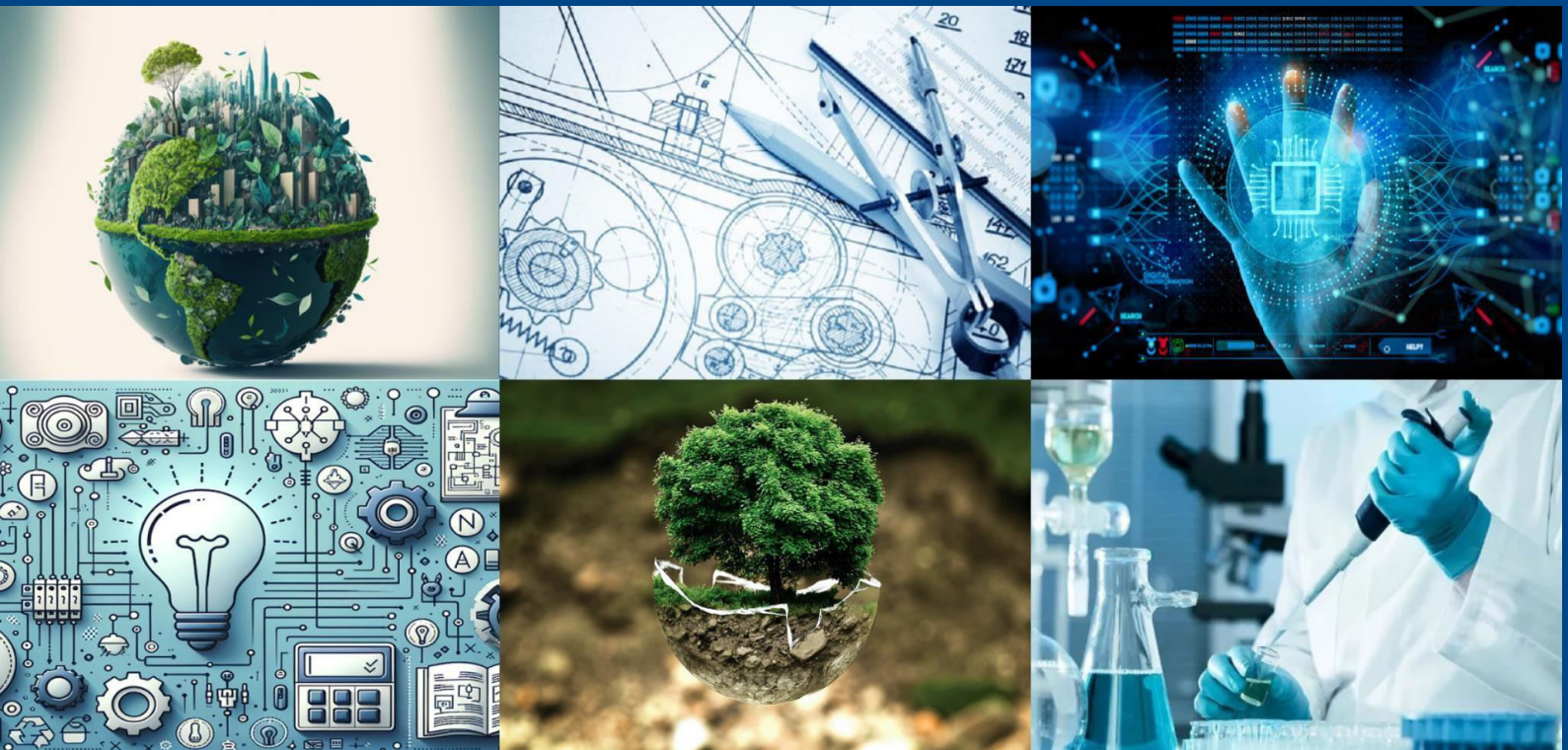




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Braille Converting Communication Device for the Hearing and Impaired Person

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ABSTRACT: This project presents a Tending to the issues of people with visual and hearing troubles through a solitary helping framework is a difficult task. Numerous researches focus on tending to the issues of one of the above difficulties yet not all. This single unique system powered by Arduino is designed to support all these solutions. Braille is a system developed to assist the visually and hearing-impaired person by creating arrangements of dots which form letters, numbers, and punctuation marks. Thanks to technology, our project focuses on achieving the best technique that helps the visually impaired by letting them listen to what is represented as text through GSM as well as feel it in Braille, which is achieved using a device that can understand the text given in the GSM as SMS and convert the content to Braille. An abled person can send a message to a Deaf- Blind person from their mobile phone. Once the message is received by the device, it starts converting the letters in the message to Braille format. The Deaf-Blind person can feel the characters by placing their palm on the Braille display unit. Using the sound bite hearing system technique, our project provides a better way for people with hearing impairments to hear audio by biting the vibrator connected to the GSM module. The deaf person can make a call through GSM using a call switch and also hear the audio from the opposite person by implementing the sound bite hearing system. The GSM module and sound bite hearing system are used for long-distance communication with deaf people.

KEYWORDS: Microprocessor, GSM module, Amplifier vibrator, call switch, mobile phone, Relay, power supply, LCD Module, keypad vibrator.

I. INTRODUCTION

Communication barriers faced by hearing and visually impaired individuals continue to pose significant challenges in daily life. To bridge this gap, technological advancements have focused on developing assistive devices that convert textual information into accessible formats such as speech or Braille. Braille, a tactile writing system, remains an essential medium for visually impaired individuals, enabling them to read and communicate effectively.

Recent studies have explored various methods to facilitate text recognition and conversion into accessible forms. Rupali et al. [1] developed a system for text detection and recognition coupled with speech output, specifically targeting visually challenged users. Their approach highlights the importance of integrating Optical Character Recognition (OCR) with user-friendly output interfaces. Similarly, Nagaraja et al. [2] demonstrated vision-based text recognition using Raspberry Pi, emphasizing cost-effective and portable solutions suitable for assistive technology.

In the realm of tactile communication, Rajkumar et al. [3] proposed a portable camera-based product label reader designed to aid blind individuals in recognizing textual information through assistive devices. Their work underscores the potential of camera-based text capture in real-world environments, enhancing independent living. Text detection in natural scenes, a complex task due to varying backgrounds and lighting conditions, has been advanced by techniques

such as Stroke Width Transform introduced by Epshtein et al. [4]. This method improves accuracy in text localization, which is crucial for converting captured text into Braille. Refer in figure [01].

PROPOSED SYSTEM BLOCK DIAGRAM:

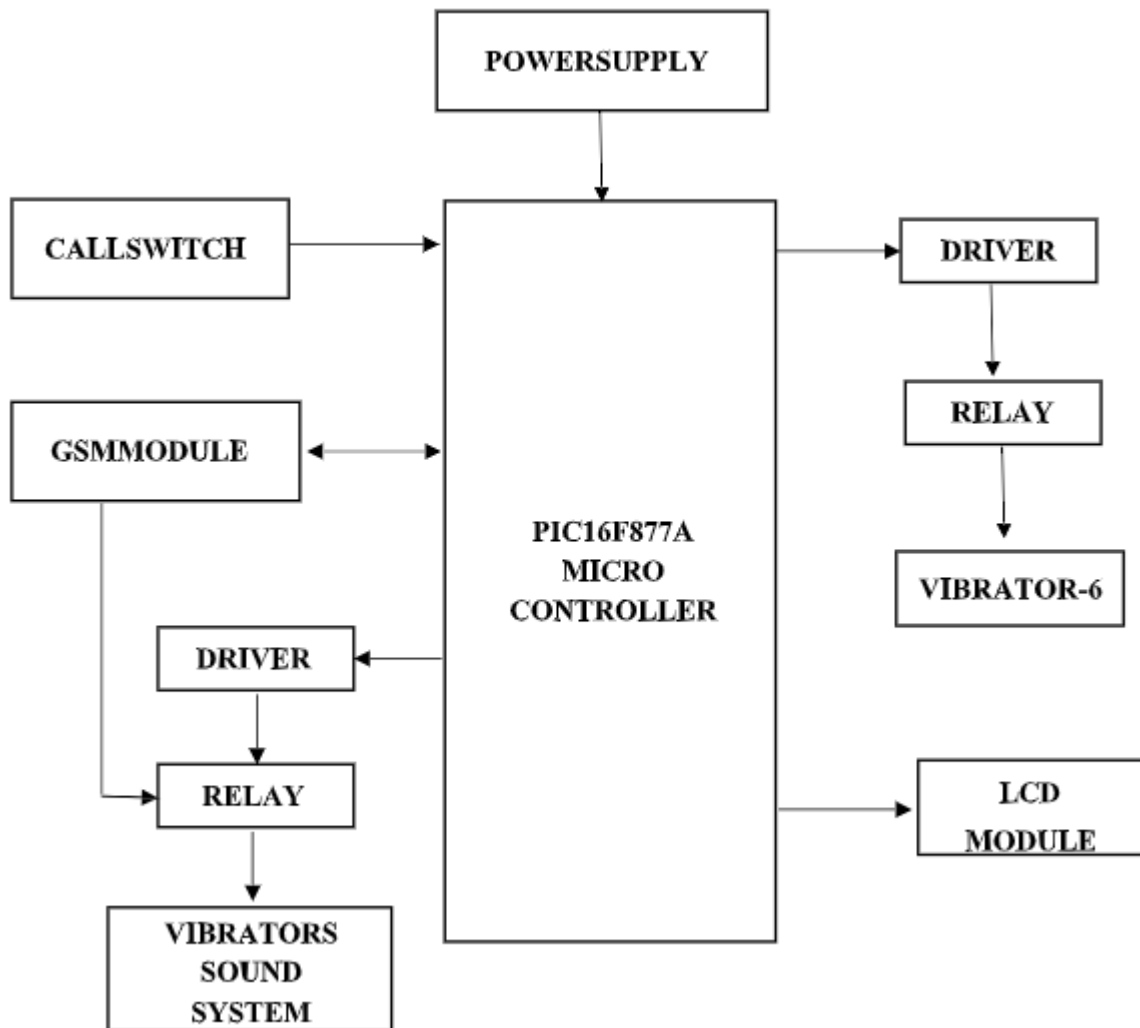


FIGURE: 01

II. COMPONENTS

1. Microcontroller(PIC16F887A)

The PIC16F887A microcontroller serves as the brain of the system. It handles all control logic, processes inputs from the user interface, manages signal conversion, and controls output devices such as the vibrator, relay, and LCD display. Its in-built peripherals make it well-suited for embedded communication applications.

2. GSMModule

This module enables wireless communication by sending and receiving text messages or alerts. In this device, it is used to transmit Braille-converted or user-inputted messages to caretakers or emergency contacts, enhancing real-time communication for impaired users.



3. Relay

The relay acts as an electrically operated switch, used to control high-power components such as the vibrator motor. It allows the low-power microcontroller to safely control these components.

4. VibratorKeypad

This specialized keypad provides tactile feedback through vibrations, enabling visually impaired users to input text or commands. It improves accessibility by providing non-visual confirmation for each key press.

5. Step-DownTransformer(230Vto12V,1A)

This transformer reduces the standard 230V AC mains supply to 12V AC, which is further rectified and regulated to power the low-voltage components of the system.

6. LCDDisplay(16×2)

The 16×2 alphanumeric LCD screen is used to display messages and feedback for users with hearing impairments. It serves as a visual communication interface, showing text-based instructions or converted messages.

7. AmplifierVibrator

This component amplifies the signal sent from the microcontroller to drive the vibration motor. It ensures sufficient intensity of vibrations for tactile output, enhancing message recognition through touch.

8. LED

LEDs are used as visual indicators, providing status notifications such as power on, message sent, or device ready. This helps guide the user through the interaction process.

9. Diode

Diodes are used for rectification and protection. In the power supply unit, they convert AC to DC, while in control circuits, they prevent back EMF and voltage spikes that could damage components.

10. Capacitor

Capacitors are used for filtering and voltage stabilization. They smooth out voltage fluctuations in the power supply and ensure stable operation of the microcontroller and other sensitive components.

11. CallSwitch

A user-activated call switch initiates communication. When pressed, it triggers the system to send a predefined message or alert through the GSM module, allowing the user to request help or signal attention.

Braille works through a system of raised dots that can be felt with the fingertips. Each Braille character, or “cell,” is made up of six dots arranged in a rectangle with two columns and three rows. By combining these dots in different patterns, Braille represents letters, numbers, punctuation, and even symbols. There are 63 possible combinations of dots within a single cell. For example: The letter A is represented by a single dot in the top-left position. The letter B uses two dots: top-left and middle-left. People who are blind or visually impaired read Braille by lightly running their fingers over the text. In the Braille concept we are using two transformers to convert 230 volt into 12 Volt (step down transformer). Capacitor to filter out fluctuations. There are 4 diodes that convert AC into DC signal. LED is used for indication, if the kit is in ON STATE. Microcontroller is used. ADC: 10-bit, 14-channel Analog-to-Digital Converter. Operating Voltage: 2.0V to 5.5V. Relay is a Sensing device. A relay is an electrically operated switch. It allows a low-power signal from the microcontroller to control a higher voltage/current load. GSM module is installed. SIM. The range of the SIM is 2G-3G. GSM module (transmitter) and Microcontroller 16F887A (receiver) Between two ICs. The two ICs are C-MOS. Signal into a carrier signal. Vibrator Keypad to absorb the letter in sign language. Amplifier vibrator are three mode Bluetooth mode, FM mode, and OX mode. Refer in the figure [02]. Amplifier vibrator are in OX mode to detect voice. Switch on Call mode, Amplifier vibrator impaired person are alerted in time due to the vibration to detect the voice. Switch on SMS mode, The SMS is displayed in LCD module. Example: *GOOD MORNING#

CIRCUIT DIAGRAM

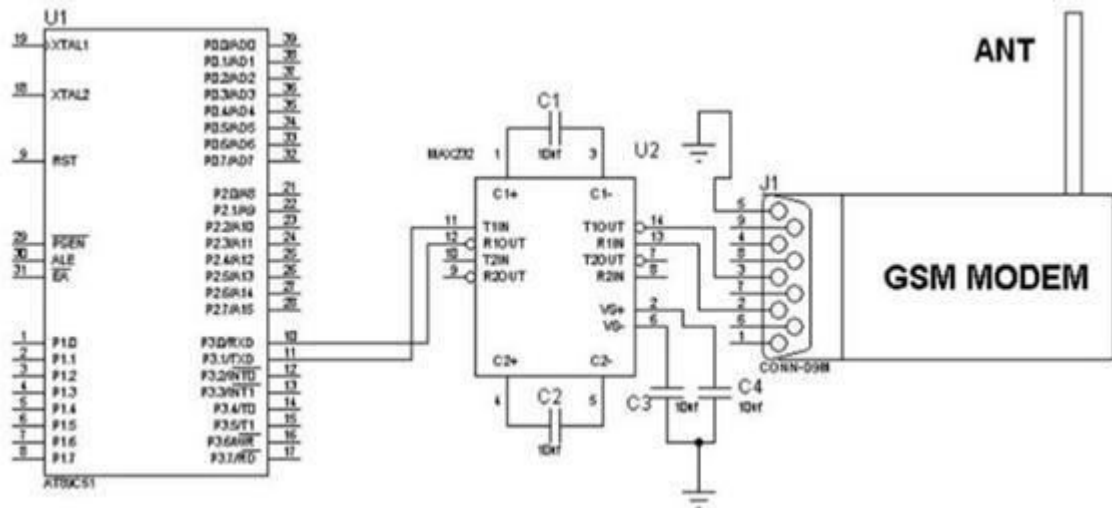


Figure 02: BLOCK DIAGRAM AND WAVE FORM

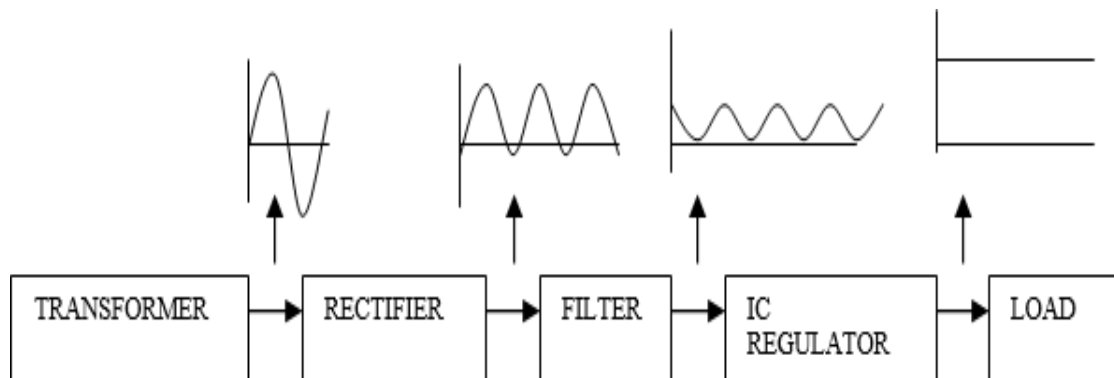


Figure [03]: POWER SUPPLY

The ac voltage, typically 220V, is connected to a transformer, which steps that ac voltage down to the level of the desired level of AC (for example 12 volt ac).Wave form representation is view in figure [03].

- A diode rectifier then provides a full-wave rectified voltage that is initially This resulting dc voltage usually has some ripple or ac voltage variation.
- A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes.
- This voltage regulation is usually obtained using one of the popular voltage regulator .Refer in figure [04].

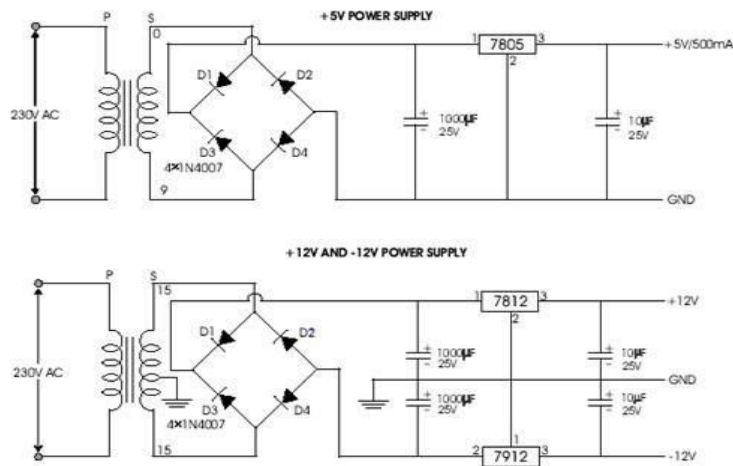


Figure 04: MICROCONTROLLER PIC16F877A

- The below given details are general description of PIC16F877A controller.
- The controller is known as the heart of the entire system which will check for the input and operate the output accordingly.
- Here, temperature sensor, dust sensor and 2 motor unit is connected with the controller's analog and digital pins
- The collected data of the system will be sent to IOT module TX Pin.

Ports in PIC16F877a:

- Port A has 8 Pins in total and it is an analogue Port. All Pins in Port A are analogue.
- Port B also has 8 Pins but these all are digital Pins.
- Port C is also a digital Port having 8 Pins.
- Port C Pins are also used for Serial Communication.
- Port D has 8 Pins and all are digital Pins.
- Port E has 3 Pins.

HARDWARE SETUP:

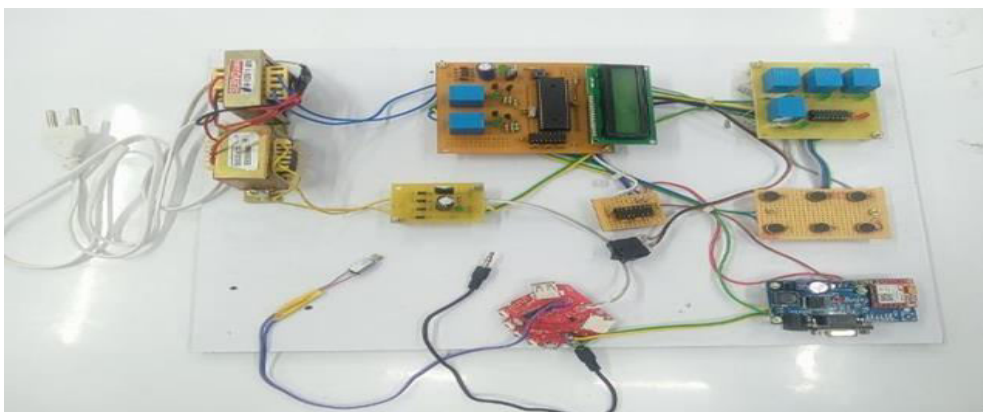


Figure: 05

Merits:

- **Enables Independent Communication**

Braille allows users to read and interpret information without relying on auditory cues or assistance from others, promoting self-reliance and independence.



- **Tactile Accessibility**

Unlike audio-based systems, Braille delivers information through touch, making it ideal for individuals who are both hearing and visually impaired.

- **Supports Education and Literacy**

The use of Braille helps maintain and improve literacy among blind individuals, allowing them to read, write, and engage with textual content effectively.

- **Non-Intrusive and Silent Operation**

Braille devices can operate silently, which is beneficial in quiet environments and for users who prefer privacy when receiving messages.

- **Reliable in Noisy Environments**

Unlike audio outputs, Braille is unaffected by external noise, making it more effective in crowded or loud settings.

- **No Need for Internet or Complex Infrastructure**

Braille communication systems, especially hardware-based devices, can function offline and in remote areas without internet access, enhancing their usability and deployment in underserved regions.

- **Durability and Low Power Consumption**

Most Braille display mechanisms consume minimal power and are mechanically robust, making them ideal for portable, long-lasting assistive devices.

- **Customizable for Multiple Languages**

Braille can be adapted to various languages and scripts, ensuring global usability and wider adoption.

- **Integration with Modern Technology**

Braille concepts can be effectively combined with microcontrollers, sensors, and communication modules (like GSM), as in this project, to create smart devices that cater to a broader spectrum of disabilities.

- **Empowers Inclusive Design**

Implementing Braille in communication devices aligns with inclusive design principles, ensuring accessibility for a diverse range of users.

III. APPLICATION

- **Communication Aid for Deaf-Blind Individuals**

Helps people with both hearing and visual impairments to receive and understand messages through Braille and sound bite techniques

- **Mobile Message Conversion System**

Converts SMS messages into Braille, enabling Deaf-Blind users to read messages sent from regular mobile phones.

- **Accessible Calling System for the Deaf**

Allows deaf users to make and receive calls using a vibration-based sound bite hearing method.

- **Smart Object Recognition for the Visually Impaired**

Detects and announces nearby objects, assisting visually impaired individuals in identifying their environment.

- **Assistive Device for Independent Living**

Empowers disabled individuals to perform daily communication and object recognition tasks without constant caregiver support.

- **Rehabilitation and Training Centers**

Can be used in special education schools or therapy centers to train Deaf- Blind students in communication and mobility.

IV. CONCLUSION

The proposed system introduces an innovative, Arduino-based assistive framework designed to support individuals who are visually impaired, hearing impaired, or both. Unlike existing solutions that address only a single disability, this system offers a unified approach by integrating Braille communication and vibration-based hearing assistance. Text messages sent via GSM are received by the device and automatically converted into tactile Braille output, enabling Deaf-Blind users to read the message by touch. For hearing-impaired users, the system features a sound bite hearing



method, where vibrations transmitted through a GSM-linked vibrator can be sensed by biting, allowing them to perceive sound during calls. Additionally, a call switch enables users to initiate communication independently. By combining these features into a single, low-cost and portable system, the project aims to enhance communication and independence for individuals with dual sensory impairments.

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