A Novel Idea "DRISTI" Towards Visually Impaired

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Abstract- *In ancient times, Braille system was developed to eradicate the darkness of visual impaired people and make them to gain knowledge for proper interaction with the world. Learning Braille script involves sensing of Braille dots. The size of the dots is too small. Therefore, sensing the dots and recognizing the letters is a difficult task. Visually Impaired students have to memorize/remember various patterns of keys of Braille matrix assigned for different letters / symbols in Braille script to read and write effectively. Different types of Braille devices are available in the market such as refreshable Braille display, rotatable Braille display and panda Braille display. The cost of them is too high. In a developing country like India, people can't afford. From the literature it is known that, in India it is true that computers have not reached even normal schools in the rural and remote areas. Therefore, providing computers for visually handicapped children to learn and use them seems certainly farfetched. Therefore, we got an idea to design and develop user friendly cost effective learning aid for visually handicapped children. The project aims to design a learning aid for visual impaired and offers "Teach and Test" platform in English language which infuse a sense of playing while learning. The proposed idea is implemented on Arduino Microcontroller interfaced with MIC, Braille Keypad and Normal Keyboard as input devices, Speaker, LCD and Braille Cell as output devices respectively. The proposed model is operated in three modes they are, learning mode, Search mode and Quiz mode. In Learning mode user can provide the input to system by either Braille keypad or normal Keyboard. The module will process the input and will develop output on Braille cell, LCD and speaker. In Search mode the user can provide the input to system through MIC. The module will process the input and develop the output on Braille cell and LCD. In Quiz mode the module will pronounce random character on speaker, the user needs to listen and provide input via Braille keypad which will be compared and acknowledged.*

Keywords- Visually Impaired, Braille language, Braille keypad, Arduino.

I. INTRODUCTION

In an information-oriented society, all members of the Society have the right to obtain and use the information. Therefore, it is necessary to develop various devices, which can provide information to anyone easily. Globally more than 44 million people are visually impaired. Physically challenged people like visually impaired or deaf-blind people are facing lots of problem while communicating or interacting with other people. To provide a helping hand towards the visually impaired, recent technological growth has been developing different skilled methods to enhance their communication procedures. Illiteracy among this group is very high, much of which is attributed due to the lack of reading material in accessible format. For reading and writing visually impaired people always use Braille representation of different alphabets, symbols (as shown in fig1) and digits (as shown in fig 2) etc. Braille is the language used by the blind to read and write. It is vital for communication and educational purposes.

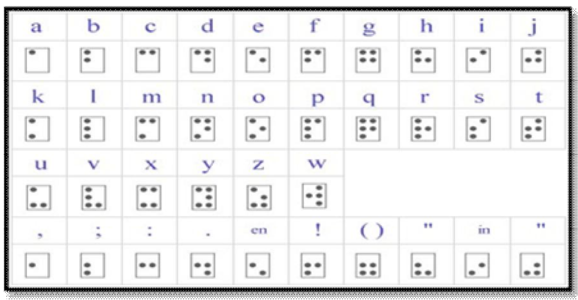


Fig 1 Standard Braille alphabets of English language

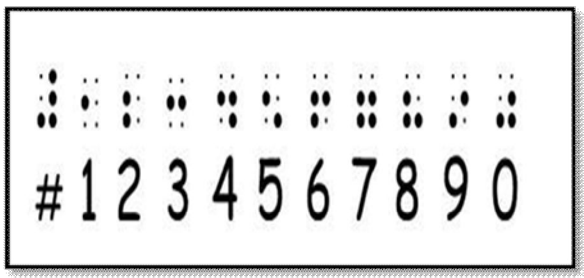


Fig 2 Standard Braille numbers in English language

The Braille is a tactile writing system used by the blind and the visually impaired. It is traditionally written with embossed paper. They can write Braille with the original slate and stylus or type it on a Braille writer, such as a portable Braille note-taker, or on a computer that prints with a Braille embosser. Braille is named after its creator, Frenchman Louis

Braille, as shown in fig 3 who lost his eyesight due to accident in childhood . In 1824, at the age of 15, Braille developed his code for the French alphabet as an improvement on night writing.

Fig 3 Image of Louis Braille

He published his system, which subsequently included musical notation, in 1829 the second revision, published in 1837, was the first binary form of writing developed in the modern era.

A. International Standards of Braille

Braille is a series of raised dots that can be read with the fingers by people who are blind, visually impaired, or deaf blind. Teachers, parents and others who are not visually impaired ordinarily read Braille with their eyes.

Braille is not a language. It is a code by which all languages may be written and read. Braille is now used in almost every country in the world and has been adapted to almost every known language, from Albanian to Zulu. Braille codes have also been developed to represent the many symbols used in advanced mathematical and technical material, musical notation, and shorthand.

B. Braille code

Braille codes are formed within units of space known as Braille cells. A full Braille cell consists of six raised dots arranged in two parallel vertical rows, each having three dots as shown in fig 1.4. The dot positions are identified by numbers one through six. Sixty-three combinations are possible using one or more of these six dots as shown in fig 4. Cells can be used to represent a letter of the alphabet, number, punctuation mark or even a whole word.

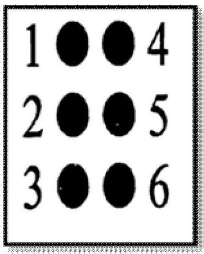


Fig 4 Braille cell

The presence or absence of dots gives the coding for the symbol. Dot height is approximately 0.02 inches (0.5 mm); the horizontal and vertical spacing between dot centers within a Braille cell is approximately 0.1 inches (2.5 mm); the blank space between dots on adjacent cells is approximately 0.15 inches (4 mm) horizontally and 0.2 inches (5.0 mm) vertically. A standard Braille page is 11 inches by 11.5 inches and typically has a maximum of 40 to 43 Braille cells per line and 25 lines.

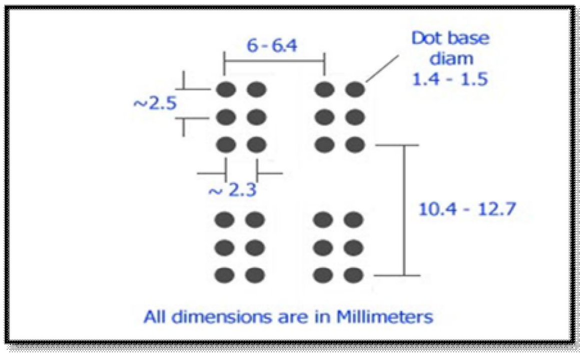


Fig 5 Dimensions of Braille cell

There are a number of different versions of Braille, Grade 1, which consists of 26 standard letters of the alphabet and punctuation. It is only used by people who are first starting to read in Braille.

Grade 2, which consist of the 26 standard letters of the alphabet, punctuation and contractions. The contractions are employed to save space because a Braille page cannot fit as much text as a standard printed page. Books, signs in public places, menus, and most other Braille materials are written in Grade 2 Braille.

Grade 3, which is used mainly in personal letters, diaries and notes, and also in literature to some extent. It is a kind of shorthand, with entire words shortened to a few letters. Braille has been adapted to write many regional languages. Indian Braille is based on Devanagari script which forms the root for all other languages.

II. MOTIVATION

Self-reliance is a word that gives a value to any person by generating self esteem in Her/Him. It is imperative for physically challenged to be self-reliant. To enable these people, it is our responsibility to provide them special care without affecting their self esteem. So, the first step in this regard is to give them the quality education. In this era of technology, one must utilize the technical knowledge to increase the quality of education to enable physically challenged people in society in order to avoid inferiority complex which is the major curse on just society.

Being engineering students, we have thought it would be better to do the project which has humanitarian approach, particularly which addresses the problem of physically challenged people. Among physically challenged people, visually impaired are the most vulnerable, because they cannot differentiate the color and see dimensions of any object. So we have decided to provide them with the learning kit which can reduce their labor and infuses excitation to learn basic letters in Braille.

III. LITERATURE SURVEY

Based on the literature survey performed over standard journal resources, we come to conclusion stating, the present state of technologies used in Braille learning devices.

The devices available in present trend are such that they develop sequential outputs, research is going on to design and develop a system where in it can process the real time input applied using either by Braille keypad, normal keyboard or audio input.

The Braille learning devices are implemented using one of the various platforms available such as Beagle Bone Processor (ARM Processor), PIC microcontrollers, ATMEL 8051, 8052 microcontrollers, MATLAB/Simulink (using image processing toolbox and signal processing toolbox). The above mentioned are various controllers to process the applied input signal and produce the desired outputs on output devices, the selection of the same depends mainly upon ease of programming, availability of number of GPIO pins, ease of interfacing other input and output devices and memory.

The actuators used in most of cases are found to be relays, solenoids switches and led's which replicate the character given as input to the system.

IV. PROBLEM STATEMENT

The major problem with the existing refreshable Braille devices is the cost. Current costs of Braille display technology (currently upwards of Rs 2,58,560/- for a 40-line display) preclude the development of Braille literacy for educational and employment opportunities. In a developing country like India, people can't afford such a huge cost. Another problem with the existing system is that the input given to the device is not real time. Normally they are previously stored data which are sent to the tactile device and then displayed. The existing Braille devices are heavy, and maintenance cost also too high.

V.OBJECTIVE

To provide quality education for the visually impaired students by designing and developing a learning aid which offers "Teach and Test" environment, in three modes which infuse a sense of playing while learning to gain expertise in Braille script in a very cost effective manner.

VI. METHODOLOGY

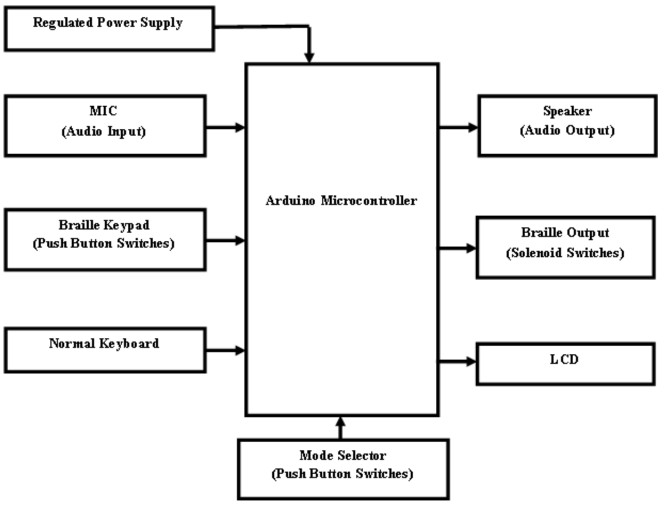


Fig 6 Block diagram of the proposed concept

The above fig. 1.9 represents block diagram of the project carried out . The regulated power supply of +15V is required for the operation of the system. The input equipments are keyboard, keypad and MIC and outputs equipments are LCD Braille cell and speaker. The system offers three mode of operation, learning mode, search mode and quiz mode.

Mode 1: Learning Mode

In this mode input to the system is provided by either Braille keypad or by normal keyboard. The system is so developed that it provides a platform for both normal teacher and blind teacher to teach Braille. In a case if input is given by

Braille pad, the input is read as digital combination of the signal from push button then further processed and compared with predefined combination to determine which letter it indicates. Further the same is displayed on LCD, Pronounced on speaker and represented on Braille output switches.

If the input is provided via keyboard then it develops an ASCII value when any key is pressed on the keyboard the system identifies and the ASCII value of a key further the system maps ASCII value of a key to
a character (number, alphabet or punctuation etc) and identifies character which will be displayed on LCD, Pronounced on speaker and equivalent code is represented on Braille output switches.

Mode 2: Search Mode

In this mode the input is provided through audio channel from mic present in the system along with head phone, further the input audio signal is processed to identify which letter it corresponds to and same is displayed on LCD, Pronounced on speaker and equivalent code is represented on Braille output switches.

Mode 3: Quiz Mode

In this mode the system will generate a random character which the user has to enter only via Braille input keypad which will be processed and verified further it is acknowledged regarding correctness of the same.

VII. HARDWARE IMPLEMENTATION

The hardware design of the overall system has been implemented in the same form as it was designed. The subsystems implemented are illustrated in a sequence.

A.Mode Selector Switch and Braille pad

The fig 7 represents circuit of mode selector switches constructed using push button and resistor of 220ohm. The mode selection keys are push buttons which are used to select the modes of operation. The circuit design for the mode selection buttons is similar to the Braille Keypad. Each switch triggers a digital signal and corresponding mode is activated by the processor.

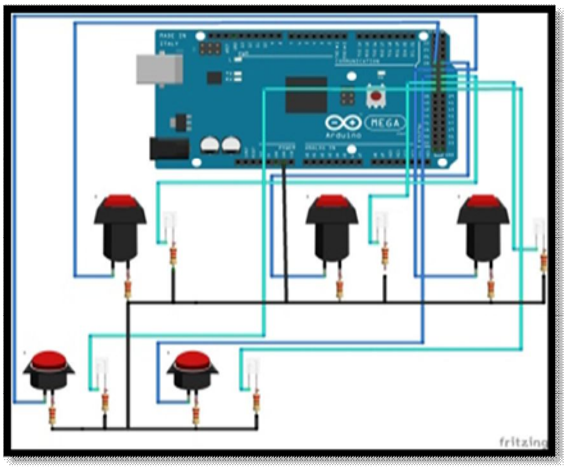


Fig. 7 Hardware implementation of mode selector switch

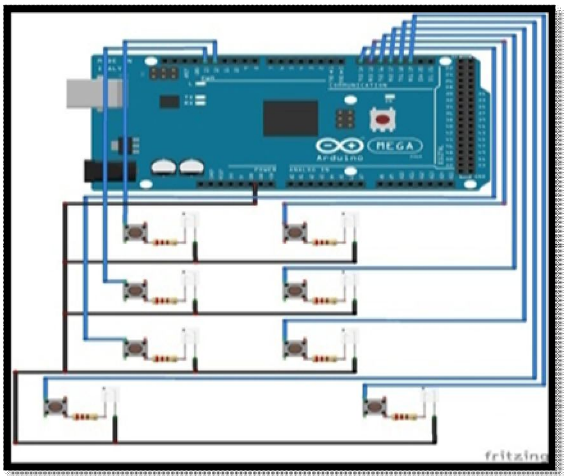


Fig 8 Hardware implementation of Braille keypad

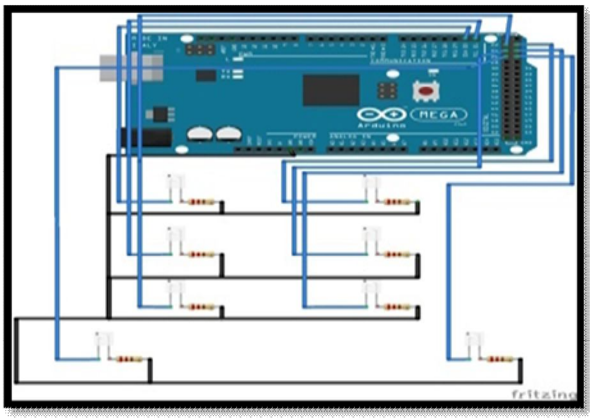


Fig. 9 Hardware implementation of led's to store states of push button

The fig 8 and fig 9 represents circuit of Braille keypad constructed using, push button, LED and resistor of 220ohm. Each key corresponds to one Braille dot and six keys together make up one character. The push buttons in the keypad are pulled to low state in default mode through resistors as seen in the figure. The digital signal through this keypad is send directly to the processor and is processed to give desired results. The Braille keypad is effectively operated so as to provide the user with additional support on the kit. Two additional buttons as input is provided on circuit namely translate and reset button. The feature of translate button is to convey the information to the controller. The reset button is used to bring the system at initial condition in case of any abnormal condition.

B. LCD interfaced with Arduino Mega

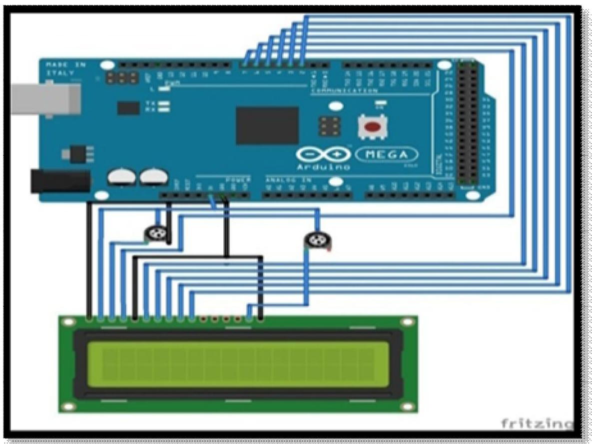


Fig. 10 Hardware implementation of LCD

The fig 10 represents circuit of LCD (20x4) interfaced with Arduino MEGA. The two potentiometer are used in order to control the contrast and brightness of the LCD. The LCD is used to display alphanumeric character. Four bit of data transmission is used to interface between the Arduino and LCD. Only write operation is used by sending a low signal to read/write terminal of the LCD.

C. Solenoid interfaced with Arduino Mega

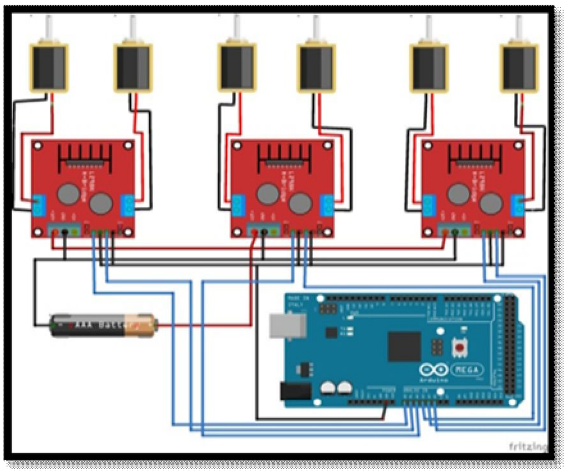


Fig. 11 Hardware implementation of solenoid

The fig 11 represents circuit of solenoid switch interfaced with Arduino MEGA. This circuit is built upon TI' s 16-pin L293D motor driver IC. The IC provides the Vcc supply at the output when the corresponding input is high. It has dual input and output pins. In total, three IC's drive six solenoid actuators of the Braille cell. To avoid damage to the IC from heat dissipation, heat sink fins have been cut and applied on the backside of the integrated circuit.

D. DF Player interfaced with Arduino Mega

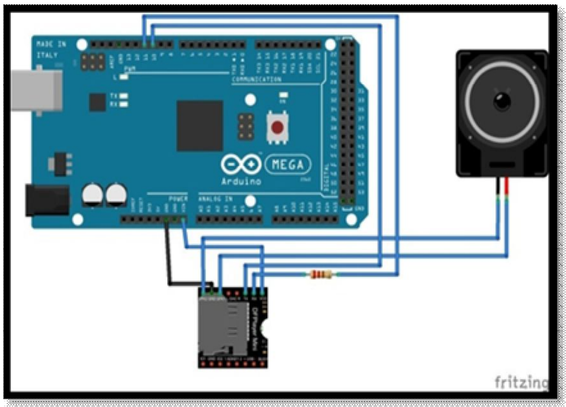


Fig. 12 Hardware implementation of DF Player

The fig 12 represents circuit of DF Player interfaced with Arduino MEGA. The DF Player Mini is a small and low cost MP3 module player with an simplified output directly to the speaker. The module is used as a standalone module with attached battery, speaker and with an Arduino . The DF Player perfectly integrates hard decoding module, which supports common audio formats such as MP3, WAV and WMA. Besides, it also supports TF card with FAT16, FAT32 file system.

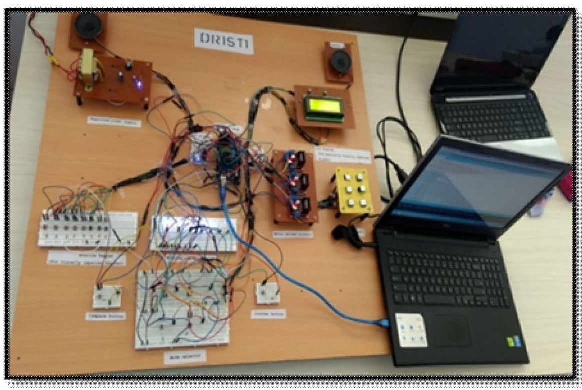


Fig. 13 Hardware implementation of embedded system

VIII. SOFTWARE IMPLEMENTATION

The Fig 14 represents the flowchart for the mode 1 . The module is so designed it would be alert always once powered up to read the data from the user. The system reads data from the user with the help of mode selector switch about the mode of operation of the module.

The user has entered mode-1 (Learning mode), now the Keyboard and Braille pad both are enabled so that the system can read input given by one of them. Lets say the input is given by keyboard, the key pressed is identified and hence the character further its equivalent Braille representation is mapped these data is developed as output on LCD, Speaker and Braille Cell. Lets say if input is given through Braille pad, once the data is read through Braille pad its basically available in 0's and 1's this data is mapped to the predefined characters so that the character can be represented on Braille cell, LCD and speaker.

The Fig 15 represents the flowchart for the mode 2 concept. If the user has entered the mode as mode-2 (search mode), In this mode the mic is enabled and input is read via mic. The input audio signal is processed to identify the character and once the character is identified it is represented on the LCD, Braille cell and speaker.

The Fig 16 represents the flowchart for the mode 3 concept. If the user has entered the mode as mode-3 (Quiz mode), In this mode Braille keypad and speaker are enabled. The system generate a random character and is pronounced by the speaker the user needs to provide equivalent Braille representation of the character for which system gives an acknowledgement about the correctness of the answer.

Mode : 1

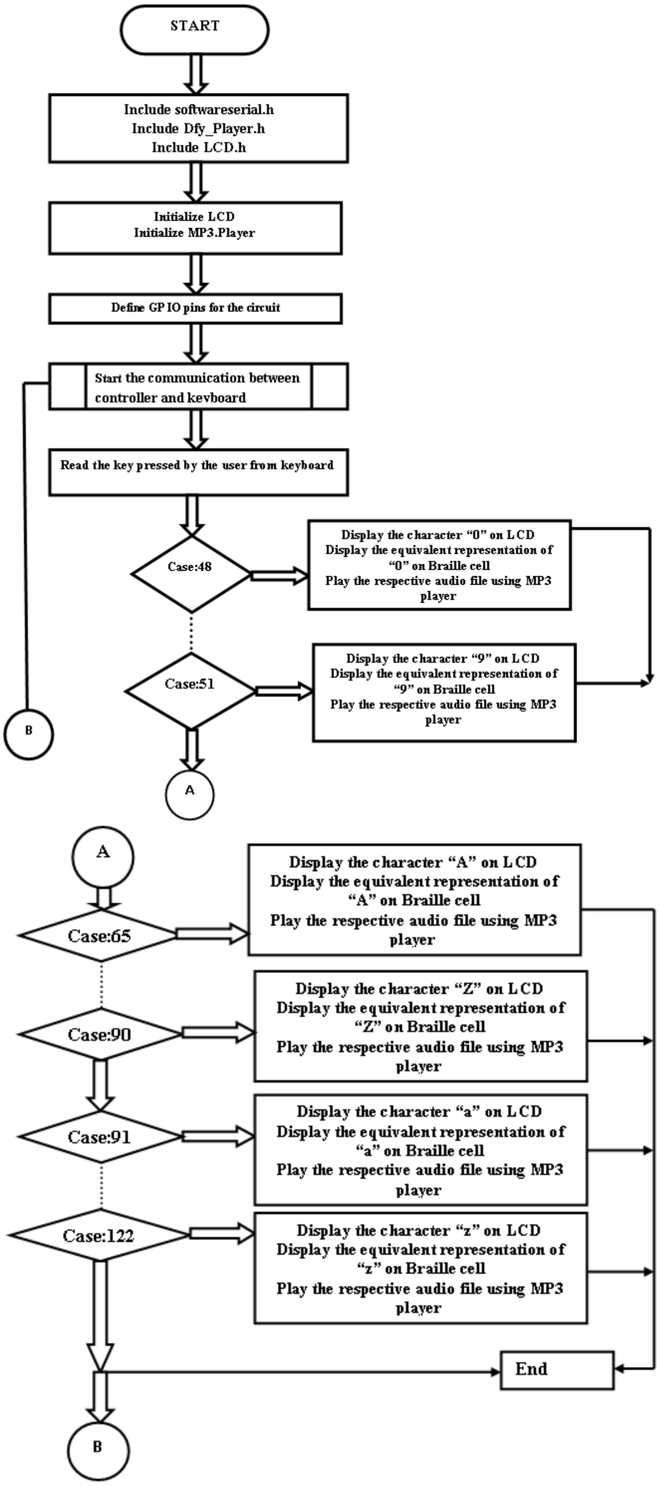


Fig. 14 Flowchart for the mode 1 operation

Mode 2

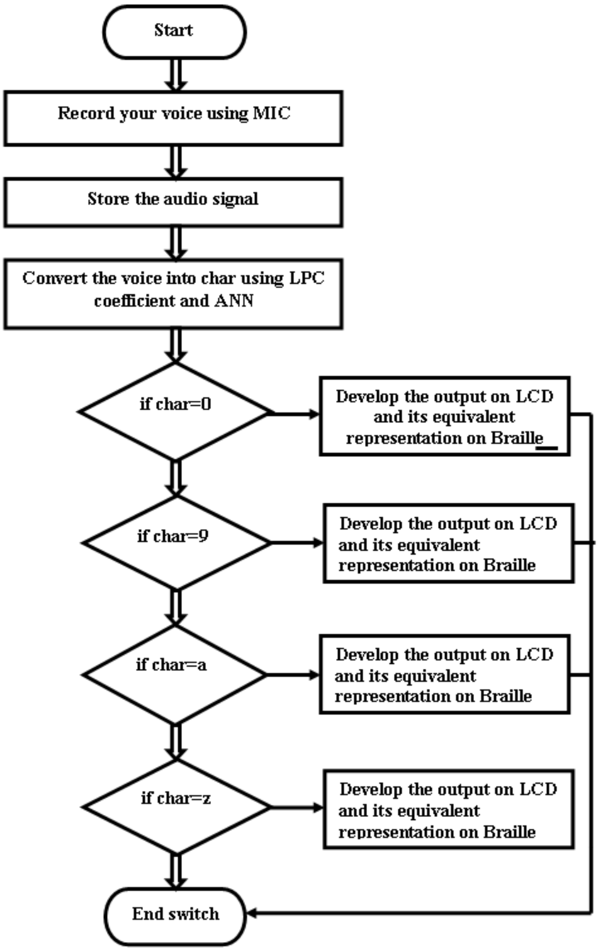


Fig. 15 Flowchart for the mode 2 system

Mode 3

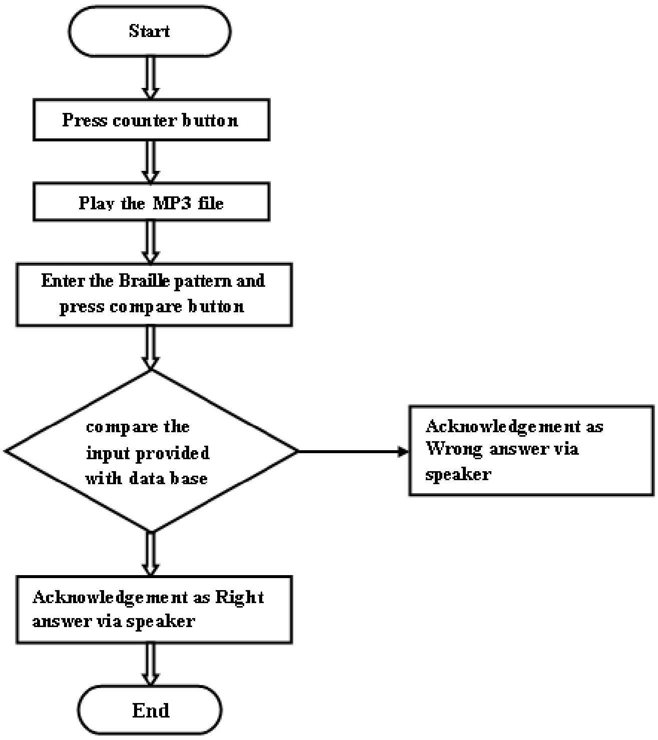


Fig. 16 Flowchart for the mode 3 system

IX.RESULTS

The results of the designed embedded system clearly describe the operational accuracy and effectiveness in making Braille learning an easy and comfortable option. The results for the mode 1 operation give consecutive Braille pattern and concurrent voice feedback from audio output. The results of mode 2 operation worked on the lines of speech recognition. The input audio samples were compared with the samples in the database. The number of stored samples in the database determined the accuracy of the recognition. After a particular number of samples, the voice recognition algorithm becomes independent of the user with almost all characters being recognized accurately and some homophonic alphabets being recognized with high percentage.

The results were calculated as an average over training and testing trials for 26 alphabets and 10 numerals. The proposed speech recognition system faces problems when there are words sounding similar are to be recognized. This system also needs improvement when there is a considerable change in the accent from the words recorded for the training and the words used for testing. The table reveals following facts: The accuracy of recognition of characters is directly proportional to the number of samples recorded for speech recognition and faithful reproduction of the characters

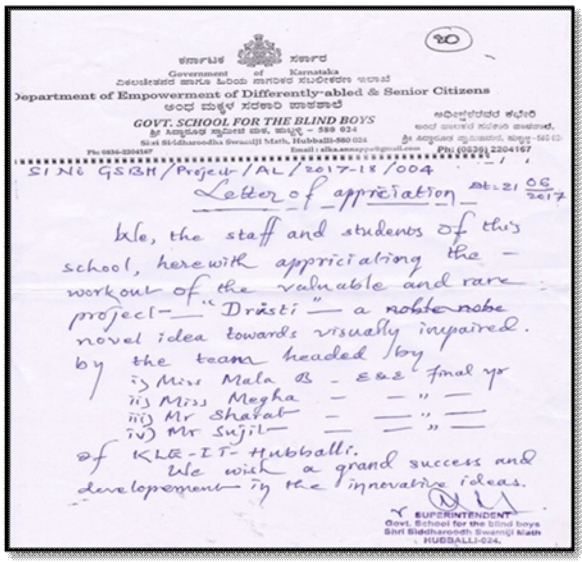
X. CONCLUSION

The problem of Braille literacy is creating a major hurdle in enabling the visually disabled people in achieving a rightful place in the society. The use of Braille system is inevitable for such people. Our project emphasizes on the use of Braille system in an independent, user friendly, portable and cost effective manner. It can affect the learning ability of visually challenged people in a comfortable and interactive way. The software processing that is performed in project is developed independently and does not rely on internet connectivity. The different modes of operation ensure user-friendly approach for the designed system. This device can be used effectively to simplify the learning of Braille. It can prove to be a small but effective step in enhancing the literacy rate for visually challenged people.

XI. ACKNOWLEDGMENT

Many people have made invaluable contributions, both directly and indirectly to our research. We would like to express our warmest gratitude to Dr. Vinoda S, our guide, for her instructive suggestions and valuable comments in the writing of this paper. Without her invaluable help and generous encouragement, the presented work would not have been accomplished. Besides, I wish to thank every people else for their help and suggestions.

XII. ACHIEVEMENT


Government of Karnataka
Department of Empowerment of Differently-abled & Senior Citizens
GOVT. SCHOOL FOR THE BLIND BOYS
Shri Siddharoodha Swamiji Math, Hubballi-580 024

Sl No GSBH/Project/AL/2017-18/004 Dt: 21 06 2017

Letter of appreciation

We, the staff and students of this school, herewith appriciating the workout of the valuable and rare project – "Drsti" – a novel idea towards visually impaired by the team headed by
i) Miss Mala B – E&E final yr
ii) Miss Megha – " –
iii) Mr Sharat – " –
iv) Mr Sujit – " –
of KLE-IT-Hubballi.
We wish a grand success and developement in the innovative ideas.

SUPERINTENDENT
Govt. School for the blind boys
Shri Siddharoodh Swamiji Math
HUBBALLI-024.

Fig. 16 Certificate of appreciation by Govt. visual impaired school

Fig. 17 Certificate of participation in VTU contest on "Science and Technological solution for specially abled persons"

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