

# IOT BASED FULL DUPLEX SMART BRAILLE SYSTEM FOR BLIND AND DEAF

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**ABSTRACT:** The Smart Braille keyboard will replace the old style Braille displays which are noisy, slow and utilize expensive technology like piezoelectrics. The Smart Braille Keyboard will be quiet so all type of handicapped people student will be able to use it in a classroom, any outside environment without disturbing others. This project is based on inventing a messenger for the differently disabled set of Humans, who may not be in the position of using mobile phones for messaging or any other kinds of communicating devices, with the satisfactory comfort. This system is linked with a NODE MCU module for the blind person and to establish a way communication path by using a wireless technology. Here the user sends the SMS to the blind person's mobile app which is able to know the SMS using NODE MCU module through inbuilt wifi shield commands and then converts the characters of the SMS into the Braille language using the lookup table present in its memory. Voice play back and OCR are the main enhancements in this concept. Raspberry integrated with camera implements OCR process for disabled people.

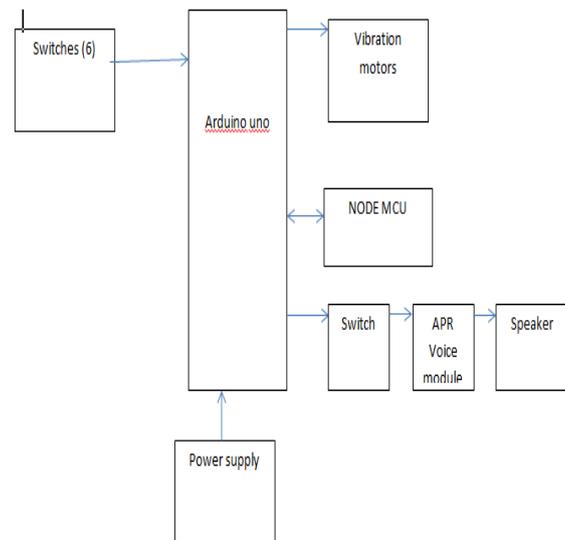
**INDEXTERMS:** *Braille keyboard, NODE MCU, Optical character recognition, Inter-nt of Things (IOT), Arduino-Uno, Raspberry-Pi.*

**INTRODUCTION:** Mobile cell phones are major important part of our modern life. It is always necessary for us to make a call or send a message at anytime from anywhere in world. For visually impaired users voice based list of contact are provided with many cell phones, they can choose contact through voice and make call when necessary. Irrespective of all these advancement in the telecommunication technology, the physically (visually) impaired people have limited access for these technologies. So to fill up the gap between the blind people and the technological advancement in the telecommunication field we have decided to design a SMS system for them. We are designing a modular device which is accessible by blind person. For that purpose we are using Braille language as the backbone of the project. So the blind people use the Braille language for reading and writing messages. Now let's limit our focus towards short message system, it is text messaging service serves as component of mobile phone, by using standardized communications protocols that allow the exchange of short text messages between mobile phones. SMS text messaging is one of the most widely used message application in the world, with 2.4 billion active users, or 74% of all mobile phone subscribers. We are designing such type of a modular device which can be accessible by blind person. Till date they conventionally use Braille books. But it is not an economical way of communicating now a day. It has limitation on the maximum number of words per page and pages per book. So we are interfacing Braille pad with the cell phone so that visually impaired person can have the access to the SMS system. Till date they conventionally use Braille books. But it is not a most efficient and economical way of communicating. We are also providing voice announcement system with it as extra feature. Braille is named after its creator, Frenchman Louis Braille, who lost his eyesight due to a childhood accident. Braille is a system of raised dots that can be read with the fingers by people who are blind or who have low vision. Teachers, parents, and others who are not visually impaired ordinarily read Braille with their eyes. Braille is not a language. Rather, it is a code by which many languages—such as English, Spanish, Arabic, Chinese, and dozens of others—may be written and read. Braille is used by thousands of people all over the world in their native languages, and provides a means of literacy for all. Technological developments in the computer industry have provided and continue to expand additional avenues of literacy for Braille users. Software programs and portable electronic Braille devices allow users to save and edit their writing, have it displayed back to them either verbally or tactually, and produce a hard copy via a desktop computer driven Braille embosser.

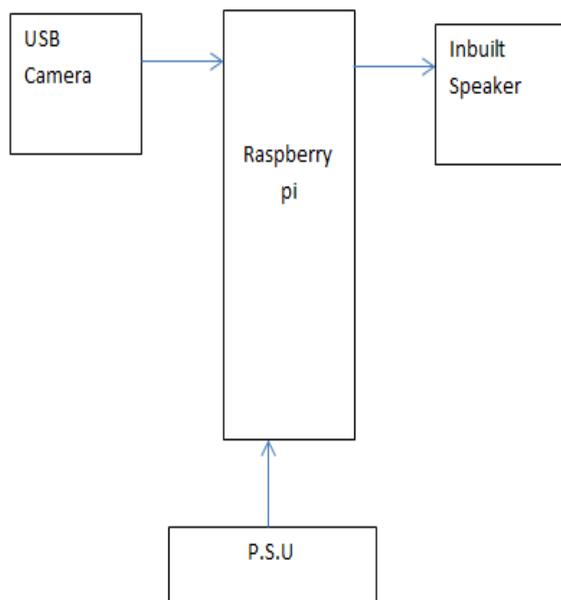
## LITERATURE SURVEY:

With all the technological advances and current devices available, large and good projects are not only restricted to the invention of new technologies and concepts but also, and mainly, to the merging of existing technologies

resulting in new ideas and devices that address problems not yet solved. Tele communication and portable devices, for example, are changing the relationships between human and communication, and are introducing a new approach of communication based on context. According to Braille messenger system this new approach of communication allows impaired people to interact seamlessly with objects, keypad, micro vibrator, environments, etc. This new project concept known as Braille messenger system, named by Louis Braille (1809-1852) has the ability to Introduced then developed many kind of idea this project. Understand the different visually impaired people [Devipriya] [1]. Its current applications and future possibilities can be utilized in an almost invisible way allowing the user to communicate with technology without other people help thus the processes occur for the blind people, as the services and interfaces the microcontroller system, [varsha] [2].The blind people field, in its constant pursuit for finding new methods of idea for read and write SMS, has been and will continue to be, a major beneficiary of telecommunication system. Although not a substitute for the direct contact between impaired people and normal people .Braille is vital to all visually impaired individuals and it's the only system through which visually impaired children can learn to read and write, yet the rate of Braille literacy among visually impaired people belonging to developing countries .[Aamir jameel] [3].The Braille system concept based on visually impaired people, in this people already used for voice based announcement system .the blind people cannot easily access the latest information and the Technologies which can provide them an alternating communication expertise. Modern technological enhancements cannot be easily affordable to the visually impaired people. Braille character is important to developing Braille project. Each and every Braille letter explains this author [S. Majumder] [4]. The reported work advances the state-of-the-art in assistive technology for the blind by enhancing a lowcost automated tutor designed to teach Braille writing skills to visually impaired children using voice feedback. We first provide some background on how the methodology of Intelligent Tutoring Systems correlates to an automated tutor for teaching Braille writing skills[ M. Bernardino Dias USA] [5]. Short Message Service is the cheapest and fastest of all forms of electronic communication. But, the visually challenged haven't been able to use this low-cost facility to the maximum possible extent. Text to voice converters exist, but they suffer a major drawback in the fact that they interfere with the user's hearing, which is the only way by which a blind person feels and senses the world-interfering with this may prove fatal to the user. Braille is a system that allows visually impaired people to write and read. It utilizes the finger touch on raised dots produced by specialized machine. In this paper, we propose a fully system to recognize characters for a single side Braille document. We also present an extensive review for Braille Recognition systems and related research efforts Our Braille recognition system is entirely flexible to the size of the scanned image. We improve each step starting from the image acquisition until the Braille cell recognition final stage. [Aisha Mousa] [6]. [Rowan Ismail Zaghoul] [10]. We propose a simple Braille Messenger which would receive a message and display it in the form of Braille script using vibrators. The Braille Messenger is an extremely low cost, highly efficient and easily implementable product. A GSM modem, a microcontroller, a Braille keypad and a Braille Cell display would suffice. The messages from the modem are filtered and sent to a microcontroller, which would control the vibrators. The micro vibrators mainly using touch to sense understand the various letters by visually impaired people. The Braille people knowledge improved so much of product available in market such as mobile phones. But the visually impaired people cannot able to use this facility. Louis Braille was the father and inventor of Braille system. This is a worldwide universally accepted basic system that is being used by blind people for reading and writing purpose. Braille is read by passing the fingers over characters designed as an arrangement of one to six embossed points. Braille is not a language but it is the way of writing other languages.

**PROPOSED TECHNIQUE:**

a)



b)

**Fig.1 Proposed block diagram a).Communication system, b).Assistance module (OCR system).**

Proposed architecture consist two modules like Communication module as well Assistance module as shown in figure 1.

Communication module is used to transmit or receive message from handicapped to other user, vice versa. Electronic information can be converted in to braille data and braille data also can be converted in to Electronic information through proposed module.

Assistance module is used for Optical Character recognition purpose to assist blind people by pronouncing captured information. Web camera used here for capturing information.

Six switches are provided here for sending information through NODEMCU module to receiver mobile app. Voice play back system is also provided to convert text message in to voice translation. Raspberry pi with live camera is used her for optical character recognision system.

**ARDUINO:**

The Arduino Software (IDE) allows you to write programs and upload them to your board. In the Arduino Software page you will find two options:

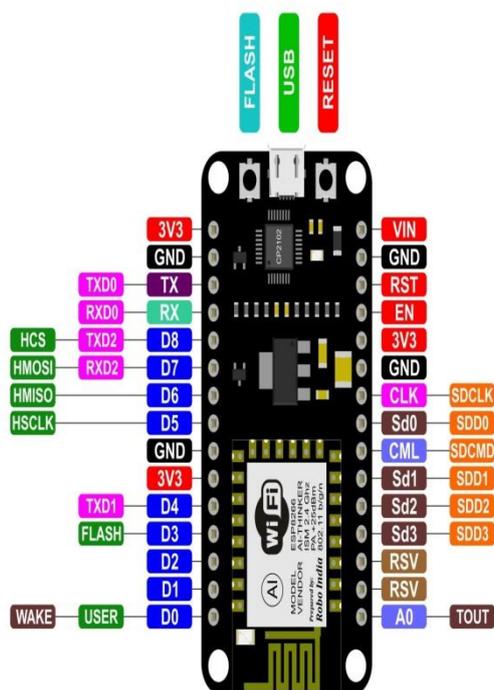
1. If you have a reliable Internet connection, you should use the online IDE (Arduino Web Editor). It will allow you to save your sketches in the cloud, having them available from any device and backed up. You will always have the most up-to-date version of the IDE without the need to install updates or community generated libraries.
2. If you would rather work offline, you should use the latest version of the desktop IDE.

Code online on the Arduino Web Editor.

To use the online IDE simply follow these instructions. Remember that boards work out-of-the-box on the Web Editor, no need to install anything.

### NODE MCU:

The Node MCU is an open source firmware and development kit that helps you to prototype your IoT product with ArduinoIDE or in few Lau script lines. It includes firmware which runs on the ESP8266 Wi-Fi SoC. And hardware which is based on the ESP-12 module. In this tutorial we explain how to use NodeMCU with Arduino IDE.



**Fig.2 NODE MCU Pin out**

The ESP8266 series, or family, of Wi-Fi chips is produced by Espressif Systems, a fabless semiconductor company operating out of Shanghai, China. The ESP8266 series presently includes the ESP8266EX and ESP8285 chips.

**ESP8266EX** (simply referred to as ESP8266) is a system-on-chip (SoC) which integrates a 32-bit Tensilica microcontroller, standard digital peripheral interfaces, antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules into a small package. It provides capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), Inter-Integrated Circuit (I<sup>2</sup>C), analog-to-digital conversion (10-bit ADC), Serial Peripheral Interface (SPI), I<sup>2</sup>S interfaces with DMA (sharing pins with GPIO), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM). The processor core, called "L106" by Espressif, is based on Tensilica's Diamond Standard 106Micro 32-bit processor controller core and runs at 80 MHz (or overclocked to 160 MHz). It has a 64 KiB boot ROM, 32 KiB instruction RAM, and 80 KiB user data RAM. (Also, 32 KiB instruction cache RAM and 16 KiB ETS system data RAM.) External flash memory can be accessed through SPI. The silicon chip itself is housed within a 5 mm × 5 mm Quad Flat No-Leads package with 33 connection pads — 8 pads along each side and one large thermal/ground pad in the center.

### APR VOICE MODULE:

This circuit is designed to record the voice signal. The microphone is used to pick up the voice signal. Then the signal is given to APR 600 multi section sound record and replay IC. APR 9600 is a low cost high performance sound record/replay IC incorporating flash analogue storage technique. Record sound is retained even after power supply is removed from the module. The replayed sound exhibits high quality with low noise level. Total sound recording time can be varied from 32 seconds to 60 seconds by changing the value of a single resistor. The IC can operate in two mode such as serial mode and parallel mode.

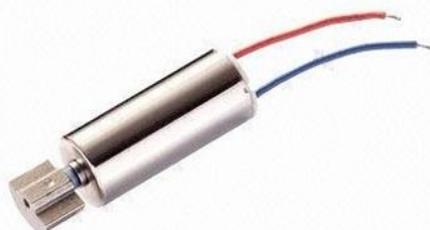
In serial access mode, sound can be recorded in 256 sections. In parallel access mode, sound can be recorded in 2, 4 and 8 section. The IC can be controlled simply using push button keys. It is also possible to control the IC using external digital circuitry such as microcontrollers and computers.

During sound recording, sound is picked up by the microphone. A microphone pre-amplifier amplifies the voltage signal from the microphone. An AGC circuit is included in the pre-amplifier, the extent of which is controlled by an external capacitor and resistor. If the voltage level of a sound signal is around 100mv peak to peak, the signal can be fed directly into the IC through ANA IN pin (pin 20). The sound signal passes through a filter and a sampling and hold circuit. The analogue voltage is then written into non volatile flash analogue RAMs. There are two kinds of modes available. They are Record and Play mode. RE pin is pulled low to enable recording and pulled high for playback. During record mode, we write the processed voice signal into the memory and read the same from memory during the play mode. If the circuit is busy in Reading or Writing, the LED glows indicating that the circuit is busy. This LED is driven by transistor Q1. For recording into memory, MS1 and MS2 are pulled high. To enable recording of message from the microphone, the RE pin goes low. The maximum length of eight sound track is 7.5 seconds each. When LED2 blinks we can speak into the mic. The recording will be terminated if the recording time exceeds 7.5 sec. Similarly for playbacks, RE pin goes high.

M1-M8 is the eight memories that are available; each pin is connected to a push button. The buttons are set initially in a high state. For example, if Button 1 is pressed, the state of the button becomes low and depending on the mode whether it is the play mode or record mode, the memory 1 is chosen to read or write. MS1 and MS2 Pins are used to indicate the part of the memory and number of the memory to be chosen whether it's one full memory or half the memory or a quarter of the memory etc. The Audio amplifier is used to amplify the signal that is to be played and an amplified output is obtained from the loud speaker. If the circuit is busy in Reading or Writing, the LED glows to indicating that the Circuit is Busy.

### VIBRATION MOTORS:

This is the micro vibration motor, as you can see it has two wires red and black. Red is the positive wire while black is the ground wire. The working voltage of the micro vibration motor is 2 to 5 volts.. The rated voltage is 3.7 volts and current is .07 amps which is equal to 70milli amps. As you can see the vibration motor has small thin wires due to which it's really hard to interface this with the Arduino, so I decided to fix the vibration motor on a small PCB board. Nowadays, electric motors are commonly used in people's daily life. Imagine that, in an apartment, a man is watching a movie played by his laptop. At that moment, a motor in his computer runs a CPU fan to draw cooler air into the case from the outside, and some motors runs the cd driver so the information on the disc could be read. So if we connect 3 volts across its terminal, it will vibrate really well, such as shown below:



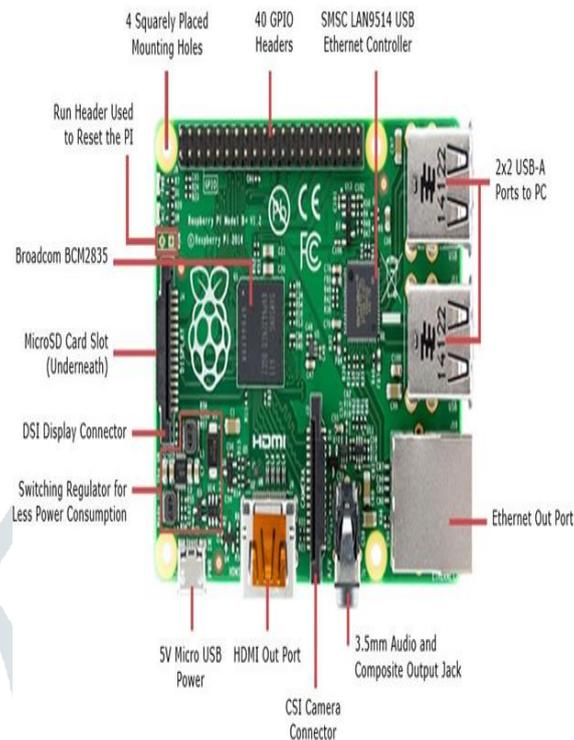
**Fig. 3 Micro Vibrator motors**

This is all that is needed to make the vibration motor vibrate. The 3 volts can be provided by 2 AA batteries in series. However, we want to take the vibration motor circuit to a more advanced level and let it be controlled by a microcontroller such as the arduino. This way, we can have more dynamic control over the vibration motor and can make it vibrate at set intervals if we want or only if a certain event occurs.

We will show how to integrate this motor with an arduino to produce this type of control.

## RASPBERRY PI

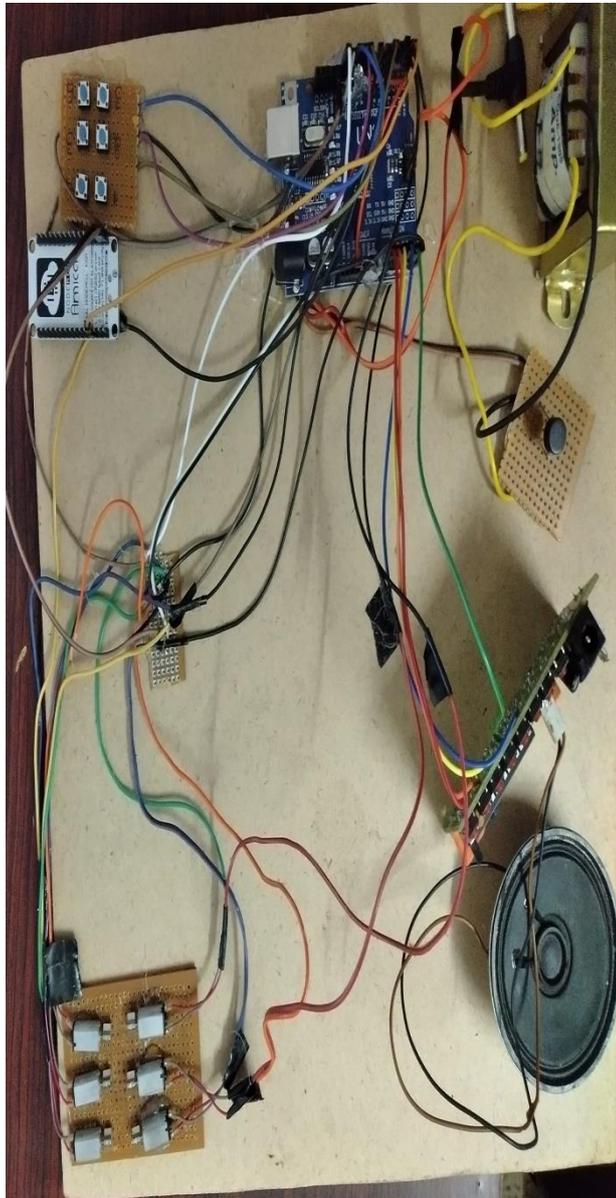
### Image of Raspberry-B+:



**Fig.4 Raspberry pi outer schematic**

- The new Raspberry pi has roughly the same form factor as the ModelB+, which changed the appearance by doubling the number of USB ports to four, adding more GPIO pins, and replacing the SD card slot with a MicroSD one.
- Raspberry pi earns its with upgrades to the CPU and MEMORY. The GPU is unchanged.
- The new pi has a quad-core processor that runs at 900MHZ, compared to a single-core CPU that ran at 700MHZ in the first generation.
- It also an ARMv7 processor rather than ARMv6 processor, which available on the original hardware.
- The new pi will have 1GB of RAM, double the previous version. Raspberry pi is a modelB, though there is no Model A yet for the second generation hardware.

**RESULT:**



**Fig.5 Communication module**



**Fig.6 Assistance module**

**CONCLUSION:**

Both assistance , communication modules works efficiently and accurately. Braille system offers a way of communication for visually impaired people including writing and reading. Communication with this important and effective community from each society .Method and system for Braille Messenger (sending SMS, Receiving SMS) using Visually Impaired peoples, to understand the text message for read and write SMS using some component (Node MCU , Micro vibrators, Micro switches). OCR system works efficiently for real images with predefined conditions.

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