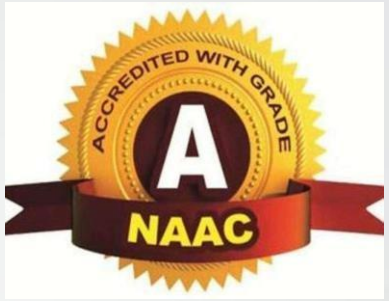
TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

(UGC-Autonomous)

Approved by AICTE, Affiliated by JNTUH, Accredited by NAAC- 'A' Grade
Medbowli , Meerpet , Balapur ,Hyderabad, Telangana- 500097
Mob: 9393959597. Email: info@tkrec.ac.in, deanacademics@tkrec.ac.in



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BATCH NO:06

SMART SHOE FOR THE BLIND PEOPLE USING ULTRASONIC SENSOR AND VOICE GUIDANCE

GUIDED BY:-
Mrs. S. PRATHYUSHA
(ASSISSTANT PROFESSOR)

TEAM MEMBERS :-

22R91A04F4:M.NANDINI

22R91A04K2:P.SURESH

22R91A04H8:P.THARUN

22R91A04J7:P.NAVEEN

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OBJECTIVES

- ✅ Detect obstacles in front, left, and right directions using ultrasonic sensors.
- ✅ Provide real-time voice guidance using ARP33A voice module.
- ✅ Ensure lightweight, wearable, and comfortable design.
- ✅ Improve mobility and independence of visually impaired individuals.
- ✅ Minimize power consumption for long-term usage.

Existing System

- Traditional aids include white canes and guide dogs.
- Limited range and no real-time voice feedback.
- Devices like smart glasses are expensive and not always comfortable.
- Most existing systems lack multi-directional obstacle detection.

Problem Identification

- Visually impaired people struggle with navigation, especially in unfamiliar environments.
- Existing aids don’t provide multi-directional feedback or instant alerts.
- There is a need for a low-cost, wearable, and intelligent navigation aid.

Proposed System

Two smart shoes embedded with Arduino Nano, ultrasonic sensors, and ARP33A voice module.

- Right Shoe:
  - Front sensor for forward obstacle detection.
  - Side sensor for right-side detection.
- Left Shoe:
  - Side sensor for left-side obstacle detection.
- Voice alerts guide users in real time to avoid obstacles.

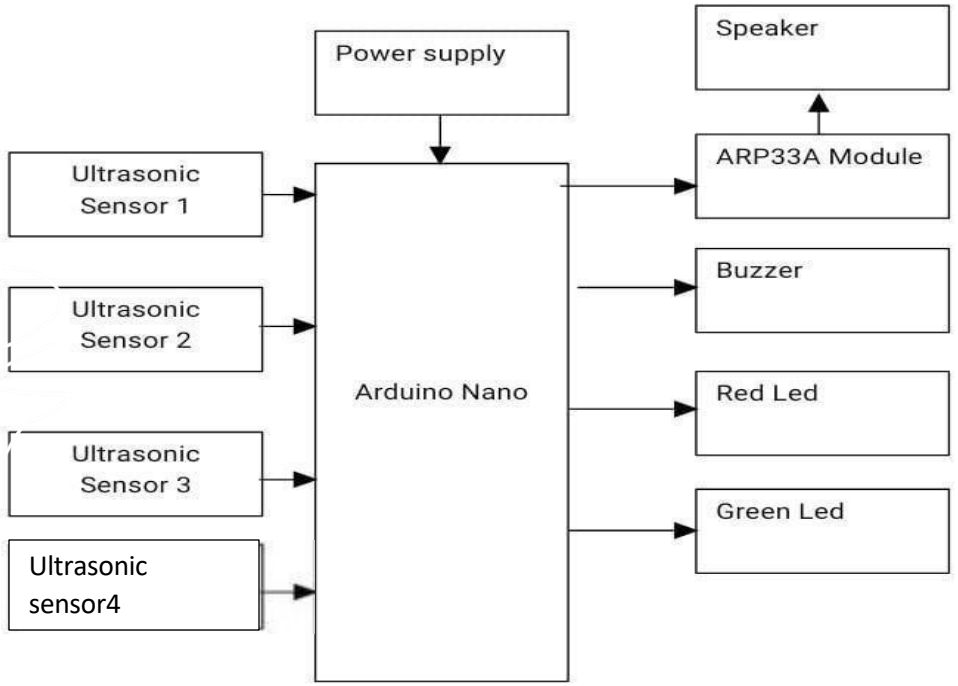
ABSTRACT

- This project presents a Smart Shoe for Blind People, integrating ultrasonic sensors and voice guidance to enhance mobility and independence.
- The system employs ultrasonic sensors to detect obstacles in the user's path and provides real-time audio feedback via a voice module.
- The ultrasonic sensors continuously scan the surroundings, and when an obstacle is detected within a predefined range, a microcontroller processes the data and triggers voice alerts through a speaker

- This innovation aims to improve the safety and autonomy of visually impaired individuals, reducing
their dependency on traditional aids like canes. The smart shoe is a cost-effective, lightweight, and user- friendly solution, making it a viable option for widespread adoption.

Keywords: Smart Shoe, Ultrasonic Sensor, Voice Guidance, Assistive Technology, Blind Navigation

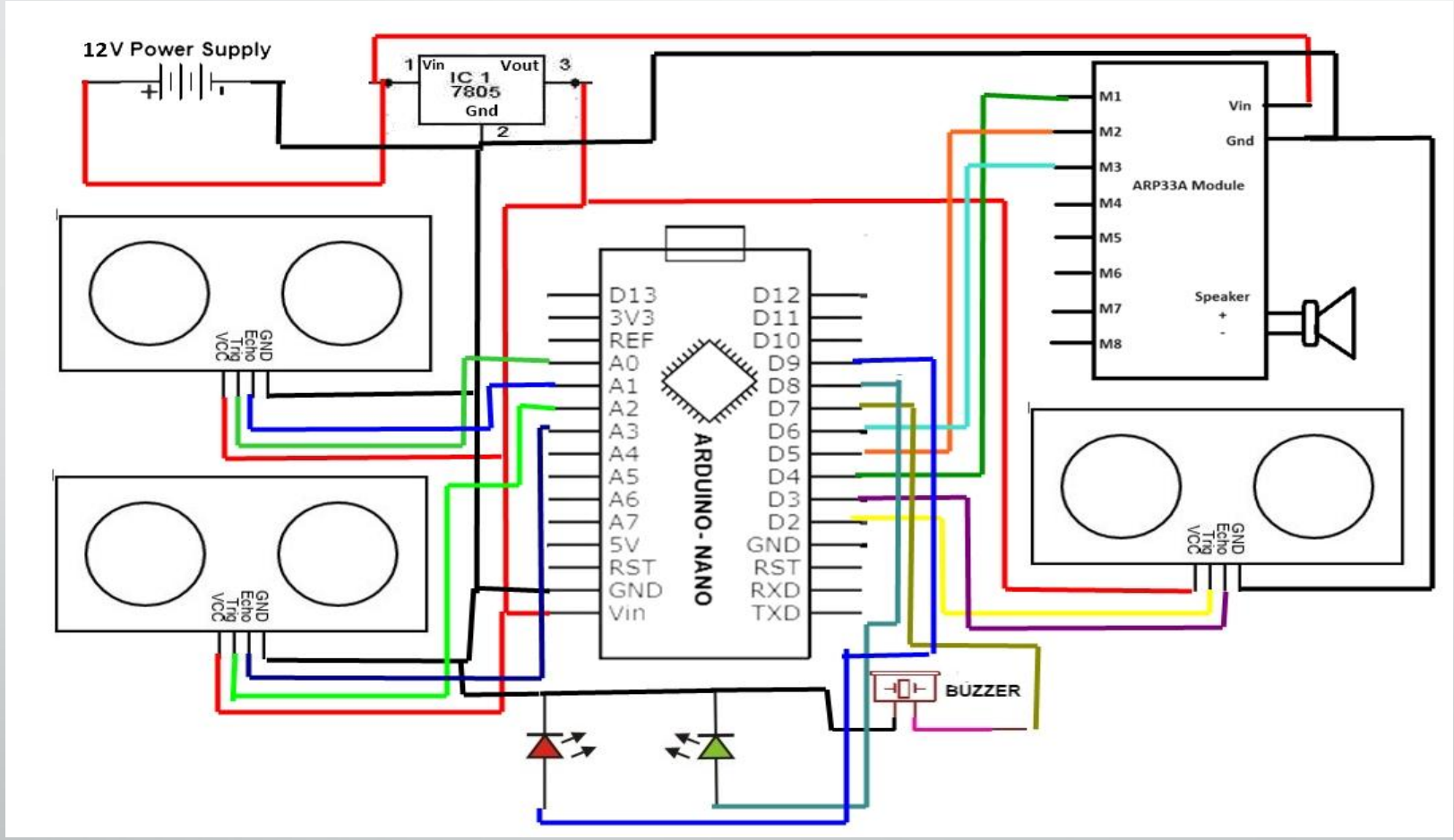
BLOCK DIAGRAM



Working

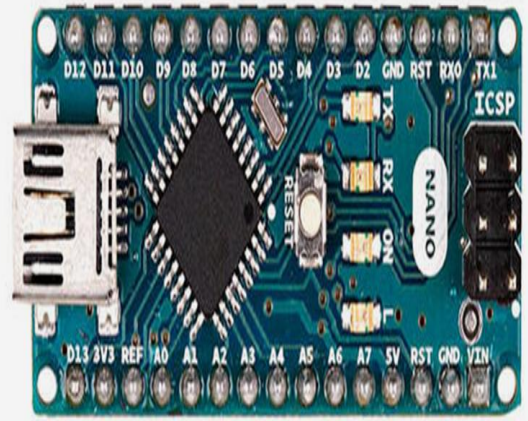
1. Ultrasonic sensors continuously detect obstacles in predefined ranges.
2. Sensor data is processed by Arduino Nano.
3. If an obstacle is detected:
   - Corresponding voice alert is played using the ARP33A module.
   - Alerts include directions like “Obstacle ahead”, “Obstacle on right”, “Obstacle on left”.
4. System runs on battery and is integrated into regular footwear.

SCHEMATIC DIAGRAM



Arduino Nano

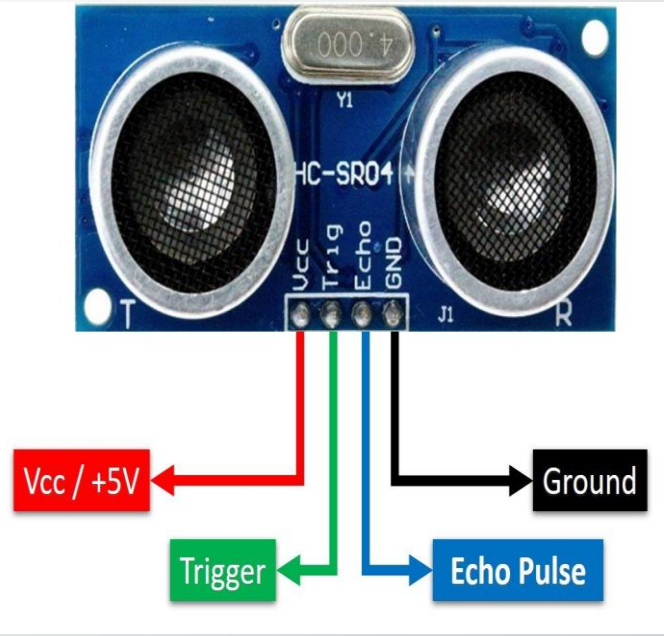
The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 . It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.



Ultrasonic Sensor

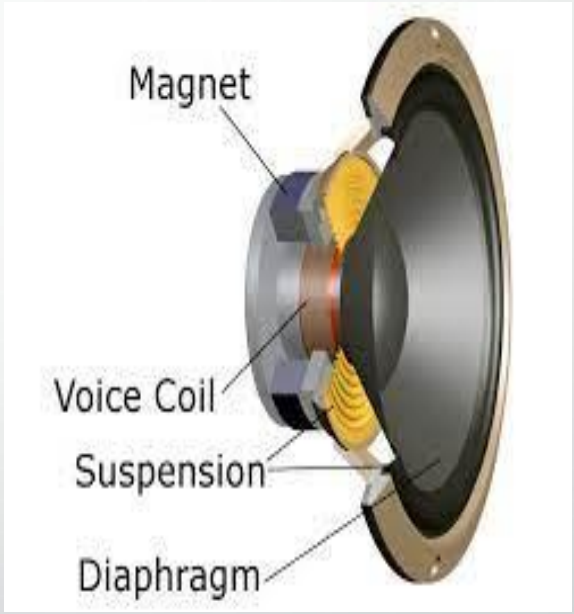
Ultrasonic sensors are based on the measured propagation time of the ultrasonic signal. They emit high-frequency sound waves which reflect on an object. The objects to be detected may be solid, liquid, granular or in powder form. Ultrasonic transducers operate at frequencies in the range of **30–500 kHz** for air-coupled applications. As the ultrasonic frequency increases, the rate of attenuation increases. Thus, low-frequency sensors (30–80 kHz) are more effective for long range, while high-frequency sensors are more effective for short range.

Distance = speed x time/ 2



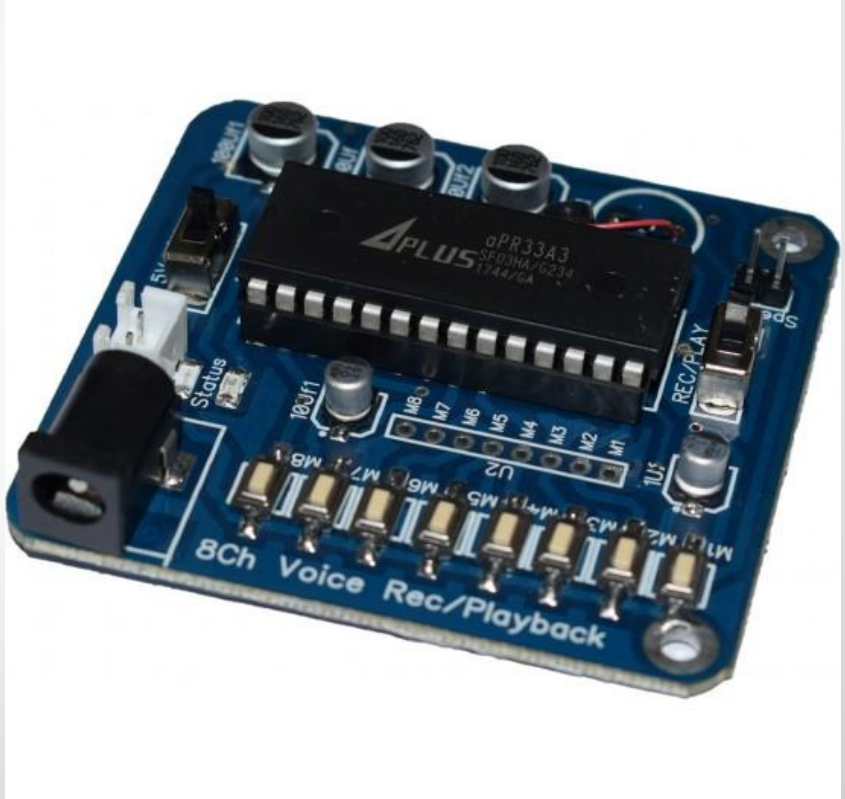
Speaker

Speakers work **by converting electrical energy into mechanical energy (motion)**. The mechanical energy compresses air and converts the motion into sound energy or sound pressure level (SPL). When an electric current is sent through a coil of wire, it induces a magnetic field.



ARP33A module

It provides high quality recording and playback with 11 minutes audio at 8 Khz Sampling rate with 16 bit resolution. The aPR33A series C2.x is specially designed for simple key trigger, user can record and playback the message averagely for 1, 2, 4 or 8 voice message(s) by switch, It is suitable in simple interface or need to limit the length of single message.



Buzzer

a piezo buzzer works by **applying an alternating voltage to the piezoelectric ceramic material**. The introduction of such an input signal causes the piezoceramic to vibrate rapidly, resulting in the generation of sound waves.

Lithium-ion rechargeable battery

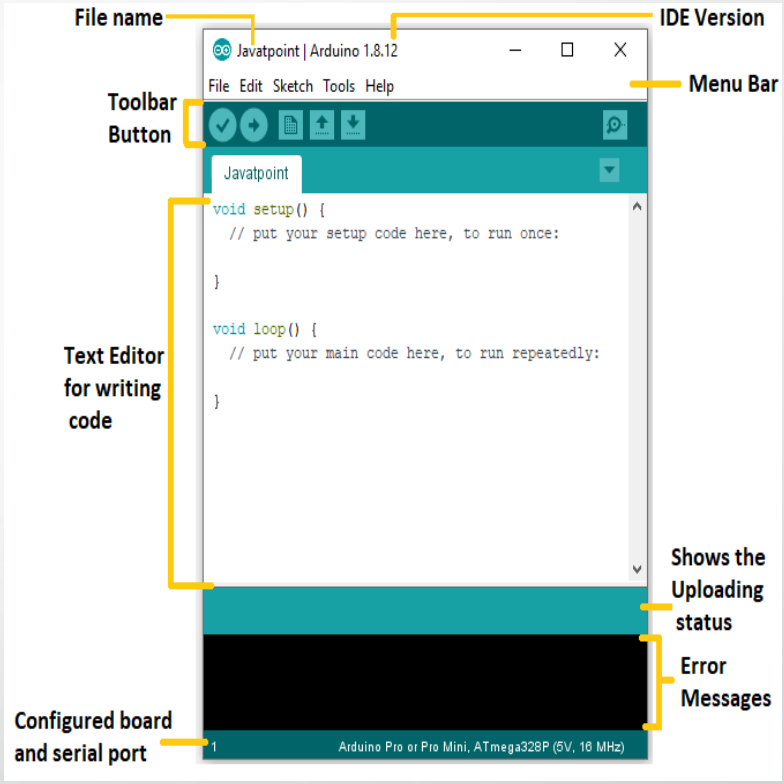
Lithium-ion is the most popular rechargeable battery chemistry used today. Lithium-ion batteries power the devices we use every day, like our mobile phones and electric vehicles. Lithium-ion batteries consist of single or multiple lithium-ion cells, along with a protective circuit board.

LED’s

A **light-emitting diode** (**LED**) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - **contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus**. It connects to the Arduino hardware to upload programs and communicate with them



Advantages

- Real-time obstacle detection from three directions.
- Hands-free and wearable solution.
- Voice alerts enhance user understanding and response.
- Compact design embedded in regular shoes.
- Cost-effective and easy to maintain.
- Increases confidence and independence.

Applications

- 🚶 Navigation aid for visually impaired individuals.
- 🏫 Can be used in special schools and institutions.
- 🏘️ Everyday movement in public or home environments.
- 🧭 Potential integration with GPS for location-aware guidance.
- 👨‍⚕️ Support in elderly care and rehabilitation scenarios.

RESULT

Conclusion

• The Smart Shoe for Blind People is an innovative, accessible, and reliable solution that enhances independence and safety.
• By integrating ultrasonic sensors and voice modules, the system bridges the gap between affordability and functionality.
• With further improvements, this assistive technology can be a mainstream navigation aid for the visually impaired.

Future Scope

- 🔊 Integration with Bluetooth speakers or headphones.
- 🌐 Add GPS and location-based services for outdoor navigation.
- 📱 Develop a mobile app interface for configuration.
- 🔋 Implement wireless charging and battery optimization.
- 🧠 Add AI for terrain classification and advanced object detection.

Reference

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Thank you...