those who are dyslexic or have certain learning disabilities. An obvious advantage of an ABC keyboard is that it reduces the learning curve of memorizing the pattern of keys found on a traditional keyboard. An ABC style keyboard is comparable in price toa traditional keyboard.

Main features of this modified keyboard are Alphabetical arrangement of the letters on the keypad. separate keys for upper- and lower-case letters, additional keys for shortcutswhich include 'cut', 'copy', 'paste', 'save as', 'new', 'undo' and 'redo', independent line is used for special symbols. The corresponding character of key pressed will be read aloud Repetition of any key is avoided which is held pressed continuously for a long duration. All the keys are provided with key-guards to prevent typing of unintended ones. The keys used are translucent, which enables easy sight of the blink.

2. OBJECTIVE

Project aims to lend assistance to the Intellectually Challenged by the construction of a keyboard, by taking advantage of ABC layout which is beneficial for those with learning disabilities and include features like separate upper- and lower-case letters, special keys for 'cut', 'copy', 'paste' for easier and effective use of keyboard. With the appropriate support in place, students with intellectual disabilities can achieve a high quality of life in many different aspects.

3. HARDWARE DESCRIPTION

1. Case
2. PCB
3. Switches
4. Keycaps
5. PIC18F4550 Microcontroller
6. USB – Keyboard connector cable
7. Capacitors
8. Pull-up resistor array
9. m031microcontroller

3.1 PIC18F4550 Microcontroller

Ideal for low power (nanowatt) and connectivity applications that benefit from the availability of three serial ports: FS-USB(12Mbit/s), I^2C™ and SPI™ (up to 10 Mbit/s) and an asynchronous (LIN capable) serial port (EUSART). Large amounts of RAM memory for buffering and Enhanced Flash program memory make it ideal for embedded control and monitoring applications that require periodic connection with a (legacy free) personal computer via USB for data upload/download and/or

firmware updates.

Fig -1: PIC18F4550 Microcontroller

- Full Speed USB 2.0 (12Mbit/s) interface
- 1K byte Dual Port RAM + 1K byte GP RAM
- Full Speed Transceiver
- 16 Endpoints (IN/OUT)
- 48 MHz performance (12 MIPS)
- Pin-to-pin compatible with PIC16C7X5

A large part of this circuitry makes up the key matrix. The key matrix is a grid of circuits underneath the keys. In all keyboards each circuit is broken at a point below each key. When you press a key, it presses a switch, completing the circuit and allowing a tiny amount of

3.2 M031 Microcontroller

Fig -2: M031 Microcontroller

Nuvoton NuMicro® M031 series is 32-bit microcontrollers based on Arm® Cortex®-M0 CPU with 32-bit hardware multiplier/divider. It features 1.8V ~ 3.6V operating voltage, 5V I/O tolerant, running up to 48/72 MHz within -40~105 °C.

- Support single-wire UART half-duplex mode with bit rate up to 6 Mbps
- Support UART (9600 bps) in power-down mode by Internal 38.4 kHz LIRC. Collaborate with 16-byte FIFO to support wake-up function (receiving up to 15 bytes in power-down mode)
- Support High-speed SPI (1.8V~3.6V) with 4x32 byte FIFO & Tx / Rx PDMA function (Master mode 24MHz/ Slave mode 16MHz)
- Pre-stored built-in bandgap voltage value. It can be used to estimate bandgap voltage value at any temperature between -40°C ~ +105°C. The voltage accuracy can be within 1%.
- PWM input clock source can be from PLL (frequency up to 96/144 MHz). PWM frequency can be up to 375 kHz (at 96 MHz clock source). PWM supports capture mode & PDMA. Pulse count value can be directly stored into SRAM using PDMA function. Support to measure the minimum pulse width down to 0.5 us.

4. WORKING

A keyboard is a lot like a miniature computer. It has its own processor and circuitry that carries information to and from that processor. The microcontroller used is PIC18F4550. Large amounts of RAM memory for buffering and Enhanced Flash program memory make it ideal for designing a keyboard.

current to flow through. The mechanical action of the switch causes some vibration, called bounce, which the processor filters out.

If you press and hold a key, the processor recognizes it as the equivalent of pressing a key repeatedly. When the processor finds a circuit that is closed, it compares the

location of that circuit on the key matrix to the character map in its read-only memory (ROM). The processor is in scanning mode looking for inputs from the circuit. Based on the value of input the character is assigned. A character map is basically a comparison chart or lookup table. It tellsthe processor the position of each key in the matrix and what each keystroke or combination of keystrokes represents.

The output is sent from the processor to the computer via aUSB port and the M031 Microcontroller via serial port. Thevoice support uses the value form the serial port and basedon the value of output the audio file is assigned. So, when pressing a key in the keyboard the letter assigned by the micro controller is sent to the USB port and serial port. Based on the value of output at the serial port the voice fileis played by the voice support.

5. CIRCUIT

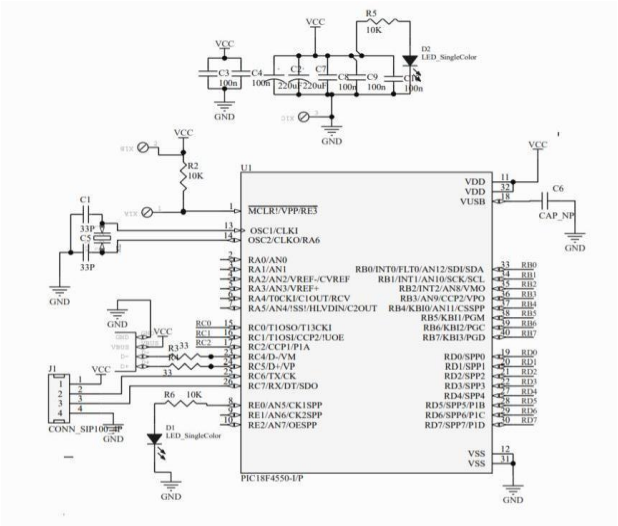

Fig -3: PIC18F4550 Microcontroller Configuration

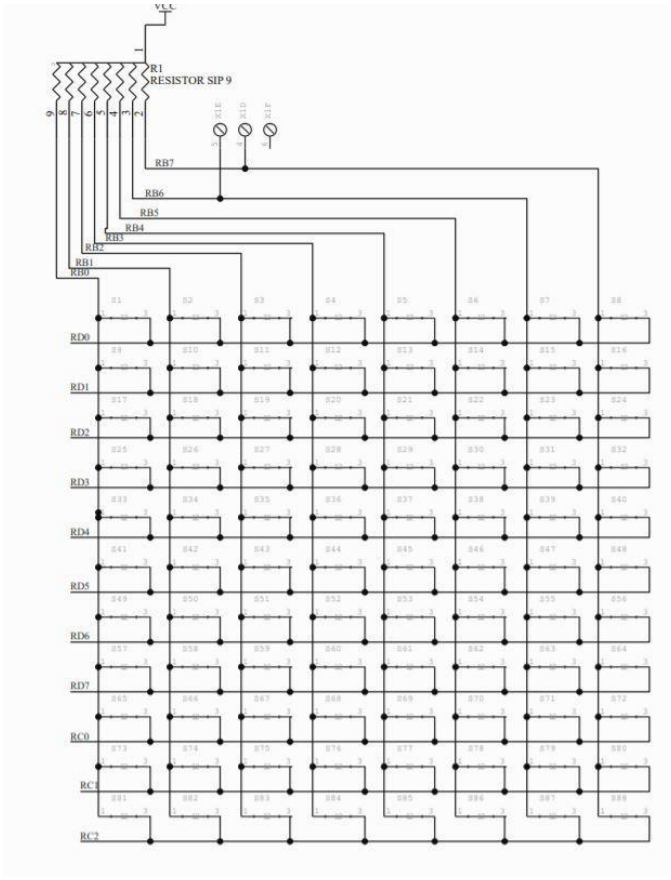

Fig -4: Keyboard Matrix

6. CONCLUSION

The keyboards available currently for people with ID have Alphabetical arrangement of characters (A, B, C…Z). Keys up to the font size of 64. Different colored keys for various sets of characters Our keyboard is by far superior than the existing solution. We have had a 56% increase in the rate of usage during field test compared to the QWERTY keyboards. We will lend a helping hand in bringing people with ID into the digital age and provide employment opportunities to them, and thereby assist India in sustainable development.

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BIOGRAPHIES

Nitin Thomas
Department of ECE
Saintgits College of Engineering

Shaniya Shyju
Department of ECE
Saintgits College of Engineering

Elcen Ninan Zachariah
Department of ECE
Saintgits College of Engineering

Ajith Mathew Jose
Department of ECE
Saintgits College of Engineering