Braille Keyboard with Disable People Assistor

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DECLARATION

We hereby, declare that the work presented in this project is the outcome of the investigation performed by us under the supervision of Md. Ashikur Rahman, Lecturer of the Electrical & Electronic Engineering Department, Sonargaon University. We also declare that no part of this project report and thereof has been or in being submitted elsewhere for the award of any degree.

We further undertake to identify the university against any loss or damage arising from breach of the forgoing obligation.

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CERTIFICATEION

This is to certify that the project report **"Braille Keyboard with Disable People Assistor"**, is the confide record of the work done by-

for partial fulfillment of the requirement of their degree of B.Sc. in Electrical and Electronic Engineering at Sonargaon University.

The project report has been carried out under my guidance and is a confide record of the successful work. I wish them success in future.

Supervised By

.....

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ABSTRACT

Braille keyboard is a wired portable keyboard comprises six dots similar to braille lipi designed for the blind people, it can interface with laptops and desktops.
The keyboard comprises 6 push buttons, represented as six dots, which produces every character or a number.
The system consists of an audio jack, through which the blind person can able to hear whatever he or she types.
We can interface the Braille keyboard with a PC through an open source software cool term.

Blind people can type in the word are PPT by using this braille keyboard which can improve their employability skills and they can write their online exams without a third person assistant.The Smart Braille keyboard, integrated with a cutting-edge third-eye system employing ultrasonic sensors, offers enhanced navigation assistance for the visually impaired.

This innovative technology combines a tactile Braille interface for user input with an ultrasonic sensor system to detect obstacles and provide real-time spatial awareness.

The Braille keyboard allows intuitive interaction, while the third-eye system utilizes ultrasonic sensors to scan the surroundings, identifying nearby objects and obstacles. Through a seamless integration of hardware and software, this system aims to empower individuals with visual impairments by offering reliable and immediate environmental perception, facilitating safer and more independent navigation in various settings.

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CHAPTER 1

INTRODUCTION

1.1 Introduction:

As per WHO, in this world, there are 39 million blind people. Out of which 90% are illiterates and 70% are unemployed. The major reason behind this is their poor access to technology. Technology is growing day by day but the use of technology by the blind people is very less due to lack of interfacing gadgets operated by the blind. We have designed a keyboard based on braille lipi. Using this, a blind person who knows braille lipi, will type and enter data into the system, and later convert it into a Word, Spreadsheet, PowerPoint or Text document [1]. This will help the person improve his employability skills and hence increase the chances of employability. One of the major key factors is it will help to write the exams without the need of a third person. The braille keyboard will act has a braille language trainer [2] for those who are in its learning stages. This will also prove to be an effective tool for communication for a blind and dumb person.

1.2 Objectives:

The main objective of this project is.

- Develop a Braille keyboard with an integrated third-eye system using ultrasonic sensors to provide real-time environmental awareness, enabling visually impaired individuals to navigate unfamiliar environments more safely and confidently.

- Implement an ultrasonic sensor-based obstacle detection system that works seamlessly with the Braille keyboard, allowing users to receive immediate alerts and feedback about nearby obstacles or hazards.

- Create an intuitive user interface that combines the tactile input of Braille with auditory or tactile feedback from the third-eye system, ensuring ease of use and accessibility for individuals with visual impairments.

- Ensure compatibility of the Braille keyboard and third-eye system with existing assistive technologies and devices, such as smartphones or navigation aids, for seamless integration into the user's daily routine.

- Strive for high accuracy and reliability of the ultrasonic sensor system to detect and relay precise information about the user's surroundings, minimizing false positives and negatives.

1.3 Background of the work:

The development of the Braille keyboard integrated with a disable people assistor like third-eye system utilizing ultrasonic sensors represents a significant leap forward in assistive technology for the visually impaired. Traditional Braille keyboards offer tactile input but lack real-time environmental perception, while standalone navigation aids often provide limited spatial awareness. Recognizing these challenges, the integration of an advanced third-eye system enhances the functionality of the Braille keyboard, addressing critical navigation barriers faced by individuals with visual impairments. Visually impaired individuals encounter obstacles and challenges when navigating unfamiliar environments due to a lack of immediate spatial information. The innovation behind this project stems from the need to bridge this gap by providing comprehensive, real-time environmental awareness alongside the tactile input of Braille. The third-eye system, utilizing ultrasonic sensors, serves as an additional sensory mechanism, enabling users to detect obstacles, identify distances, and gain a nuanced understanding of their surroundings. By combining a Braille keyboard for user input and an ultrasonic sensor-based third-eye system, this technology aims to empower users with the ability to navigate independently and confidently in diverse settings, including busy streets, public transportation, and indoor spaces. The development process involves intricate hardware integration and software design to seamlessly merge the Braille keyboard with the sensor technology. Challenges include ensuring accurate obstacle detection, establishing a user-friendly interface that combines tactile and auditory feedback, and optimizing the system's compatibility with existing assistive devices. Ultimately, this amalgamation of tactile input and real-time spatial awareness seeks to redefine accessibility for the visually impaired, promoting increased autonomy and safety in their daily navigation endeavors. The project's background underscores a commitment to leveraging technology to break barriers and empower individuals with visual impairments to navigate the world with greater independence and confidence.

1.4 Problem statement:

Visually impaired individuals encounter difficulties in obtaining real-time information about their surroundings while using Braille keyboards, resulting in a lack of immediate spatial awareness and potential obstacles. Existing assistive technologies do not offer comprehensive environmental perception, leading to a heavy reliance on sighted individuals for navigating unfamiliar environments, restricting independence. The absence of a unified system combining tactile input with live environmental feedback increases the risk of accidents or collisions due to the inability to detect obstacles in real-time. The current lack of an integrated Braille keyboard with an ultrasonic sensor-based third-eye system limits the adaptability of visually impaired individuals in various environments, such as busy streets, indoor spaces, or public transportation. Challenges arise in seamlessly merging the tactile input of a Braille keyboard with the functionality of ultrasonic sensors to provide accurate and immediate environmental perception without compromising ease of use. The absence of a comprehensive solution hampers the empowerment of visually impaired individuals by hindering their ability to navigate independently, limiting their freedom and confidence. Addressing these problems through the development of a cohesive system that combines Braille input with real-time environmental feedback from ultrasonic sensors can significantly enhance navigation and autonomy for individuals with visual impairments.

CHAPTER 2

LITERATURE REVIEW

2.1 Existing System Analysis:

Certainly, an existing system analysis for a "Braille keyboard disable people assistor like a third-eye system using ultrasonic sensors," would involve assessing the current landscape of assistive technologies for the visually impaired and exploring any systems or devices that partially address the functionalities intended in this innovation. These keyboards provide tactile input for users proficient in Braille but lack additional features for real-time environmental perception. They primarily serve as input devices without integrated sensory feedback systems. Existing standalone devices offer navigation assistance through GPS or other location-based technologies. However, they might lack comprehensive real-time environmental awareness and tactile input capabilities. Some assistive devices employ ultrasonic sensors to detect obstacles or provide spatial information. However, these systems might not be integrated with Braille keyboards and may not offer a comprehensive solution for both tactile input and immediate environmental perception. Smartphones offer accessibility features such as screen readers and voice assistants, aiding visually impaired users. However, these features do not necessarily include ultrasonic sensors for live environmental perception or tactile Braille input. Some ongoing research or experimental prototypes might explore integrating Braille keyboards with sensory systems for environmental perception. However, these might not be widely available or refined for practical use. The analysis reveals a gap in the existing systems as they lack a cohesive integration of tactile Braille input with an effective real-time third-eye system utilizing ultrasonic sensors. Current systems focus either on tactile input or environmental perception separately, highlighting the need for a combined solution that empowers visually impaired individuals with comprehensive navigation and information in real-time. Developing a Braille keyboard with an integrated third-eye system using ultrasonic sensors aims to bridge this gap by offering a seamless interface that combines tactile input and live environmental perception, thereby enhancing the independence and safety of visually impaired individuals during navigation.

2.2 Literature Review:

Assistive technologies serve as critical aids for visually impaired individuals, aiming to improve their mobility, independence, and overall quality of life. The integration of a Braille keyboard with a third-eye system using ultrasonic sensors represents a promising innovation to address the challenges faced by individuals with visual impairments during navigation. Several studies have explored the significance of Braille keyboards as essential tools for providing tactile input to visually impaired users. These keyboards offer a means of communication and data entry but are often standalone devices without integrated environmental perception features. Research has extensively discussed various sensory systems, including ultrasonic sensors, employed in assistive devices to aid in obstacle detection and spatial awareness. Ultrasonic sensors have shown promise in identifying obstacles in proximity but may not have been integrated effectively with Braille keyboards for comprehensive navigation. Literature in HCI emphasizes the importance of designing user-friendly interfaces and accessibility features for individuals with visual impairments. Studies highlight the significance of tactile feedback and intuitive interfaces but might lack comprehensive exploration of integrating tactile input with real-time environmental feedback. Some publications discuss experimental prototypes and emerging technologies attempting to merge Braille input with sensory systems. These studies often showcase proof-of-concept designs or early-stage developments, outlining potential benefits but may lack practical implementation or user-centric evaluation. Several articles address challenges associated with integrating tactile input via Braille with real-time environmental perception using ultrasonic sensors. Challenges include hardware-software integration, accuracy of sensor data, ergonomic design, and usability considerations. Opportunities for improvement and future directions are often proposed, emphasizing the need for enhanced integration and user involvement in design processes. The existing literature underscores the importance of integrating tactile input through Braille with immediate environmental perception using ultrasonic sensors to enhance navigation for the visually impaired. However, there remains a gap in the research concerning a fully integrated, widely accessible system that seamlessly combines these functionalities. This literature review emphasizes the need for further research, development, and user-centered design to create a comprehensive Braille keyboard with an integrated third-eye system using ultrasonic sensors. Such a system could significantly empower visually impaired individuals, enabling them to navigate their surroundings with increased confidence, independence, and safety.

CHAPTER 3

METHODOLOGY

3.1 Description of Methodology:

Creating an idea for Design and construction of Microcontroller Based Braille Keyboard With Disable People Assistor and designing a block diagram & circuit diagram to know which components need to construct it.

Collecting the all components and programming for the microcontroller to controlled the system. Setting all components in a PCB board & soldering. Then assembling the all block in a board and finally run the system & checking.

3.2: System Planning:

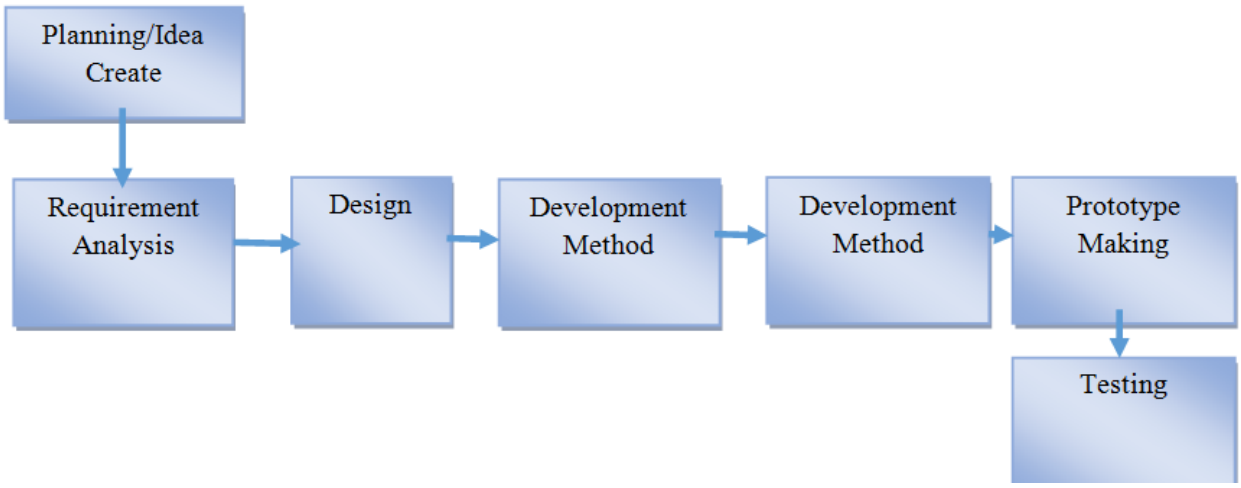


Figure 3.1: System Planning Diagram

3.3 Requirement Analysis:

SL NO:	Particulars	Qty.	Unit
1	Node MCU(esp8266)	1	Nos
2	Ultrasonic sensor	1	Nos
3	Arduino	1	Nos
4	Relay Driver	1	Nos
5	Buzzer	1	Nos
6	LCD	1	Nos
7	Push Button Switch	6	Nos
8	Lead	1	Nos
9	PCB	1	Nos
10	PVC	1	Lot
11	SD Card	1	Nos
12	Wire	1	Lot
13	I2C	1	Nos
14	SD Card Module	1	Nos
15	Amplifier Circuit module	1	Nos
16	Speaker	1	Nos
17	Slide 3pin Switch	1	Nos

Table 3.1 List of the Components

3.4 Hardware Requirements:

Among the many raw materials we have used to make this pack are Arduino, a series of circuit boards with a series of atmega328p microcontrollers. We have used some more electronics components which we are highlighting below step by

1. Node mcu ESP8266
2. Arduino
3. Sd card Module
4. PAM 8403 Amplifier circuit module
5. LCD
6. Ultrasonic Sensor
7. Speaker
8. I2C circuit
9. PVC, etc.

1. ESP32 Module:

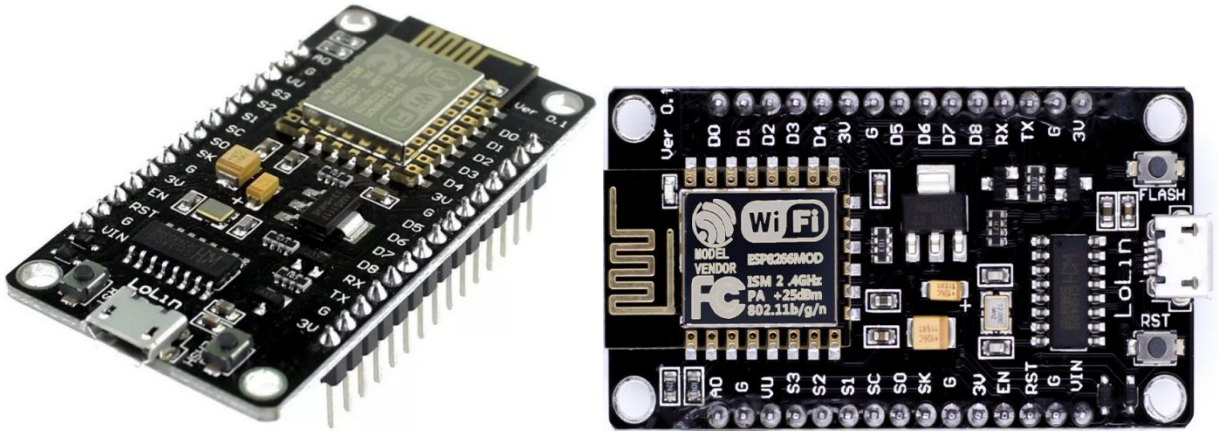


Figure 3.2 ESP8266 Wi-Fi Modules

- ESP8266 embedded, Xtensa® single-core 32-bit LX6 microprocessor, up to 160 MHz
- +19.5 dBm output at the antenna ensures a good physical range
- Sleep current is less than 20 μA, making it suitable for battery-powered and wearable-electronics applications
- Peripherals include UART, GPIO, I2C, I2S, SDIO, PWM, ADC and SPI
- Fully certified with integrated antenna and software stacks.

Node MCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).

Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits.

[Citation needed] Both the firmware and prototyping board designs are open source.[8] The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson[9] and SPIFFS.[10] Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a TensilicaXtensa LX106 core, widely used in IoT applications

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU used in the Arduino Due, they needed to modify the Arduino IDE so it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFiSoC, popularly called the "ESP8266 Core for the Arduino IDE".[18] This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

LCD Display

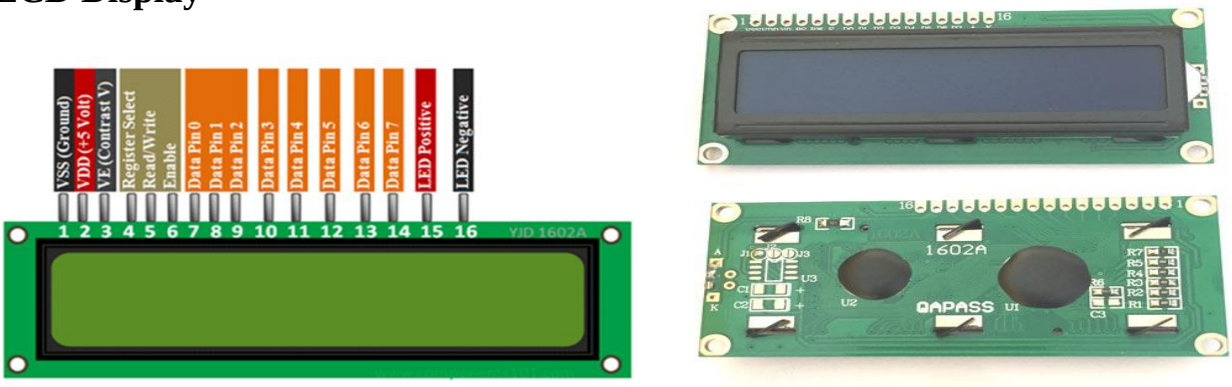


Figure 3.3 LCD Display

LCD Pinout Configuration

Pin No:	Pin Name:	Description
1	Vss (Ground)	Ground pin connected to system ground
2	Vdd (+5 Volt)	Powers the LCD with +5V (4.7V – 5.3V)
3	VE (Contrast V)	Decides the contrast level of display. Grounded to get maximum contrast.
4	Register Select	Connected to Microcontroller to shift between command/data register
5	Read/Write	Used to read or write data. Normally grounded to write data to LCD
6	Enable	Connected to Microcontroller Pin and toggled between 1 and 0 for data acknowledgement
7	Data Pin 0	Data pins 0 to 7 forms a 8-bit data line. They can be connected to Microcontroller to send 8-bit data. These LCD's can also operate on 4-bit mode in such case Data pin 4,5,6 and 7 will be left free.
8	Data Pin 1	It can be connected to microcontroller to send 8-bit data.
9	Data Pin 2	It can be connected to microcontroller to send 8-bit data.
10	Data Pin 3	It can be connected to microcontroller to send 8-bit data.
11	Data Pin 4	It can be connected to microcontroller to send 8-bit data. This leaves the point free when LCDs also operate in 4-bit mode.
12	Data Pin 5	It can be connected to microcontroller to send 8-bit data. This leaves the point free when LCDs also operate in 4-bit mode.
13	Data Pin 6	It can be connected to microcontroller to send 8-bit data. This leaves the point free when LCDs also operate in 4-bit mode.
14	Data Pin 7	It can be connected to microcontroller to send 8-bit data. This leaves the point free when LCDs also operate in 4-bit mode.
15	LED Positive	Backlight LED pin positive terminal
16	LED Negative	Backlight LED pin negative terminal

Table 3.2 LCD Pin Out Configuration

I2C:



Figure 3.4 Inter-Integrated Circuit (12C)

I2C (Inter-Integrated Circuit) is a serial communication protocol used to connect microcontrollers and other devices to communicate with each other. When you're dealing with an LCD display using I2C, it typically involves an LCD screen with an I2C interface (usually an I2C backpack or an I2C-enabled LCD module) to reduce the number of pins required to connect it to a microcontroller.

Ultrasonic Sensor:



Figure 3.5 Ultrasonic Sensor (HS-SR04)

Ultrasonic sensors are electronic devices that calculate the target's distance by emission of ultrasonic sound waves and convert those waves into electrical signals. The speed of emitted ultrasonic waves traveling speed is faster than the audible sound.

There are mainly two essential elements which are the transmitter and receiver. Using the piezoelectric crystals, the transmitter generates sound, and from there it travels to the target and gets back to the receiver component.

To know the distance between the target and the sensor, the sensor calculates the amount of time required for sound emission to travel from transmitter to receiver. The calculation is done as follows:

$$D = 1/2\ T * C$$

Where ‘T’ corresponds to time measured in seconds

‘C’ corresponds to sound speed = 343 measured in mts/sec

Ultrasonic sensor working principle is either similar to sonar or radar which evaluates the target/object attributes by understanding the received echoes from sound/radio waves correspondingly. These sensors produce high-frequency sound waves and analyze the echo which is received from the sensor. The sensors measure the time interval between transmitted and received echoes so that the distance to the target is known.

Ultrasonic Sensor Specifications

Knowing the specifications of an ultrasonic sensor helps in understanding the reliable approximations of distance measurements.

- The sensing range lies between 40 cm to 300 cm.
- The response time is between 50 milliseconds to 200 milliseconds.
- The Beam angle is around $5^{0.}$
- It operates within the voltage range of 20 VDC to 30 VDC
- Preciseness is ±5%
- The frequency of the ultrasound wave is 120 kHz
- Resolution is 1mm
- The voltage of sensor output is between 0 VDC – 10 VDC
- The ultrasonic sensor weight nearly 150 grams
- Ambient temperature is -25^{0}C to $+70^{0}$C
- The target dimensions to measure maximum distance is 5 cm × 5 cm

Ultrasonic Sensor Arduino

This section explains the interfacing of the ultrasonic sensor with an Arduino by considering HC-SR-04 where it explains the ultrasonic sensor pinout, its specifications, wiring diagram, and how the sensor with Arduino connection.

The ultrasonic sensor pin diagram is:



Figure 3.6 Ultrasonic Sensor Pin Diagram

Vcc – This pin has to be connected to a power supply +5V.

TRIG – This pin is used to receive controlling signals from the Arduino board. This is the triggering input pin of the sensor

ECHO – This pin is used for sending signals to the Arduino board where the Arduino calculates the pulse duration to know the distance. This pin is the ECHO output of the sensor.

GND – This pin has to be connected to the ground.

The below picture shows the **ultrasonic sensor block diagram** for distance measurement.

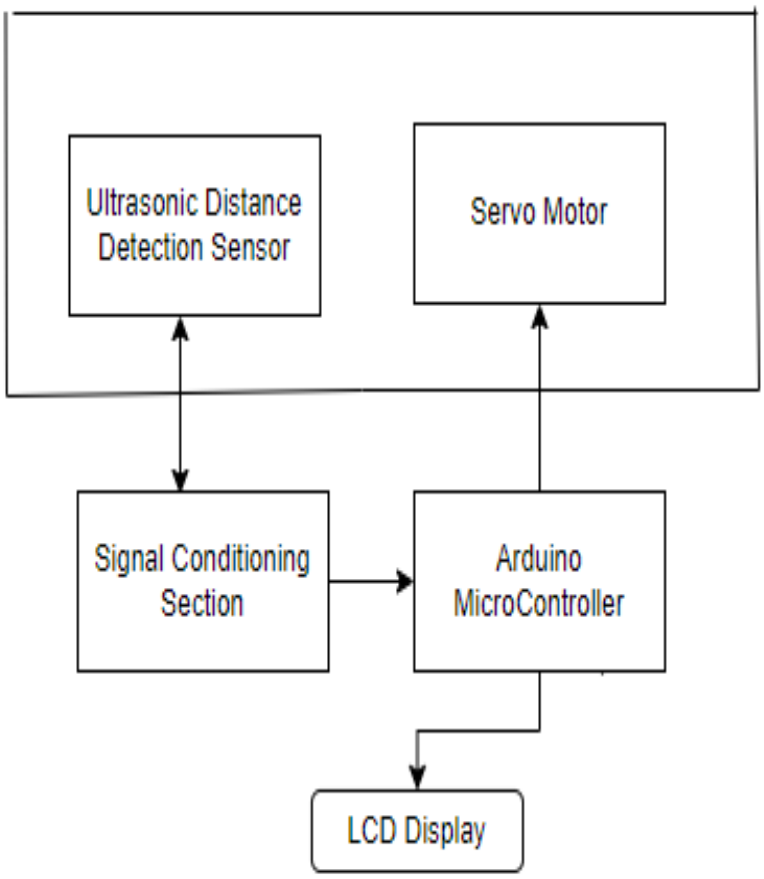


Figure 3.7 Ultrasonic Sensor Block Diagram

The target's distance is calculated using an ultrasonic distance sensor and the output from the sensor is provided to the signal conditioning section and then is processed using an Arduino microcontroller. The results from the microcontroller are fed to the LCD display and then moved to a personal computer.

Arduino pro mini :

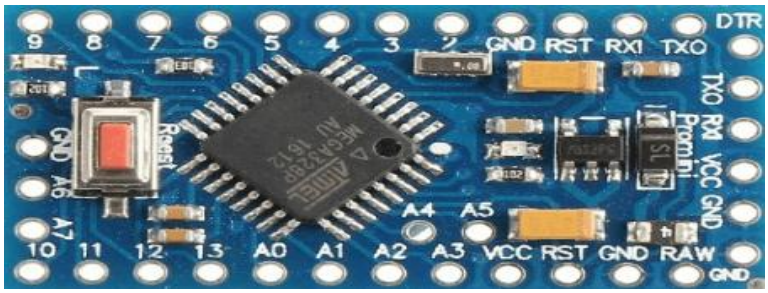


Figure 3.8 Arduino pro mini (ATmega328P)

This board was developed for applications and installations where space is premium and projects are made as permanent set ups. Small, available in 3.3 V and 5 V versions, powered by ATmega328P. The Arduino Pro Mini is a microcontroller board based on the ATmega328P.

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, an on-board resonator, a reset button, and holes for mounting pin headers. A six pin header can be connected to an FTDI cable or Sparkfun breakout board to provide USB power and communication to the board. Arduino Pro Mini is intended for semi-permanent installation in objects or exhibitions. The board comes without pre-mounted headers, allowing the use of various types of connectors or direct soldering of wires. The pin layout is compatible with the Arduino Mini. There are two version of the Pro Mini. One runs at 3.3V and 8 MHz, the other at 5V and 16 MHz.The Arduino Pro Mini was designed and is manufactured by SparkFun Electronics.

Power

The Arduino Pro Mini can be powered with an FTDI cable or breakout board connected to its six pin header, or with a regulated 3.3V or 5V supply (depending on the model) on the Vcc pin. There is a voltage regulator on board so it can accept voltage up to 12VDC. If you're supplying unregulated power to the board, be sure to connect to the "RAW" pin on not VCC.

The power pins are as follows:

RAW For supplying a raw voltage to the board.

VCC The regulated 3.3 or 5 volt supply.

GND Ground pins.

Memory

The ATmega328P has 32 kB of flash memory for storing code (of which 0.5kB is used for the bootloader). It has 2 kB of SRAM and 1kBs of EEPROM (which can be read and written with the EEPROM library.

Input and Output

Each of the 14 digital pins on the Pro Mini can be used as an input or output, using pinMode,digitalWrite, and digitalRead functions. They operate at 3.3 or 5 volts (depending on the model). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions: Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the TX-0 and RX-1 pins of the six pin header.

External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Pro Mini has 8 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). Four of them are on the headers on the edge of the board; two (inputs 4 and 5) on holes in the interior of the board. The analog inputs measure from ground to VCC. Additionally, some pins have specialized functionality:

I2C: A4 (SDA) and A5 (SCL). Support I2C (TWI) communication using the Wire library.

There is another pin on the board: Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Communication

The Arduino Pro Mini has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328P provides UART TTL serial communication, which is available on digital pins 0 (RX) and 1 (TX). The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board via a USB connection.

A SoftwareSerial library allows for serial communication on any of the Pro Mini's digital pins. ATmega328P also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the reference for details. To use the SPI communication, please see the ATmega328P data sheet.

Programming

The Arduino Pro Mini can be programmed with the Arduino software download. For details, see the reference and tutorials. The ATmega328P on the Arduino Pro Mini comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol reference , C header files. You can also bypass the bootloader and program the ATmega328P with an external programmer; see these instructions for details.

Automatic (Software) Reset

Rather than requiring a physical press of the reset button before an upload, the Arduino Pro Mini is designed in a way that allows it to be reset by software running on a connected computer. One of the pins on the six-pin header is connected to the reset line of the ATmega328P via a 100 nF capacitor. This pin connects to one of the hardware flow control lines of the USB-to-serial converter connected to the header: RTS when using an FTDI cable, DTR when using the Sparkfun breakout board. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the boot loader can have a shorter timeout, as the lowering of the reset line can be well-coordinated with the start of the upload.

This setup has other implications. When the Pro Mini is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the Pro. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

Physical Characteristics

The dimensions of the Pro Mini PCB are approximately 0.7" x 1.3"

Tech Specs

Microcontroller ATmega328P *

Board Power Supply 3.35 -12 V (3.3V model) or 5 - 12 V (5V model)

Circuit Operating Voltage 3.3V or 5V (depending on model)

Digital I/O Pins 14

PWM Pins 6

UART 1

SPI 1

I2C 1

Analog Input Pins 6

External Interrupts 2

DC Current per I/O Pin 40 mA

Flash Memory 32KB of which 2 KB used by bootloader *

SRAM 2 KB *

EEPROM 1 KB *

Clock Speed 8 MHz (3.3V versions) or 16 MHz (5V versions)

Older boards were equipped with ATmega 168 with this specs:

Flash memory: 16 KB

SRAM: 1 KB

EEPROM: 512 bytes

This is a soil moisture sensor that measures soil moisture levels by capacitive sensing rather than resistive sensing like other sensors on the market. The Soil Moisture Sensor is made of corrosion-resistant material which gives it excellent service life.

Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the sometime, act to lower voltage levels within circuits. Resistors may have fixed resistances or variable resistances, such as those founding thermostats, visitors, trimmers, photo resistors, hamsters and potentiometers. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. This relationship is represented by Ohm's law



Figure 3.9 1KΩ Resistor

Theory of operation

The behavior of an ideal resistor is dictated by the relationship specified by Ohm ‘slaw:

$$V = I.R$$

Ohm's law states that the voltage (V) across a resistor is proportional to the current(I), where the constant of proportionality is the resistance (R).

Equivalently, Ohm's law can be stated:

$$I = V/R$$

This formulation states that the current (I) is proportional to the voltage (V) and inversely proportional to the resistance (R). This is directly used in practical computations. For example, if a 300-ohm resistor is attached across the terminals of a12 volt battery, then a current of12 / 300 = 0.04 amperes flows through that resistor.

SD Card Module:

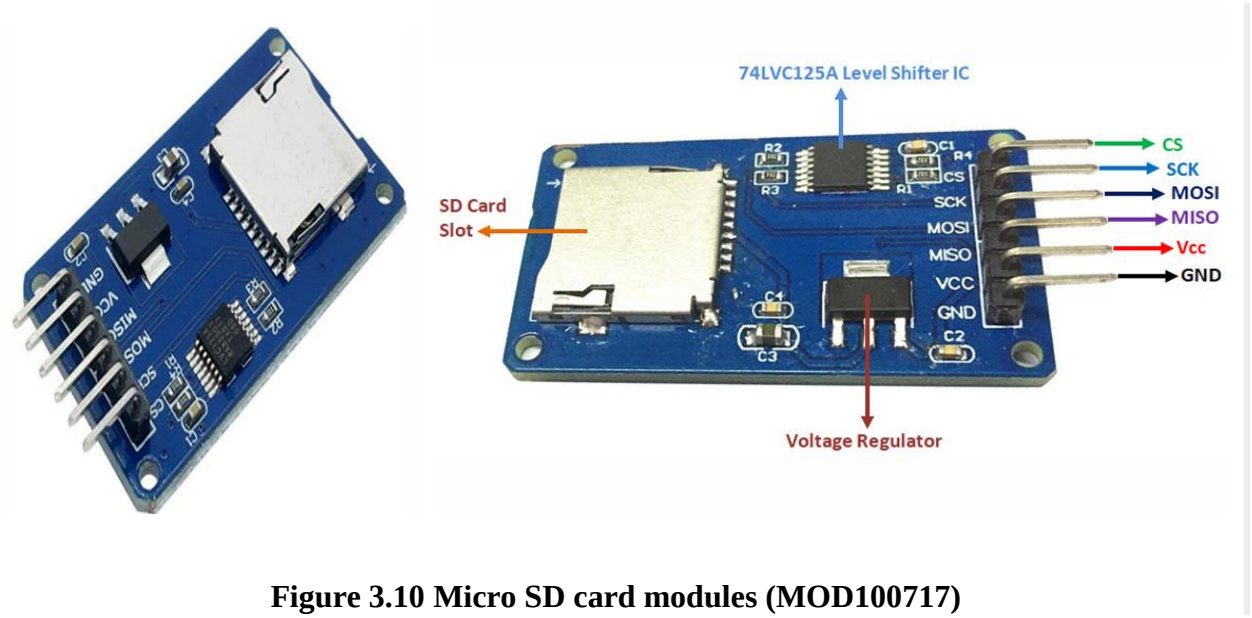


Figure 3.10 Micro SD card modules (MOD100717)

SD cards or Micro SD cards are widely used in various applications, such as data logging, data visualization, and many more. Micro SD Card Adapter modules make it easier for us to access these SD cards with ease. The Micro SD Card Adapter module is an easy-to-use module with an SPI interface and an on-board 3.3V voltage regulator to provide proper supply to the SD card.

Features and Specifications of Micro SD Card Adapter Module

This section mentions some of the features and specifications of the Micro SD Card Adapter Module.

1. Operating Voltage: 4.5V - 5.5V DC
2. Current Requirement: 0.2-200 mA
3. 3.3 V on-board Voltage Regulator
4. Supports FAT file system
5. Supports micro SD up to 2GB
6. Supports Micro SDHC up to 32GB

Pin Configuration of Micro SD Card Adapter Module

The module contains 6 pins for power and communicating with the controller. The table below describes the pin type and role of each pin on the module.

Pin Type	Pin Description
GND	Ground
VCC	Voltage Input
MISO	Master In Slave Out(SPI)
MOSI	Master Out Slave In(SPI)
SCK	Serial Clock(SPI)
CS	Chip Select(SPI)

Connecting Micro SD Card Adapter Module to an MCU/MPU

A Micro SD Card adapter module can be easily connected to an MCU/MPU. Since the module communicates via the SPI protocol, we need to connect the MISO, MOSI, SCK, and CS of the module to the MCU's.

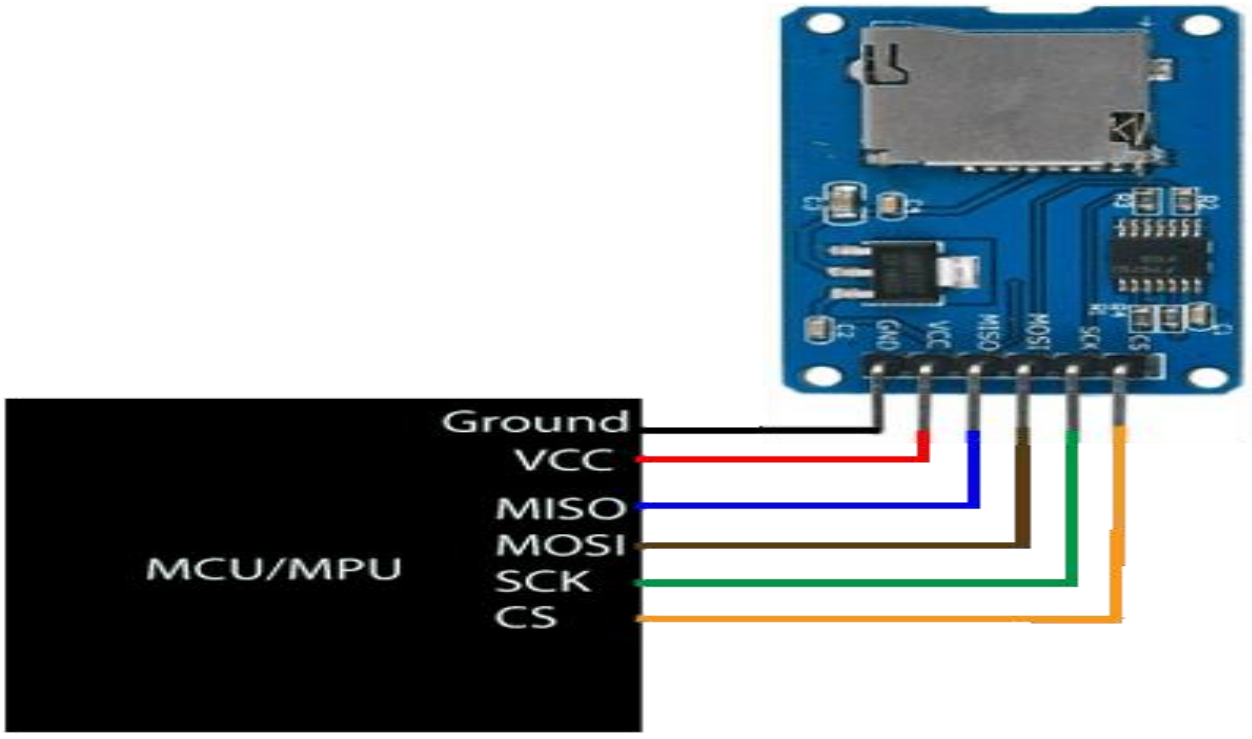


Figure 3.11 SD card holder

The image can be seen as a reference and the connections can be made based upon that. Along with the SD card holder, the module has a 3.3V voltage regulator, along with a 74LVC125A Level shifter IC.

Alternatives for Micro SD Card Adapter Module

MOD100717 Micro SD card module, Mini Micro SD Card Reader Module

Applications of Micro SD Card Adapter Module

Here are some of the applications of the Micro SD Card Adapter Module.

1. Data loggers
2. Audio, Video storage, and Visualization
3. Expandable memory

PAM8403 Amplifier Circuit Module:

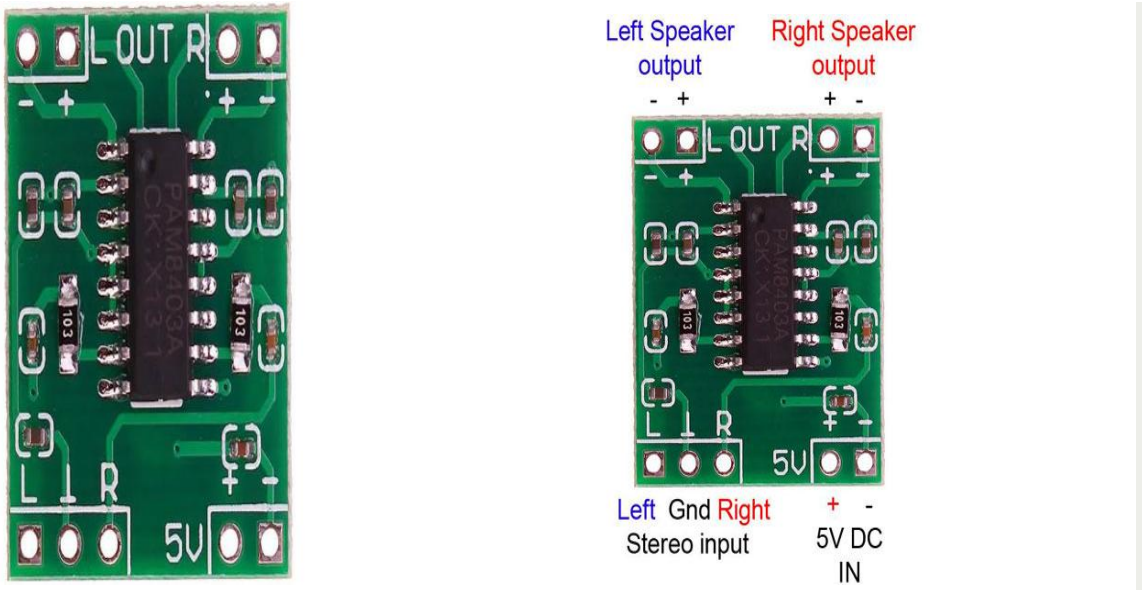


Figure 3.12 Amplifier Circuit Module (PAM8403)

PAM8403 is an Amplifier Board which can be powered using simple 5V input and could drive two **3W + 3W stereo speakers**. It is an excellent choice, who wants a **Class-D stereo audio amplifier** in small board space. This Amplifier allows the user to achieve high-quality audio reproduction from a stereo input. Additionally, it has a special feature that is, it can drive speakers directly from its output.

Pin Description of PAM8403 Amplifier Board

Pin Name	Description
L	Audio Jack (TRS-Tip) Left Channel Input
Gnd	Audio Jack (TRS-Sleeve) Ground Channel Input
R	Audio Jack (TRS-Ring) Right Channel Input
5v(+)	5v DC Power VDD
5v(-)	5v DC Power GND
L(+)	Left Channel Positive Output
L(-)	Left Channel Negative Output
R(+)	Right Channel Positive Output
R(-)	Right Channel Negative Output

Alternatives for PAM8403: PAM8406, TDA7265

Other Audio Amplifier ICs: LM386, LM380, LM4871, TDA2030, LM1875

Features of PAM8403 Amplifier Board

- Operating Voltage: Wide power supply ranges from 2.5V to 5.5V DC
- Dual-channel stereo with high output power (3W+3W Output at 10% THD with a 4Ω Load @5v DC)
- Max Gain 24 dB.
- Filter less architecture
- Low Quiescent Current and Low EMI
- Operating Temperature: -40 to +85°C
- Short Circuit Protection
- Thermal Shutdown
- Superior Low Noise
- Efficiency up to 90%
- Dimensions (LxWxH) in cm 2.1 x 1.8 x .3

Note: Complete technical details can be found in the **PAM8403 Datasheet** linked at the bottom of this page.

PAM8403 Amplifier Board

The main power Amplifier IC is the PAM8403, as you can see, the below image other than the IC, the module consists of a few components like capacitors and resistors.

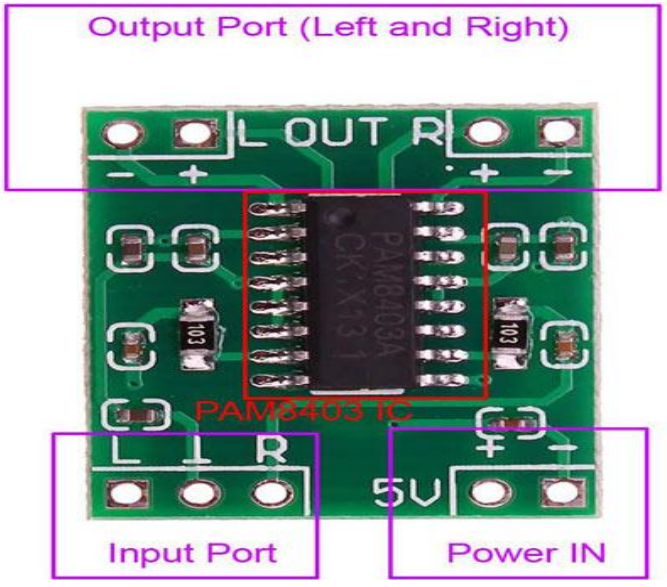


Figure 3.13 Amplifier IC is the PAM8403

The PAM8403 amplifier board is a dual-channel (stereo) amplifier that produces **6W** (3W+3W) output. As any major amplifier system needs to have short circuit protection, PAM8403 has inbuilt short circuit protection that is essential for trouble-free operations.

PAM8403 Amplifier IC itself does not require any kind of heat sink, so this will be a perfect choice for custom speaker projects. It can directly drive **4Ω or 8Ω** speakers. It is mandatory to use a proper speaker with not more than a 3W output rating.

As this is a stereo amplifier board, the input section has two input L (Left) and R (Right) with a common ground in between them. Use any kind of audio input that needs to be amplified and it will produce **3W + 3W** audio output.

This amplifier module provides a maximum gain of **24 dB** with **10% THD** at 5V DC input and 4 Ohms load output. It does not require heatsink which also saves additional board space. Irrespective of the heatsink, it could also provide thermal protection which is another essential feature for such a small wattage amplifier module.

PAM8403 Amplifier Board Interfacing Diagram

Circuit diagram for interfacing with two 3W speakers with the PAM8403 Amplifier Board is given below. The PAM8403 Amplifier Board can be powered using any voltage ranging from 2.5V to 5V DC. But it is recommended to use 5V input for maximum output performance.

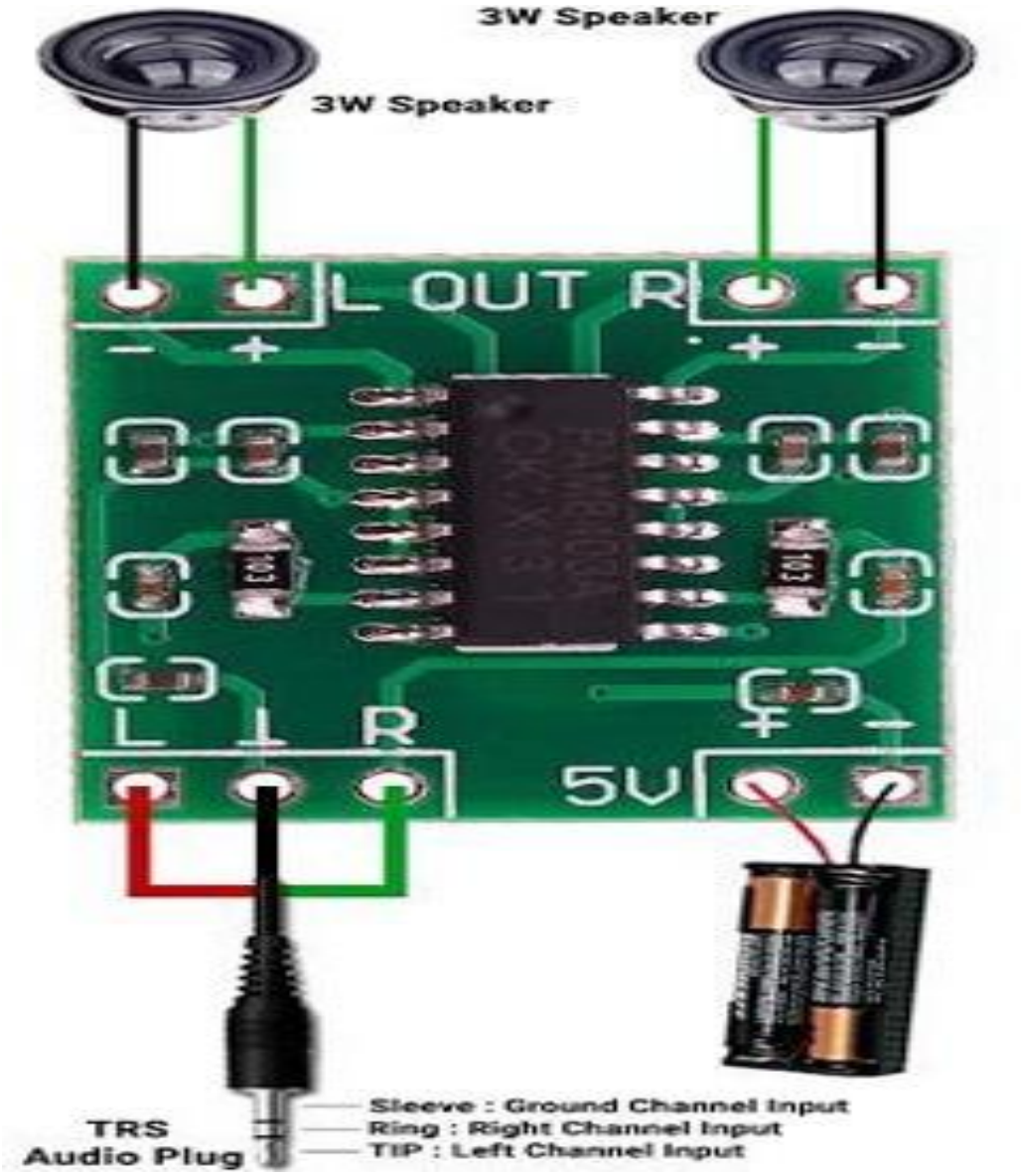


Figure 3.14 Amplifier Board with 3W speakers (PAM8403)

Applications of PAM8403 Amplifier Board

- Speaker output in LCD Monitors / TV Projectors
- Speaker output amplifier in Notebook Computers
- Can be used for Portable Speakers, Portable DVD Players, Game Machines
- Any possible amplifier-based project where small space and 5V output is available

3.5 Software Requirements:

1. Arduino Software IDE.

Arduino software:

The smart microcontroller unit named as Arduino Uno can be programmed with the Arduino software. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Uno from the Tools , Board menu (according to the microcontroller on your board).The IC used named as ATmega328 on the Arduino Uno comes pre burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer.

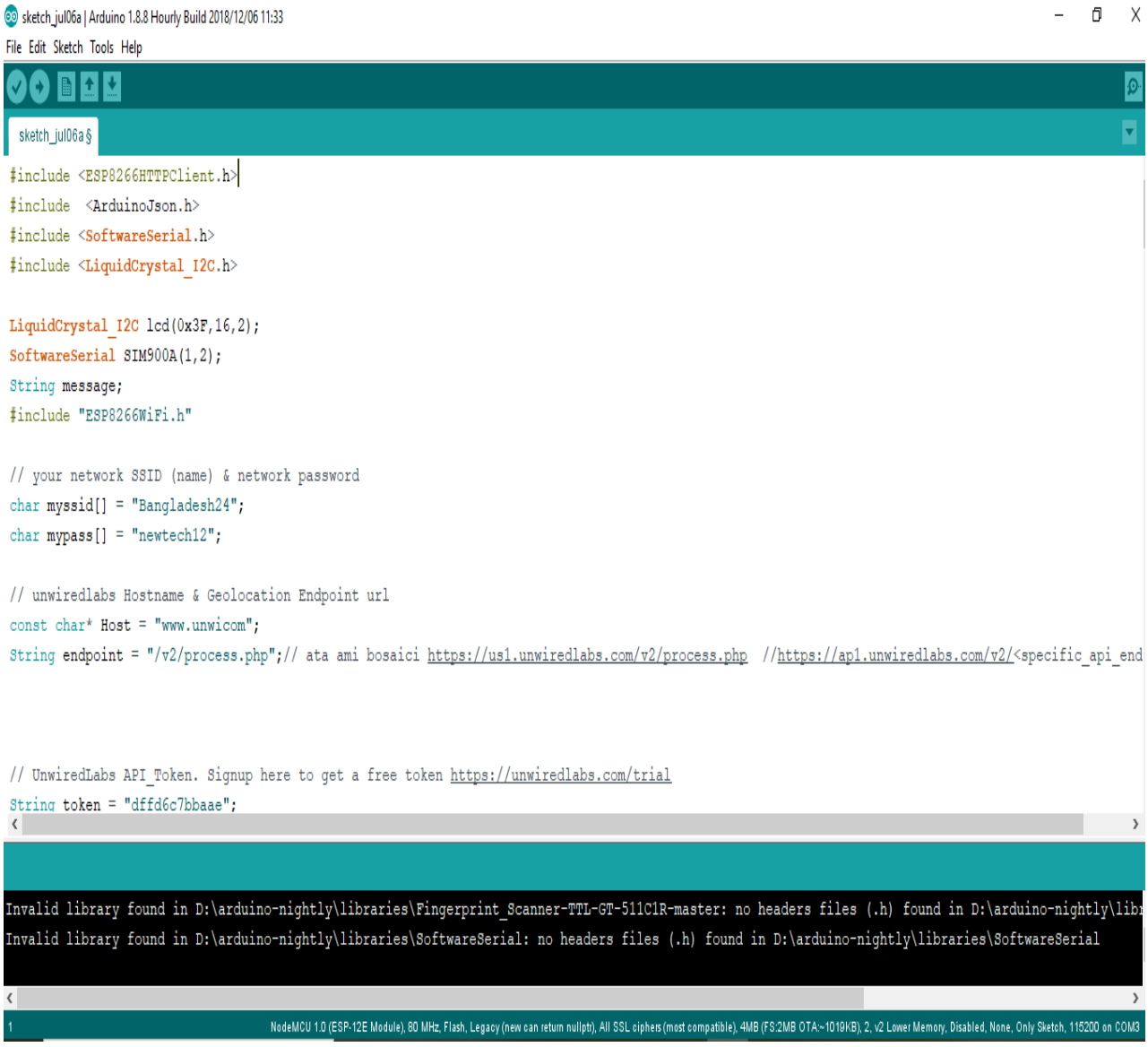


Figure 3.15 Arduino Software Code

Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the microcontroller through the ICSP (In Circuit Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:

On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

The Arduino Uno is one of the latest smart microcontroller units and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.

The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial Communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Lab to compile programs, and for uploading the programs it uses argued. As the Arduino platform uses Atmel microcontrollers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino.

CHAPTER 4
DESIGN AND DEVELOPMENT

4.1 System Design & Braille Lippi:

The system design for a Braille keyboard integrated with a third-eye system using ultrasonic sensors entails a comprehensive approach to merging tactile input and real-time environmental perception for the benefit of visually impaired individuals. The system design involves integrating a standard Braille keyboard with ultrasonic sensors and associated hardware components. This includes the incorporation of Braille tactile input mechanisms with sensors capable of detecting obstacles and distances in the surrounding environment. The hardware setup might encompass ultrasonic sensors, microcontrollers, processing units, and actuators to provide feedback. Ultrasonic sensors are strategically placed around the user to detect obstacles and spatial information. These sensors emit ultrasonic waves and analyze their reflections to determine distances, allowing the system to provide real-time feedback about nearby obstacles, enabling the user to navigate safely. The user interface is designed to be intuitive and user-friendly, allowing visually impaired individuals to interact seamlessly with the Braille keyboard and receive real-time feedback from the third-eye system. Feedback mechanisms could include auditory cues, tactile vibrations, or spoken instructions to convey information about detected obstacles or environmental changes. Software algorithms are crucial for processing the data collected by the ultrasonic sensors and translating it into actionable information for the user. These algorithms need to interpret sensor data accurately and rapidly to provide timely feedback about the user's surroundings. The system design aims for compatibility with existing assistive technologies, such as smartphones or navigation devices, ensuring seamless integration for enhanced functionality. Moreover, the system prioritizes accessibility features, including high contrast displays, tactile buttons, and adjustable feedback options, to cater to varying degrees of visual impairment. Usability testing with visually impaired users is fundamental to refine the system's design. Continuous optimization based on user feedback is crucial to enhance the system's effectiveness, usability, and overall user experience. In essence, the system design involves a holistic integration of hardware, software, and user interface elements to create a cohesive and accessible Braille keyboard integrated with a third-eye system using ultrasonic sensors.

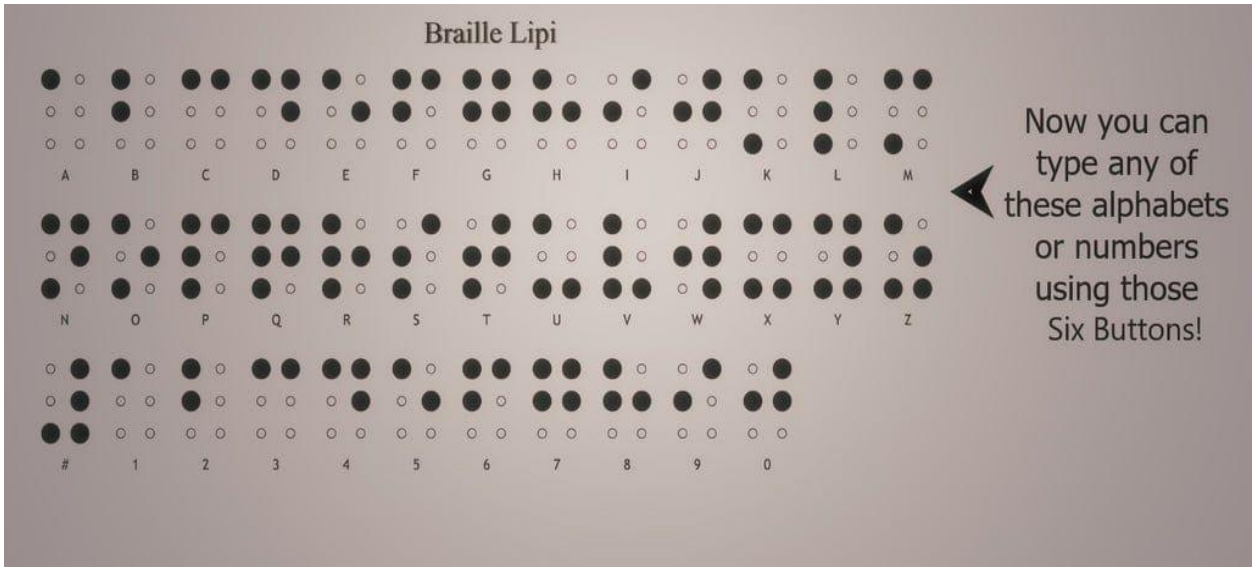


Figure 4.1 Braille Lippi

4.2 Block Diagram:

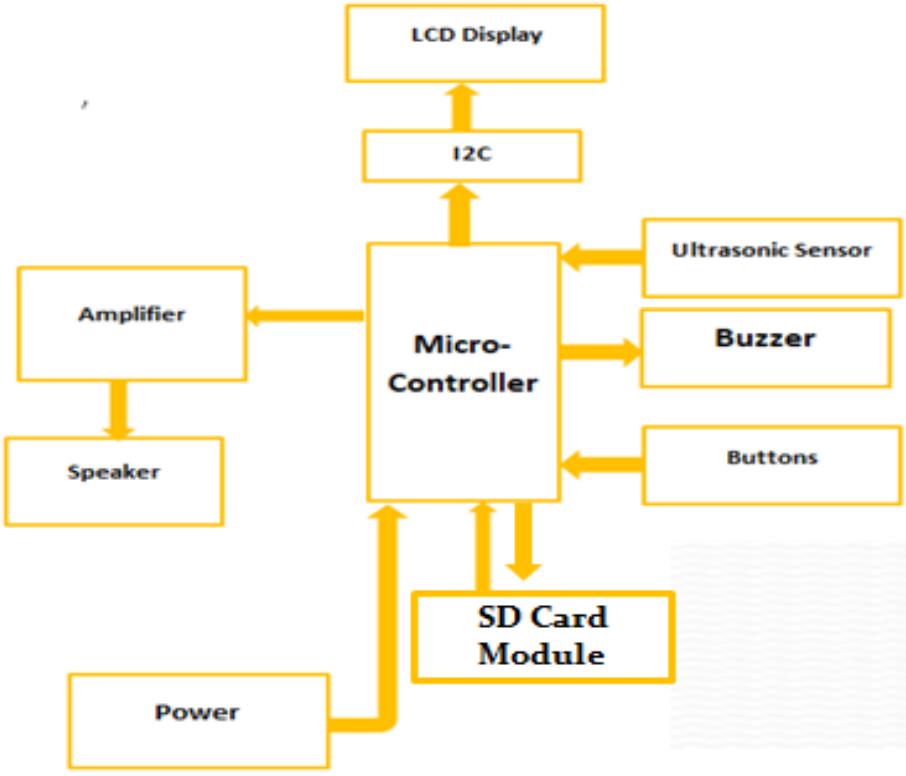


Figure 4.2 Block Diagram

4.3 Data Flow Diagram:

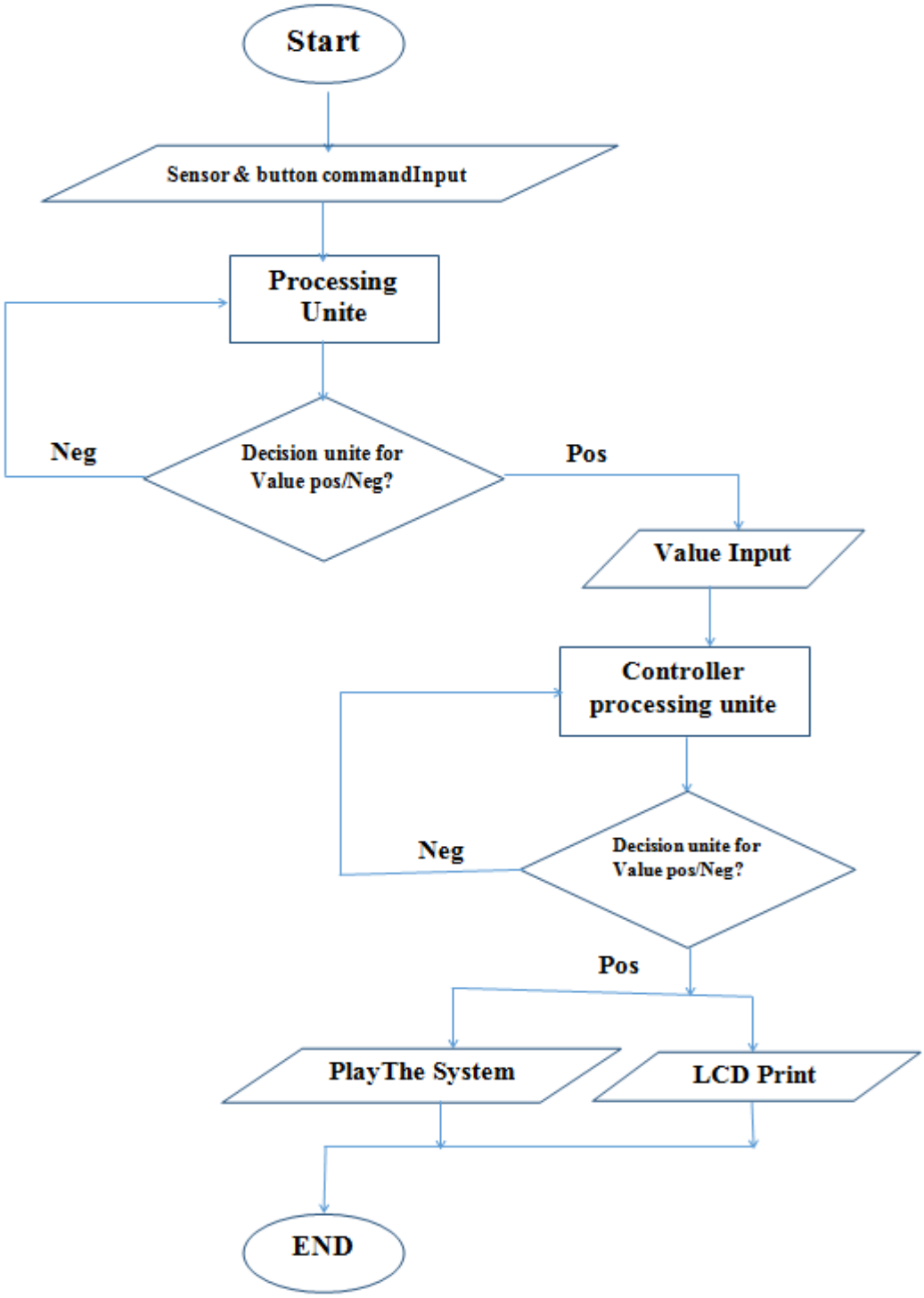


Figure 4.3: Data Flow Diagram

4.4 Circuit Diagram:

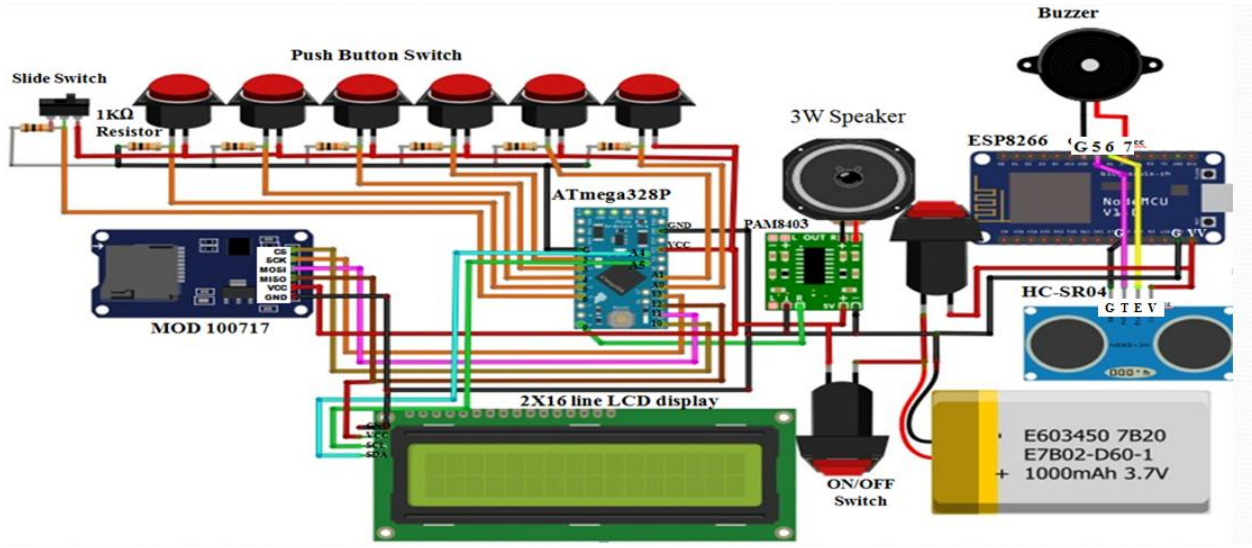


Figure 4.4: Circuit Connection Diagram

4.5 Working Procedure:

The working procedure of a Braille keyboard integrated with a third-eye system using ultrasonic sensors involves a seamless blend of tactile input and real-time environmental perception to aid visually impaired individuals in navigation. The user interacts with the Braille keyboard, inputting commands or queries using Braille tactile symbols. This serves as the primary means of communication and control for the system. Simultaneously, the integrated ultrasonic sensors actively scan the surrounding environment, emitting ultrasonic waves and analyzing their reflections to detect nearby obstacles, distances, and spatial information in real-time. The sensor data is processed by onboard or connected computational units. Algorithms interpret the sensor readings, identifying obstacles or potential hazards in the user's path. Upon detecting obstacles or changes in the environment, the system generates feedback. This feedback is relayed to the user through various modes such as auditory cues, tactile vibrations, or spoken instructions, providing timely and relevant information about the surroundings. Users receive the feedback and use it to adjust their navigation or movements accordingly. The system provides guidance, alerting users to obstacles or changes in their environment, facilitating safer and more independent navigation. The system continuously monitors the environment, updating information in real-time as the user moves. It adapts to changes, providing ongoing assistance and ensuring users are informed about their surroundings during navigation. By integrating tactile input from the Braille keyboard with the real-time environmental perception enabled by ultrasonic sensors, this working procedure empowers visually impaired individuals to navigate their surroundings more confidently and independently.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Implementation of the Project:

First all the electronics components that will be used to implement this project are listed separately. And these are ordered from various online shops and then as soon as the components are available, the PDF study of each component is done. And after studying the PDFs, taking ideas from them, various research activities are carried out on how to work by interfacing the components with the microcontroller. At various times various components were damaged and had to be reassembled. In this way, through various studies, the components interface with the microcontroller and learn how to work. After completing the operation of the components, all of them are merged and merged. The project is implemented by combining all the components. This project is made through a combination of hardware and software.

5.2Results:

- We tested the project and it worked perfectly, as shown on the LCD of Project Picture.
- We have identified signals separately.
- Depending on the button value and ultrasonic value in the project all conditions were working correctly.
- The values of the sensors are correctly sent to the chip. At the same time all text is shown correctly on the display.
- The microcontroller had to be properly calibrated from the sensor.
- At the same time, the assistant system for the disabled was also working properly.

Project Picture:

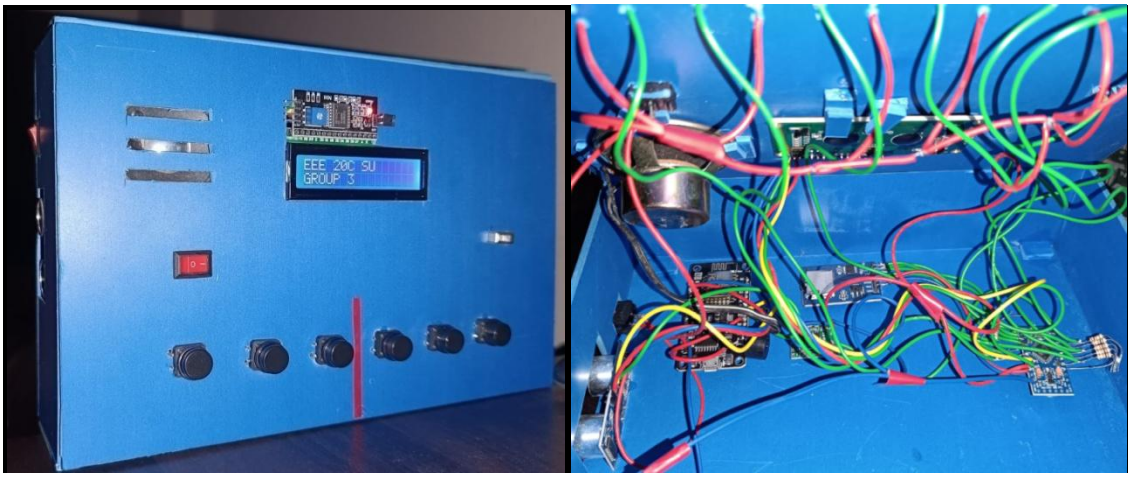


Figure 5.1 Project Picture

CHAPTER 6
DISCUSSION & CONCLUSION

6.1. Conclusion:

In conclusion, the integration of a Braille keyboard with a disable people assistor system using ultrasonic sensors marks a significant advancement in assistive technology for the visually impaired. This innovative fusion of tactile input and real-time environmental perception aims to address critical challenges faced by individuals with visual impairments during navigation. By combining the tactile familiarity of Braille input with the immediate environmental awareness provided by ultrasonic sensors, this system endeavors to empower visually impaired individuals with increased independence, safety, and confidence in navigating diverse surroundings. The seamless integration of hardware, software, and user interface elements creates a cohesive solution that enhances mobility and accessibility for this community. Furthermore, the system's ability to detect obstacles, provide spatial information, and offer timely feedback through various sensory cues serves as a guiding beacon for users, enabling them to navigate unfamiliar environments more confidently and safely. However, continuous refinement, user-centered design, and rigorous testing remain essential to optimize the system's functionality, usability, and accessibility. Ultimately, the Braille keyboard integrated with a third-eye system using ultrasonic sensors represents a pivotal step forward in enhancing the quality of life for visually impaired individuals, fostering greater autonomy and inclusivity in their daily navigation endeavors.

6.2. Future Scope:

- The future scope for the integration of a Braille keyboard with a third-eye system using ultrasonic sensors holds promising avenues for further advancement in assistive technology for the visually impaired.
- Implementing machine learning algorithms and artificial intelligence could further refine the system's ability to recognize complex environmental patterns, predict potential obstacles, and personalize feedback based on user preferences and behavior.
- Future iterations may focus on miniaturizing components and integrating them into wearable devices, offering a more discreet and portable solution for users, possibly integrated into smart glasses or wearable for hands-free operation.
- Efforts to make the technology more affordable and accessible worldwide will be crucial, ensuring that visually impaired individuals across diverse socioeconomic backgrounds can benefit from its functionalities.
- Collaborative research involving user feedback and interdisciplinary partnerships will be pivotal to continually improve the system's design, functionality, and user experience, ultimately leading to more inclusive and empowering assistive technologies for the visually impaired.

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