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The Third Eye for the Blind

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Abstract: ***A technical advancement knows as "The third eye for the blind" enables the blind people to travel with confidence and speed by employing ultrasonic waves to identify obstructions in their environment and notifying them with a buzzer sound or vibration. This item is simply a wristband or a piece of fabric that can be worn. The tool operates by projecting ultrasonic waves in the user's direction. These waves are reflected to the gadget when they strike an object. The device then calculates the distance to the objects by measuring the amount of time it takes for the waves to go there and return. The third eye for the blind is a promising new automation that has the potential to greatly improve the lives of blind individuals. It allows them to navigate their surroundings with greater confidence and safety, and it can help them to live more independent and fulfilling lives.***
Some of the advantages of the third eye for the blind includes:

- ***Greater independence: the third eye for the blind can enable blind people to independently navigate their surroundings,***
- ***Increased self-assurance: The third eye for the blind help blind people feel more confident about their abilities to find their way around.***
- ***Decrease in injury risk: The third eye for the blind can assist blind people in avoiding hazards and lowering their risk of getting hurt.***

A revolutionary new technology called the third eye for the blind has the potential to significantly improve the lives of blind people all around the world. This device has the potential to be a standard aid for blind navigation with additional improvement.
Keywords: Ultrasonic waves, buzzer, sound, IoT safety.

I. INTRODUCTION

There are more than 253 million blind individuals around the globe, and many of them have trouble getting around on their own. Although the traditional white cane is a useful aid, it can be challenging to wield in crowded or strange places.

Imagine a world where blind people can independently and with confidence navigate their environment. A world where the kids don't have to worry about running into anything or falling over as they cross the street. A world where they can go on adventures and discover their surroundings.

The third eye for the blind claims to build a world like this. With the use of ultrasonic waves, this cutting-edge new tool, blind people may now "see" their environment. Wearable as a headband or bracelet, the device produces ultrasonic waves that reflect off nearby objects. The gadgets then make a map of the area using the reflected waves, which is subsequently place back to the user through vibrations or sound.

Though it is still in the early stages of development, the third eye for the blind has already showed a lot of promise. This device has the potential to be a standard aid for blind navigation with additional improvement.

Millions of blind individuals worldwide could have their lives completely transformed by the third eye for the blind. It might enable children to wander around freely and discover their surroundings on their own. They might feel more self-assured as a result. The third eye is a genuinely ground breaking invention for the blind. It could have a profoundly positive effect on the lives of blind people all around the world.

A high performance 8-bit AVR RISC-based microcontroller called Atmega-328 is used by the system. Additionally, to 1kb EEPROM and 2kb SRAM, it contains 32kb of read-write ISP flash memory. It also includes features such as 32 general purpose working registers, 23 general- purpose I/O lines, and three customizable timer/counters with compare modes. The system employs an ultrasonic rangefinder distance sensor module, model number HC-SR04 to measure distance. The sensor module uses the SONAR or RADAR principle, which uses an ultrasonic wave to calculate an object's distance, to measure the distance between two objects. An alert buzzer and a motor that produces vibration signals are also included in the system.

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II. MOTIVATION

The third eye for the blind is designed to make it easier and safer for blind individuals to navigate their surroundings. Although the traditional white cane is a useful aid, it can be challenging to wield in crowded or strange places. The third eye for the blind creates a map of the environment using ultrasonic waves, which is then played back to the user through vibrations or sound. This makes it easier for blind people to "see" their environment and avoid hazards.

Although technology is still in its infancy, the third eye for the blind has showed a lot of promise. This device has a potential to be a standard aid for blind navigation with additional improvement.

III. OBJECTIVE

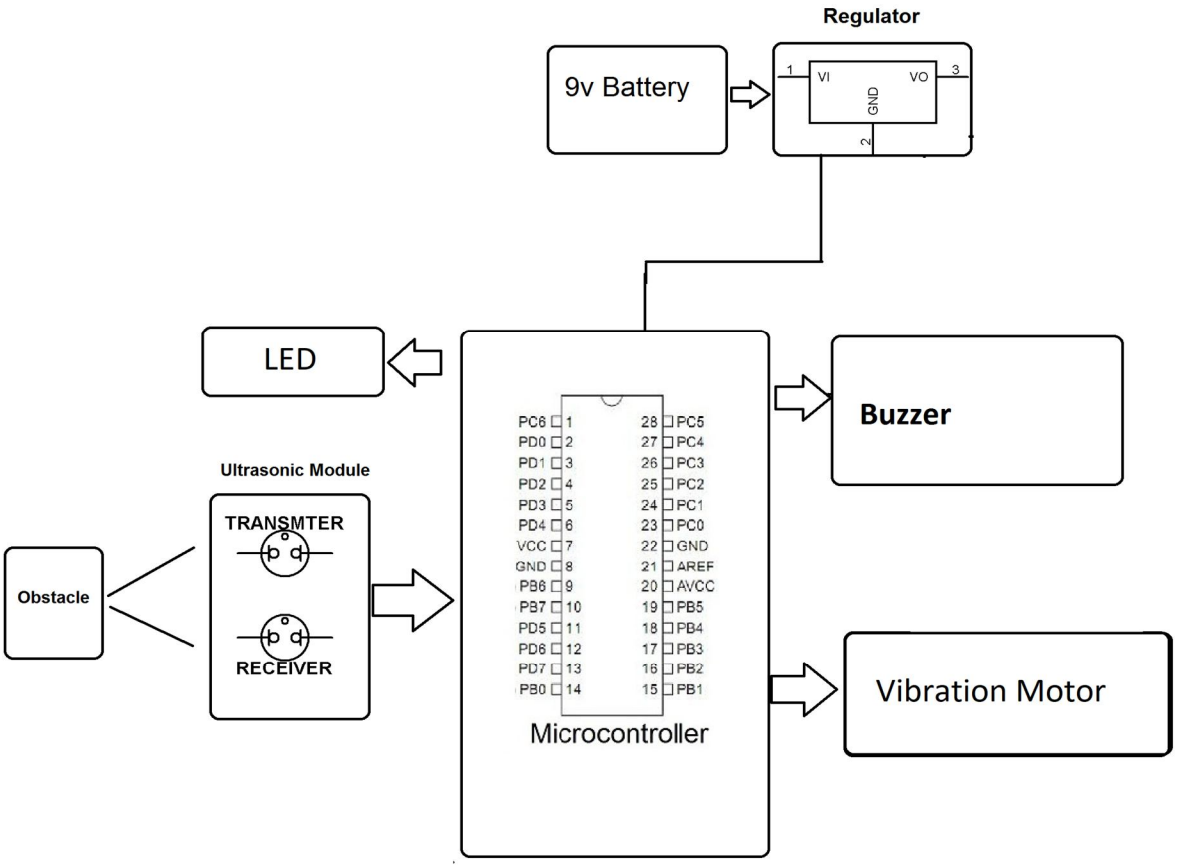
The objective of the project "The third eye for the blind" is to make I easier and safer for blind individuals to navigate their surroundings. The tool creates a map of the area using the ultrasonic waves, which is then played back to the user through vibrations or sound. This makes it easier for blind people to "see" their environment and avoid hazards.

Some specified objectives are:

1) To assist blind people in freely navigating their surroundings: The third eye for the blind should assist the blind individuals in independently navigating their surroundings without the need or a sighted guide. Blind people will feel independent and free as a result.

2) The third eye for the blind should be able to assist blind people in avoiding obstacles and lowering their chance of getting hurt. Blind people would feel safer and more at ease in their surroundings as a result.

IV. BLOCK DIAGRAM



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V. THE WORKING

The primary goal of the project is to create an obstacle detection alerting system for blind person using an ultrasonic distance sensor. The ultrasonic waves in order to detect any impediments in its route. The ultrasonic waves are reflected back to the system if there is an obstruction nearby. These ultrasonic waves are detected by the ultrasonic receiver, which then transmits this information to the microcontroller. A beeping sound is the microcontroller's method of alerting users.

1) Around the user's hand, the device has a number of ultrasonic sensors. Before the user, the sensors emit ultrasonic waves.
2) The waves are reflected back to the sensors when they encounter an obstruction.
3) The sensors track how long it takes the waves to reach the obstacle and return, and then utilise this data to determine how far away it is.
4) The buzzer or vibration motor then receives a signal from the sensors, altering the user to the obstacle's presence.
5) The user can gauge how far away the obstacle is because the signal's strength grows as it gets closer to it.

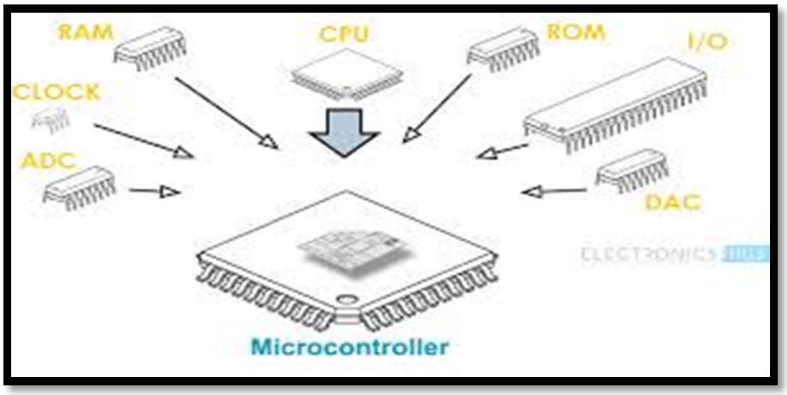
A. *Hardware Used*

1) Atmega microcontroller
2) Ultrasonic sensor
3) Crystal oscillator
4) Resisters
5) Capacitors
6) Transistors
7) Cables and connectors
8) Diodes
9) PCB and Breadboards
10) LED
11) Transformer/Adaptor
12) Push Buttons
13) Switch
14) IC
15) IC Sockets
16) Vibrator motor
17) Gloves

B. *Software Used*

1) Arduino Compiler
2) Language: C

C. *ATmega Microcontroller*



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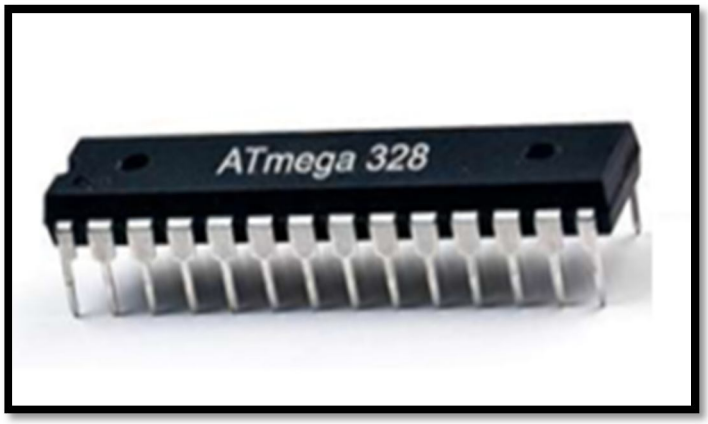
On a single integrated circuit chip made of metal oxide semiconductors, a microcontroller is a little computer. On a single chip, a typical microcontroller has a CPU, memory, and input/output(I/O) peripherals. Without including any additional external digital components, a microcontroller already has all the capabilities needed for a computing system and performs the same operations as a computer. The user can programme the majority of the pins on the microcontroller chip.

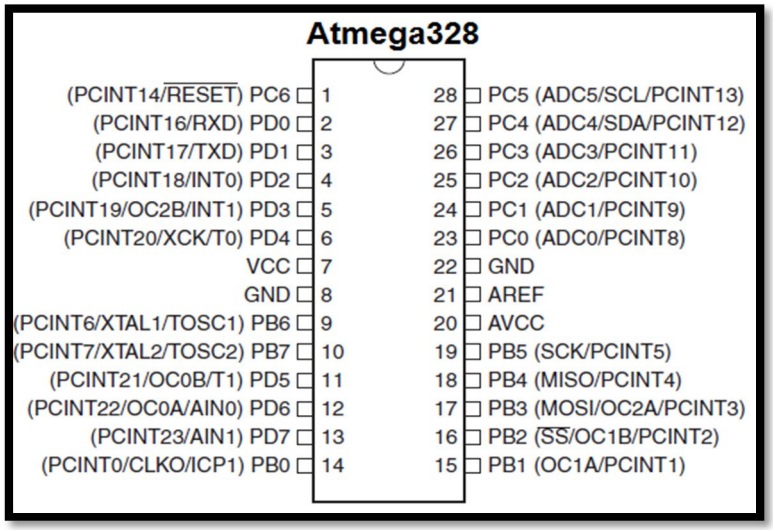
Advantages of atmega microcontroller:

1) A microcontroller includes numerous bit handling commands that are simple for a programmer to comprehend.
2) It has the ability to handle Boolean operations.
3) It is quicker and more effective.
4) A microcontroller's on-chip ROM structure offers improved firmware security.
5) Simple to construct, inexpensive and compact.



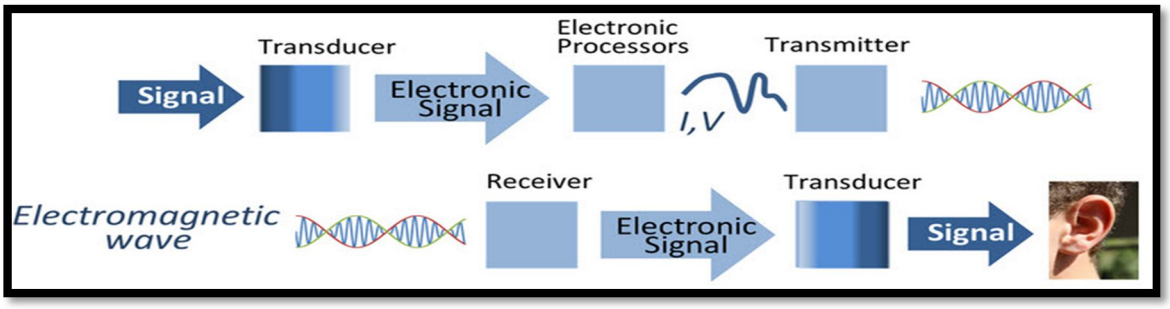
The single chip Atmega328 microcontroller utilised in the device belongs to the megaAVR series and was developed by Atmel. An 8-bit microcontroller with RISC-based Harward architecture is known as ATMega328 microcontroller. They have a programme memory that runs from 4k to 256k bytes with a 120 or more instructions set. Electrically Erasable Programmable Read-only Memory (EEPROM) for the ATmega 328 is 1KB. This feature demonstrates that even if the microcontroller's electric supply is cut off, it will still be able to store data and produce results after being given an electric supply. Cost effectiveness, minimal power consumption, a programming lock for security, and a real-time counter with a separate oscillator are just a few of its outstanding quantities.

Working of Atmega328:



1) The atmega328 has a total of 28 pins.
2) It has a total of three ports, called Port B, Port C, and Port D.
3) The total number of pins on Port C, an analogue port, is six. Therefore, to put it simply, the ATmega328 has six analogue pins.
4) Digital ports with 7 pins each are ports with 7 pins each are ports B and D.
5) Thus, the ATmega328 has a total of 14 digital pins.
6) Additionally, it allows for serial communications, which we can carry out using pins. Also supported is the SPI Protocol.
7) A crystal oscillator is required to produce the frequency. 4MHz to 40MHz crystal oscillators are available for application.

D. Ultrasonic Sensors



It is one of the model's key elements. An ultrasonic sensor is a device that uses ultrasonic sound waves to gauge a distance to an item. It transmits and receives ultrasonic pulses using a transducer in order to learn about an object's vicinity. Boundaries reflect high-frequency sound waves, creating different echo patterns. To receive and transmit the ultrasonic sound, the sensor's transducer functions as a microphone. A transducer is a device that transforms changes in a physical quantity, such as pressure or brightness, into an electrical signal or vice versa.

Our ultrasonic sensor, like many others, uses a single transducer to send a pulse and to receive the echo. They can gauge the distance to an object that is between 3cm and 3m away if it is closer than 3 cm because the sound waves will reverberate back to the sensor before the detector is ready to receive them. The ultrasonic sensor really consists of two components: an emitter that generates sound waves at a frequency of 40kHz and a detector that picks up these waves and relays an electrical signal to the microcontroller. The microcontroller code must include a timing loop that measures the amount of time needed for the sound wave emitted by the emitter to travel the distance to the item in order to calculate how far away it is.

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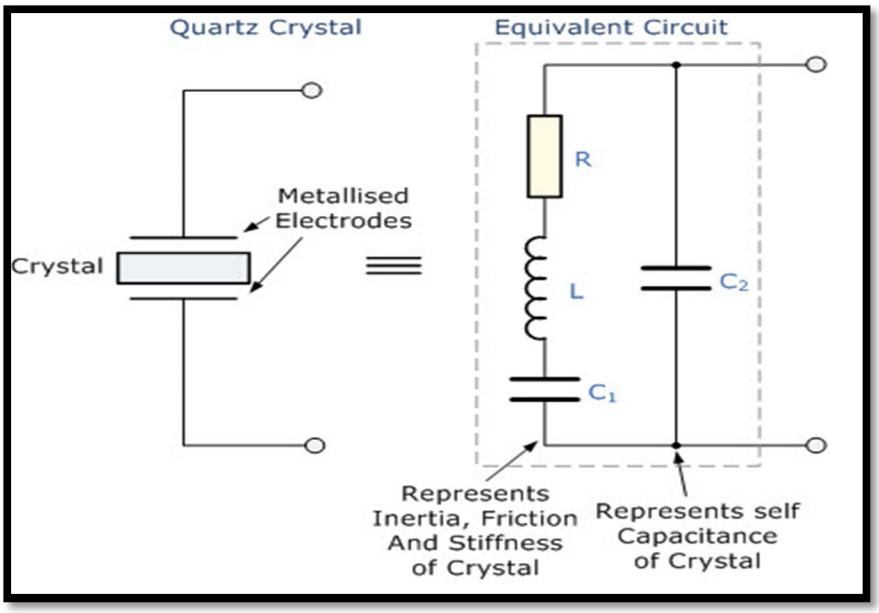
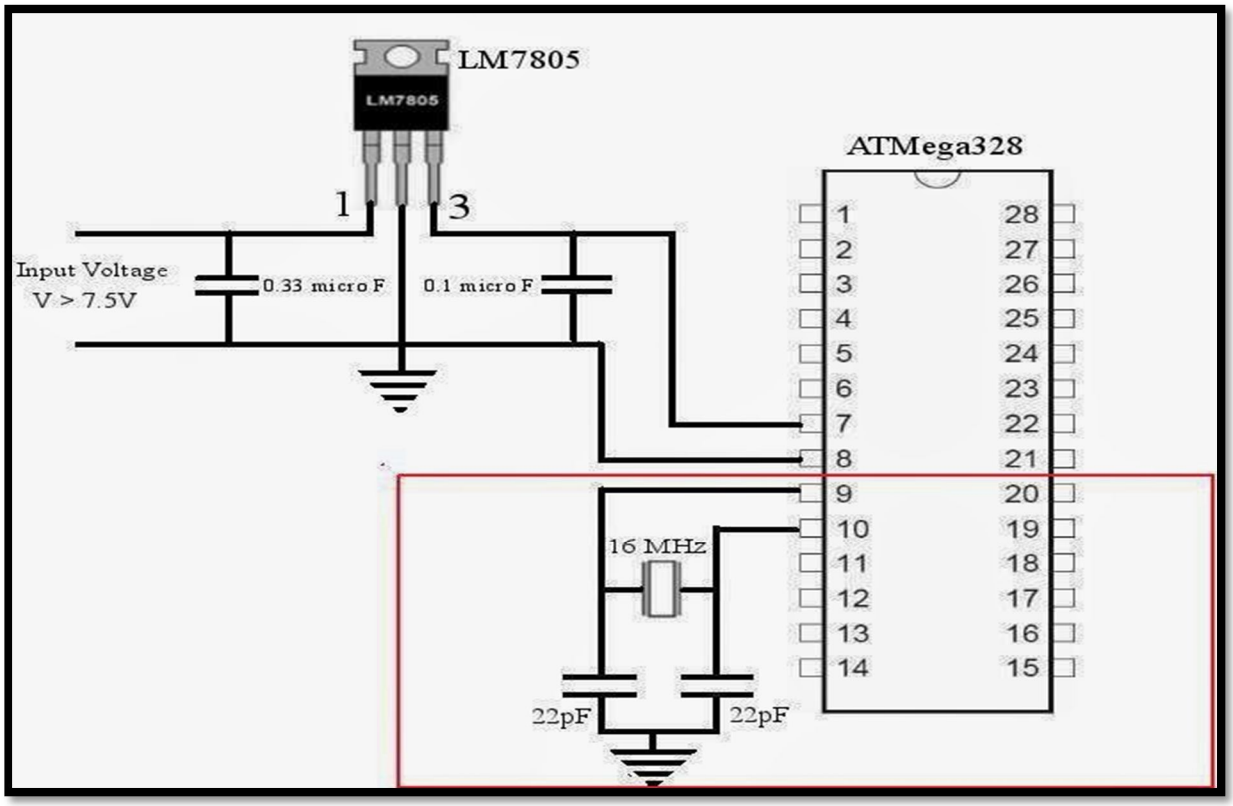
E. Crystal Oscillator



A crystal oscillator is an electronic oscillator circuit that generates a frequency- specific electrical signal by using the mechanical resonance of a piezoelectric crystal that is vibrating. The quartz crystal is the most popular kind of piezoelectric resonator employed. The piezoelectric effect is a very significant feature is a very significant feature of quartz crystals. A voltage that is proportional to mechanical pressure is applied across its faces.

The crystal is distorted as a result of that voltage. The amount of distortion will depend on the applied voltage and any other voltage used to make a crystal vibrate at its natural frequency.

Connections of crystal oscillator in microcontroller (ATmega328)



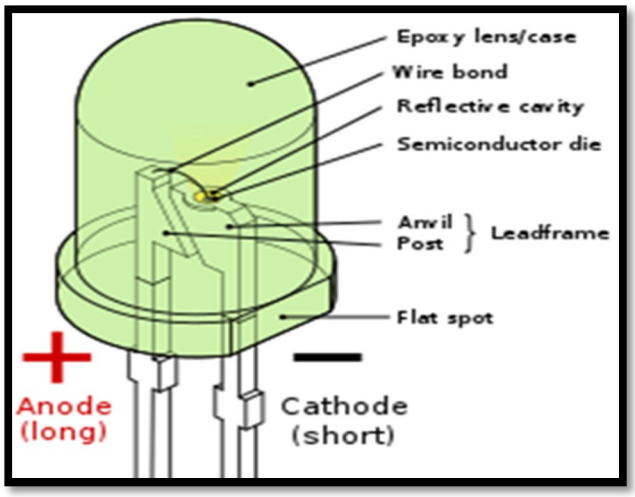
An external crystal oscillator with a 16MHz frequency should be attached to the circuit since we are utilising an ATMega328 microcontroller that was programmed using an Arduino board. The oscillator's clock signals typically alternate between these two states is known as the edge.

Function of the Clock in the Microcontroller:

1) Facilitates communication between all microcontroller components.
2) We can speed up the microcontroller by accelerating the clock.
3) The microcontroller is made up of parts that change state in response to clock pulse edges. We may readily estimate "Which operation will take place at a particular clock cycle" by knowing the oscillator's frequency and the number of clock pulses required to complete each operation

According to the circuit diagram below, an external crystal oscillator is linked to the microcontroller. A 16MHz oscillator is linked to this location. The crystal oscillator will not oscillate properly if the capacitors are not linked as depicted in the image.

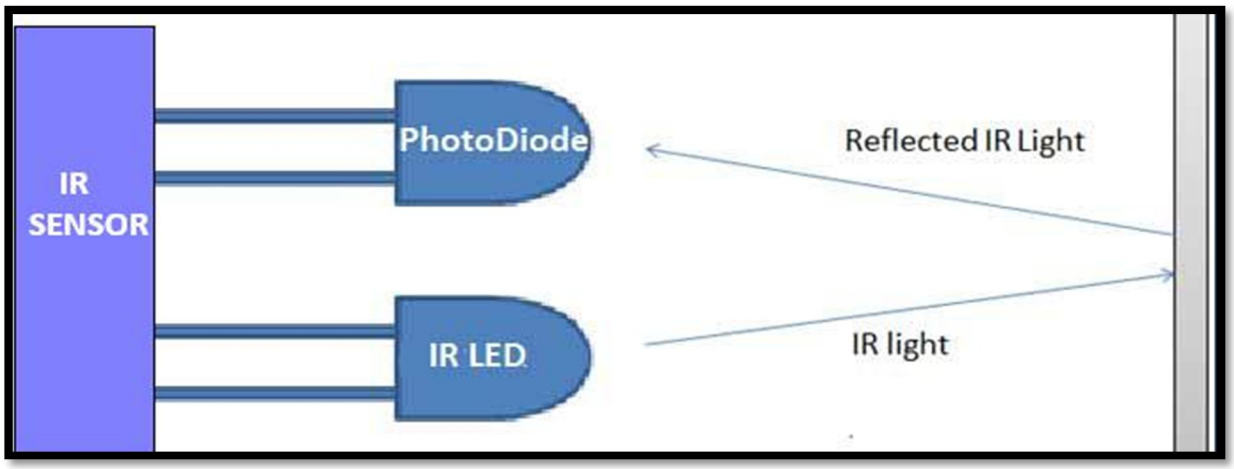
F. Light Emitting Diode



According to the circuit diagram above, an external crystal oscillator is linked to the microcontroller. A 16MHz oscillator is linked to this location. The crystal oscillator will not oscillate properly if the capacitors are not linked as depicted in the image.

Components of a typical LED. The anvil's and post's flat bottom surfaces, which are encased in epoxy and serve as anchors to stop the conductors from being violently yanked out by mechanical stress or vibration.

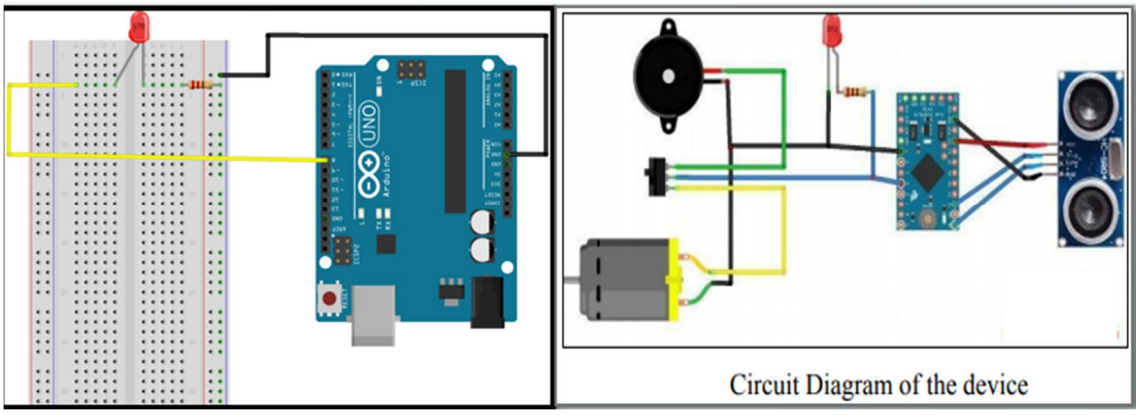
G. Infrared LED/ Infrared Sensor



A special purpose LED that emits infrared light with a wavelength between 700nm and 1mm is known as an infrared light emitting diode (IR LED). In addition to IR receiver, these are frequently employed as sensors.

The emitter circuit and the receiver circuit make up an infrared sensor. This is referred to as a photo-coupler or an optocoupler collectively. An IR LED serves as the emitter, while an IR photodiode serves as the detector. The IR light that an IR LED emits can be detected by an IR photodiode. In proportion to the amount of IR light received, the photo diode's output voltage and resistance change. This is how the IR sensor functions fundamentally.

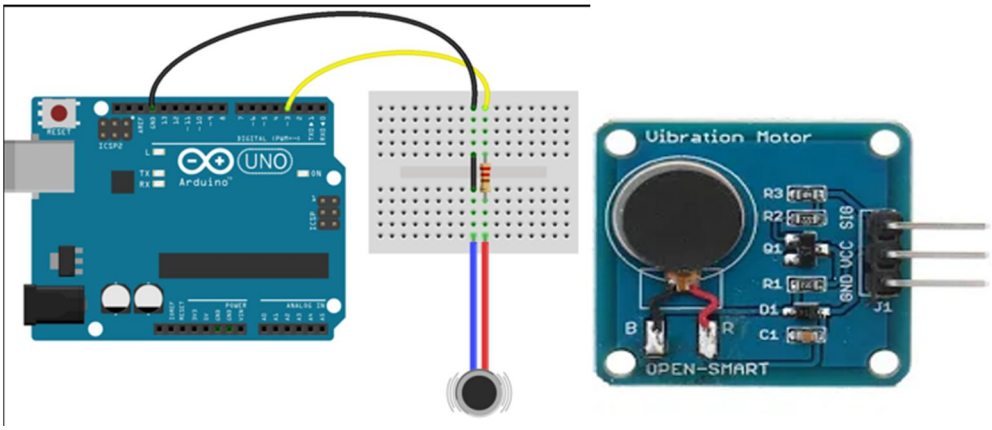
Direct incidence or indirect incidence are both possible types of incidence. In indirect incidence, a transparent object is placed in front of the sensor and both diodes are positioned side by side. The opaque surface receives the IR LED's light, which is then reflected back to the photodiode.



Circuit Diagram of the device

After being reflected back by the object, the IR LED emits radiation, which is then captured by the photodiode. The intensity of incident of incident radiation on the photodiode will increase with increasing proximity to the object. As a result, the LED and microcontroller are connected in the model. When an obstacle's opaque surface is detected by IR sensors, a signal is sent to the microcontroller or main circuit, which then makes judgements using the Arduino algorithm that that bot's designer has defined. As a result, when an obstruction is detected, an LED light blinks and a beeping sound is made.

H. DC Motor (Vibrating motor)



Any of a group of rotary electrical machines known as DC motors transform electrical energy form direct current into mechanical energy. In our model, the person is warmed up for the treat using a vibrating motor. A small, coreless DC motor is used for the vibration mechanism. This motor's primary function is to warm the user when they receive a call without sound or vibration. This motor's key characteristics are its magnetic qualities, light weight, and compact size. These characteristics contribute to the motor's high degree of consistency.

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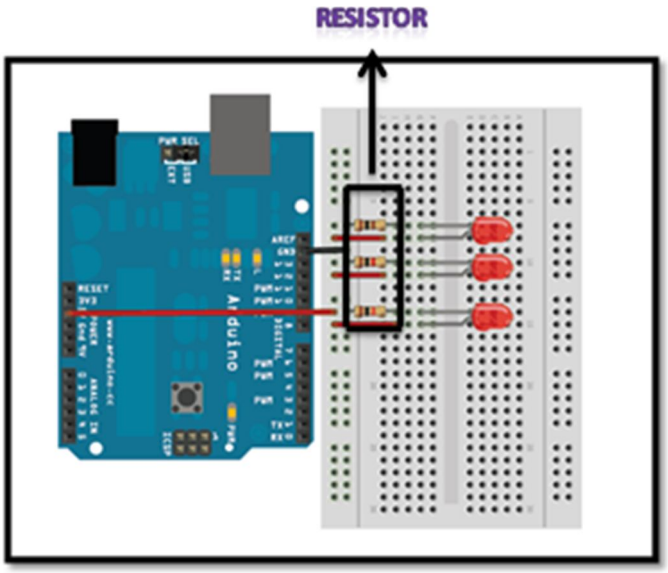
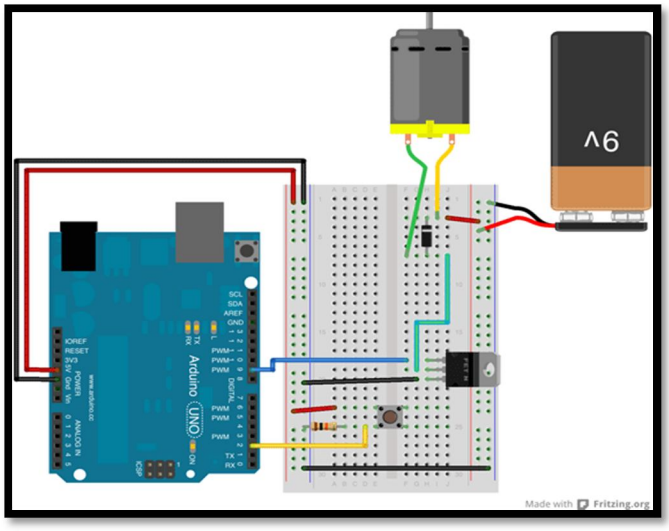
I. Resistors



We utilise resistors to control the current flowing to specific circuit elements, including LEDs and microcontroller integrated circuits, when constructing our Arduino-based model.

J. Transistors



By serving as a digital switch, a transistor enables an Arduino programme to manage loads with larger electrical demands. The programme will use PULSE-WIDTH MODULATION(PWM) to regulate a transistor, which will ramp up the motor's speed and then slow it back down.

K. Arduino Program

An open-source electronics platform called Arduino is build on simple hardware and software. The Arduino platform can receive inputs, such as light on a sensor or pressure on a button, and convert them into outputs, such as starting a motor or an LED. By delivering a set of instructions to the board's microcontroller (the atmega328), we can direct the board's actions. To do this, we make use of the Processing-based Arduino software and the Arduino programming language.

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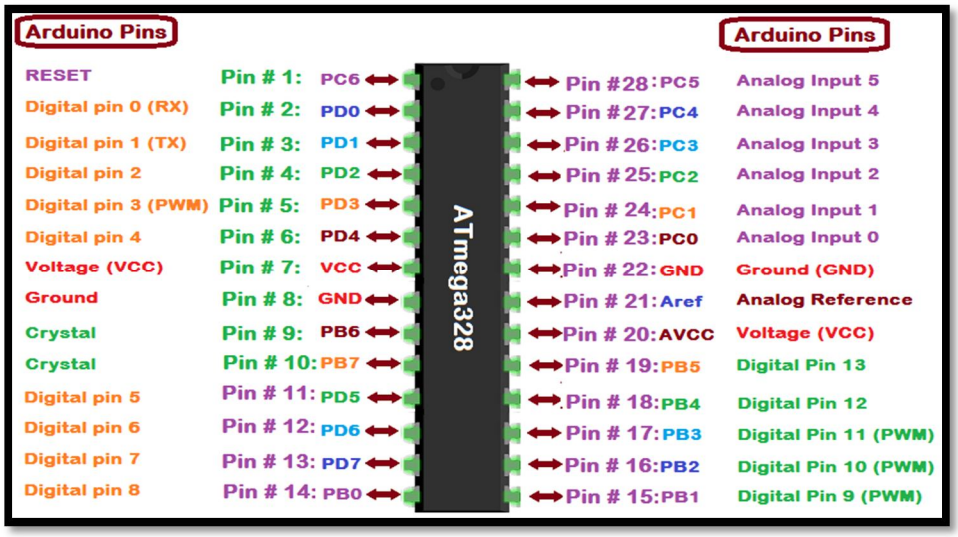
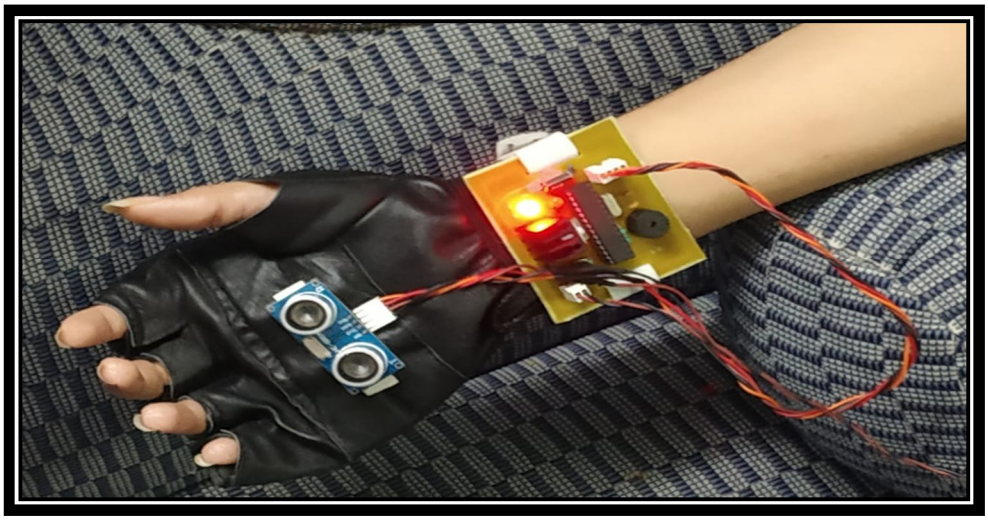
1) Why Arduino?

In terms of cost, Arduino boards are competitive with other microcontroller architectures.

Cross-platform: The Arduino software (IDE) is compatible with windows, Macintosh OSX, and Linux. The majority of microcontroller systems are Windows-only.

Programming environment that is easy to understand and use- The Arduino software is flexible enough to be used by both novice and advanced users. Software that is extendable and open source.





VI. FINAL TESTING AND WORKING

With the power supply cut off from the PCB, carefully insert the IC' s like micro-controller, motor drivers, encoders, decoders, etc whichever maybe relevant into their respective IC sockets/ connectors.

Special attention to be taken while inserting IC's to be paid as if the pins bend while inserting, they may break off rendering it unusable for further user in the project.

If the power supply is functioning proper with proper voltages at the components and the crystal circuitry (Crystal and allied capacitors) properly assembled then the project should be up and functioning as desired when powered up.

Also, special attention should be paid that the assembled PCB should be kept in far off vicinity of moist areas as water may short circuit the PCB (when powered on) and that the project should be handled with care.

VII. CONCLUSION

In conclusion, the idea of the "third eye" for the blind has enormous potential to improve the quality of life for those who are visually impaired. Researchers and inventors have prepared the way for a new domain of sensory perception and information processing through the use of cutting-edge technology like sensory replacement devices and brain-computer interfaces. Third eye provides blind people with new opportunities for improved spatial awareness, object recognition, and even artistic expression by translating visual information into alternative sensory cues like sound or touch.

The third eye has the potential to lower barriers and promote inclusivity for the blind as study and technology develop. It has the ability to change how society views blindness, empower individuals, and improve their daily life. The third eye might finally develop into a transformational instrument that boosts both independence and connectedness for people without sight via ongoing dedication and multidisciplinary work.

VIII. FUTURE SCOPE

A straightforward, affordable, customizable, and user-friendly electronic guidance system is suggested to offer helpful assistance and support to blind and visually impaired people.

In order to improve the mobility of the blind and visually impaired individuals in a safe and autonomous manner, the ultrasonic sensor has been extensively utilised. This technique doesn't call for any hefty equipment to be carried over large distances, nor does it call for any specialised training.

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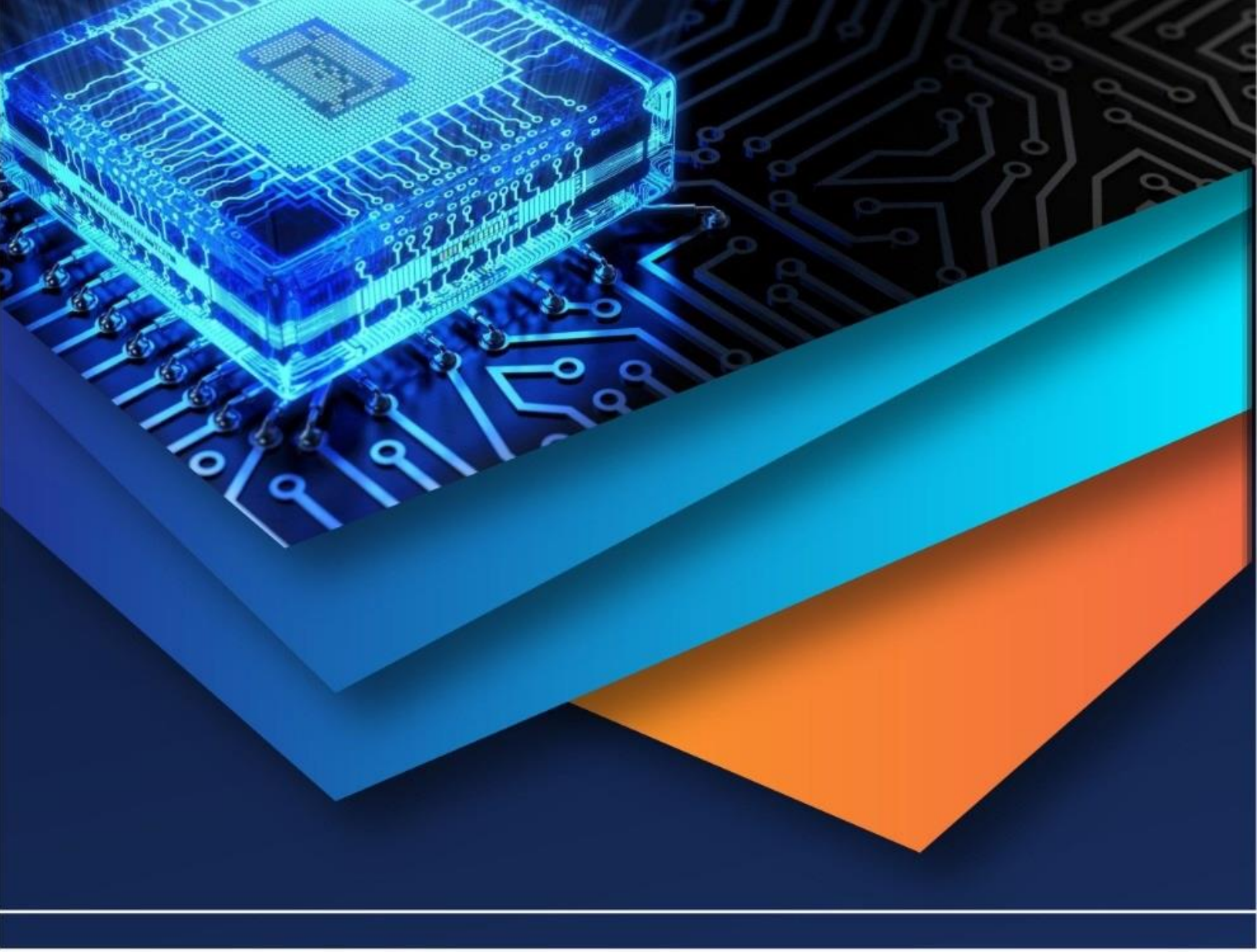

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