Sreyas Institute of Engineering and Technology

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

TOPIC : Metal Detector

Presented by Batch : A-11

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Abstract

This project involves the design and implementation of a practical metal detector using electromagnetic induction principles. The detector features a copper coil that generates a magnetic field when powered by an oscillator circuit. When a metal object is brought near the coil, it disrupts the magnetic field, causing a change in the coil's resonance frequency. This frequency alteration is detected by transistors, which amplify the signal before directing it to a buzzer. The buzzer then emits an audible alert, indicating the presence of metal.

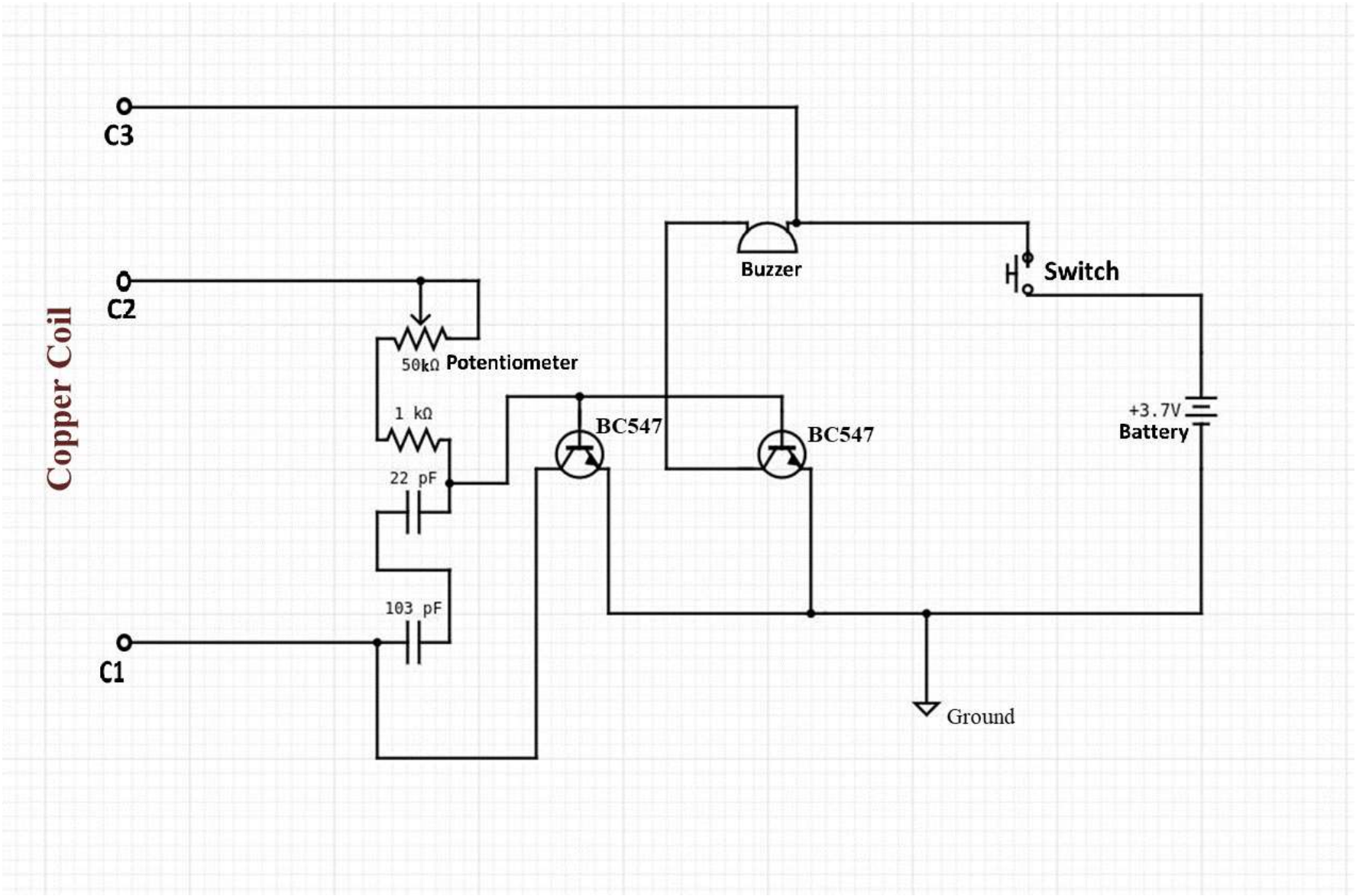
The detector can identify both ferrous metals like iron and steel, as well as non-ferrous metals such as aluminum, copper, and brass. A potentiometer allows for sensitivity adjustment, enabling precise tuning to detect metals of various sizes and distances. This feature makes the detector versatile for applications ranging from locating hidden metal objects to educational demonstrations of electromagnetic principles.

Constructed from basic electronic components, this project exemplifies fundamental concepts such as oscillation, signal amplification, and electromagnetic field interaction with conductive materials like metals. It serves as an invaluable educational tool, offering hands-on experience in electronics and enhancing understanding of real-world applications of electromagnetic theory. Overall, this metal detector project provides practical insights into electronics and showcases its potential in diverse educational and practical settings.

Tools :

- BC547 TRANSISTORS
- 102 PF CAPACITOR
- 22 PF CAPACITOR
- 1K RESISTOR
- 5V BUZZER
- 50K POTENTIOMETER
- INSULATED COPPER WIRE
- PUSH-ON/OFF SWITCH
- 2 PIN SCREW TERMINAL

Circuit Diagram

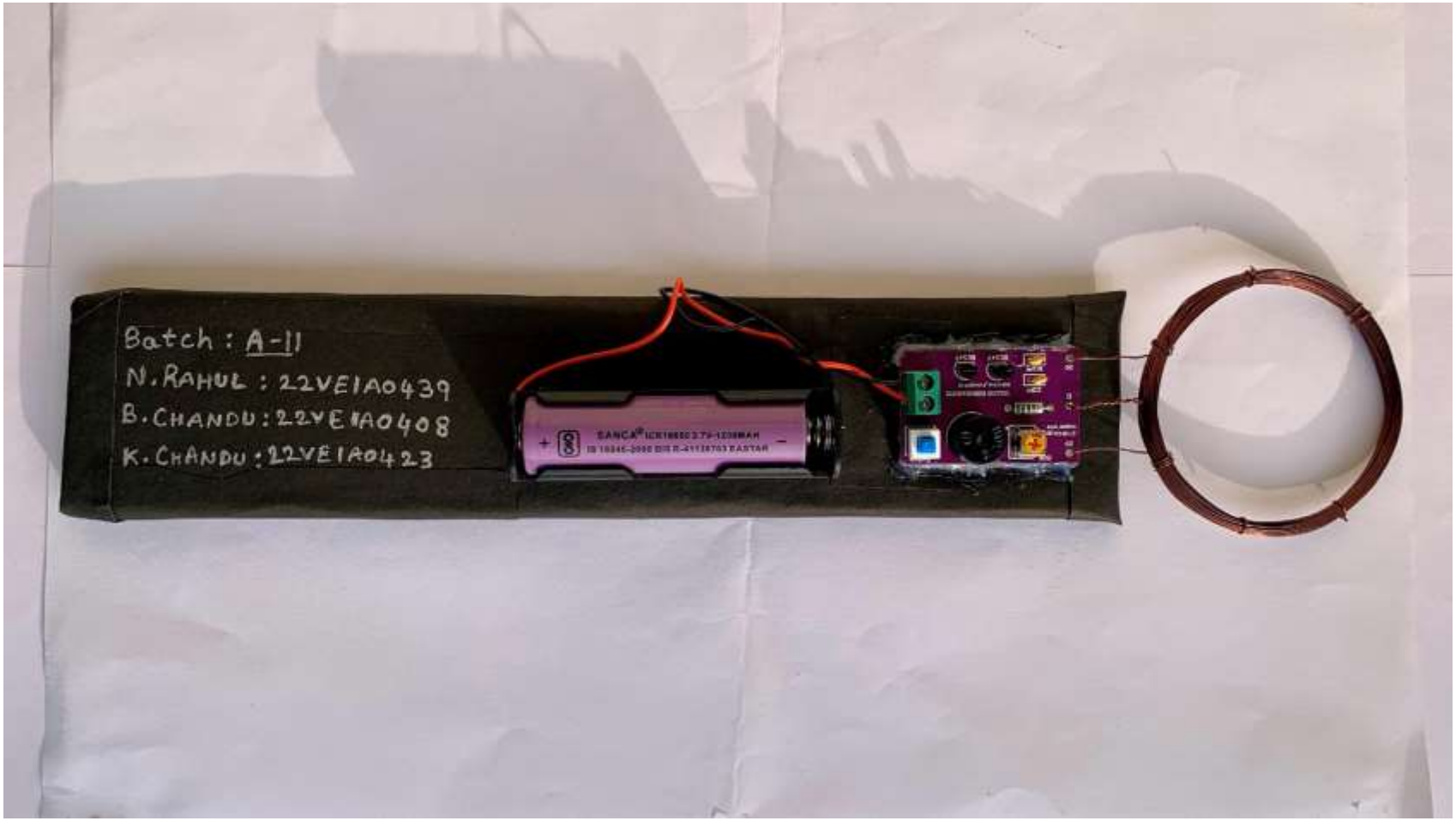


Working

The metal detector operates by utilizing changes in the magnetic field when it approaches a metal object. This alteration disrupts the normal resonance frequency of the oscillator circuit within the detector. The oscillator, reacting to these changes, produces a fluctuating electrical signal. This signal is then processed and amplified by the transistors in the circuit.

Once amplified, the signal is directed to a buzzer, which converts it into an audible sound. The intensity and frequency of this sound indicate the proximity and size of the metal object detected. To fine-tune the detector's sensitivity according to specific needs, a potentiometer is integrated into the circuit. Adjusting the potentiometer allows users to regulate how easily the detector responds to variations in the magnetic field, ensuring accurate detection tailored to different environments or metal types.

SIMULATION MODEL



Simulation Output:

Buzzer is ON

Simulation Output:

Buzzer is Off

Advantages

- **Portability** : Lightweight and battery-operated for easy transportation.
- **Affordability** : Cost-effective compared to commercial metal detectors.
- **Customizability** : Adjustable sensitivity to detect various sizes of metal objects.
- **Educational** : Provides hands-on learning in electronics and circuit design.
- **Versatility** : Suitable for indoor and outdoor use in diverse environments.

Applications

- **Hobbyist Treasure Hunting** : Search for coins, relics, and jewelry in parks or beaches.
- **Security Screening** : Screen for metal objects in small-scale security applications.
- **DIY Projects** : Integrate into robotics or automated systems for metal detection.
- **Environmental Studies** : Locate buried metal utilities or study soil composition.
- **Recreational Use** : Enjoy activities like beachcombing or explore historical sites for metal artifacts.

Conclusion & Future Scope

"In conclusion, the metal detector project showcases the application of fundamental electronic principles to create a functional device. By utilizing components like transistors, capacitors, resistors, and a buzzer, we've developed a tool that detects metal objects through disturbances in magnetic fields. This project not only enhances our understanding of electronics but also demonstrates how theoretical knowledge can be translated into practical solutions. It's been a rewarding journey of learning and innovation, highlighting the versatility and real-world relevance of electronics in everyday applications."

References

- A. Smith, "Design and implementation of a metal detector using basic electronic components," in Proceedings of the IEEE International Conference on Electronics and Communication Engineering, New Delhi, India, 2024, pp. 100-105.

THANK YOU!