Metal Detector for Security Checking

K. Govinda [1] Venkata Sai Akhil Jonnadula [2] Karthikeyan. M [3]
[1] SCSE, University, Vellore, India. [2] SENSE, VIT University, Vellore, India.

Abstract---This paper proposes a method for designing and implementation of metal detector using latest technology. The metal detector which is used for security checking. This metal detector can be used to detect slightly big size metallic objects. It is used as a sensing coil. This coil should be kept near the metallic objects for detection. Input of circuit is a weak culprit's R.F range oscillator. Sensing coil forms parts of turned oscillator. This work focuses on the adaptation, simulation and construction of a commonly available schematic for metal detector. Metal detectors are finding applications all over the place as the ability to detect certain types of materials at a distance become ever more crucial.

I. Introduction

A basic approach to creating a superior metal detector includes.

— Products that offer the most useful features and best possible performance
— Products that are highly reliable
— Products that exceed expectations every time they are used.

To achieve these goals we must know advanced detector theory intimately. A sound working knowledge of electronics, mathematics, and mechanical engineering are essential as is familiarity with government regulations. We also pride ourselves on our practical knowledge of hands-on detecting in the field.

The transmitted magnetic field varies in time, usually at rates of fairly high-pitched audio signals. The magnetic transmitter is in the form of a transmit coil with a varying electric current flowing through it produced by transmit electronics. The receiver is in the form of a receive coil connected to receive and signal processing electronics. The transmit coil and receive coil are sometimes the same coil. The coils are within a coil housing which is usually simply called "the coil," and all the electronics are within the electronics housing attached to the coil via an electric cable and commonly called the "control box".

The changing transmitted magnetic field causes electric currents to flow in metal targets. These electric currents are called eddy currents, which in turn generate a weak magnetic field, but their generated magnetic field is different from the transmitted magnetic field in shape and strength. It is the altered shape of this regenerated magnetic field that metal detectors use to detect metal targets.

The regenerated magnetic field from the eddy currents causes an alternating voltage signal at the receive coil. This is amplified by the electronics because relatively deeply buried targets produce signals in the receive coil which can be millions of times weaker than the signal in the transmit coil, and thus need to be amplified to a reasonable level for the electronics to be able to process. In summary:

1. Transmit signal from the electronics causes transmit electrical current in transmit coil.
2. Electrical current in the transmit coil causes a transmitted magnetic field.
3. Transmitted magnetic field causes electrical currents to flow in metal targets (called eddy currents.)
4. Eddy currents generate a magnetic field. This field is altered compared to the transmitted field.
5. Receive coil detects the magnetic field generated by eddy currents as a very small voltage.
6. Signal from receive coil is amplified by receive electronics, then processed to extract signal from the target, rather than Signals from other environment magnetic sources such as earth's magnetic field.

II. Literature Review

Metal detectors work on the principle of transmitting a magnetic field and analyzing a return signal from the target and environment [1]. The transmitted magnetic field varies in time, usually at rates of fairly high-pitched audio signals [2]. The magnetic transmitter is in the form of a transmit coil with a varying electric current flowing through it produced by transmit electronics [5]. The receiver is in the form of a receive coil connected to receive and signal processing electronics. The transmit coil and receive coil are sometimes the same coil. The coils are within a coil housing which is usually simply called "the coil," and all the electronics are within the electronics housing attached to the coil via an electric cable and commonly called the "control box".

This changing transmitted magnetic field causes electric currents to flow in metal targets. These electric currents are called eddy currents, which in turn generate a weak magnetic field, but their generated magnetic field is different from the transmitted magnetic field in shape and strength. It is the altered shape of this regenerated magnetic field that metal detectors use to detect metal targets [3]. (The different "shape" may be in the form of a time delay.) The regenerated magnetic field from the eddy currents causes an alternating voltage signal at the receive coil [4]. This is amplified by the electronics because relatively deeply buried targets produce signals in the receive coil which can be millions of times weaker than the signal in the transmit coil, and thus need to be amplified to a reasonable level for the electronics to be able to process. In summary:

1. Transmit signal from the electronics causes transmit electrical current in transmit coil [6].
2. Electrical current in the transmit coil causes a transmitted magnetic field [6].
3. Transmitted magnetic field causes electrical currents to flow in metal targets (called eddy currents.)
4. Eddy currents generate a magnetic field. This field is altered compared to the transmitted field [7]
5. Receive coil detects the magnetic field generated by eddy currents as a very small voltage.
6. Signal from receive coil is amplified by receive electronics, then processed to extract signal from the target, rather than signals from other environment magnetic sources such as earth's magnetic field [8].

III. PROPOSED METHODOLOGY

A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. Another common type are stationary "walk through" metal detectors used for security screening at access points in prisons, courthouses, and airports to detect concealed metal weapons on a person's body.

The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces a magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected.

The first industrial metal detectors were developed in the 1960s and were used extensively for mineral prospecting and other industrial applications. Uses include de-mining (the detection of land mines), the detection of weapons such as knives and guns (especially in airport security), geophysical prospecting, archaeology and treasure hunting. Metal detectors are also used to detect foreign bodies in food, and in the construction to detect steel reinforcing bars in concrete and pipes and wires buried in walls and floors.

IV. DESIGN AND IMPLEMENTATION

Two inductors that are used to detect the presence of a Metal. One inductor is used as a reference coil with Specific known inductance. This was constructed by Winding a 120 turns of 34 AWG wire around a ½ wooden Dowel. When placed in an RLC circuit, it will oscillate at a Given frequency. A second inductor (the search coil) is Used to detect the presence of metal. Our search coil Consisted of a 12 inch non-conducting loop wrapped with 8 turns of 34 AWG wire. This frequency is then closely matched with the Reference coil by the fine tuning of the reference coil; it is Tuned by screwing or unscrewing a metal washer around the reference coil until the frequencies are about the same. Once there are two oscillating RLC circuits, closely Matched, one can slightly alter the search coil's inductance Then compare the difference between them.

Altering the search coil's inductance is accomplished by Placing a large metal object near the search coil; this will In turn change the frequency at which this RLC circuit is Oscillating. Now that the two circuits are oscillating at Different frequencies, this frequency difference can be Analyzed, stepped down and amplified into an audible tone Utilizing a high impedance speaker or headphones. If there Is a large difference between the frequencies, this will Produce a higher frequency on the audio output. However, When the frequencies are still very close together, a small Beat, or no beat will be output to the audio.

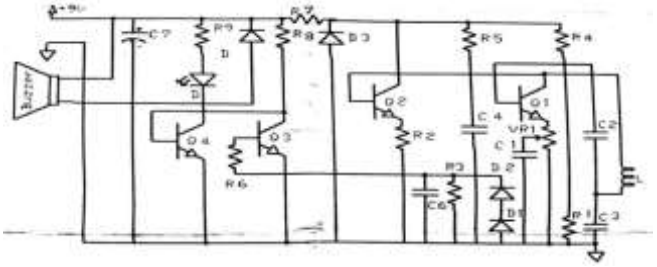

Fig. 1: Circuit Diagram

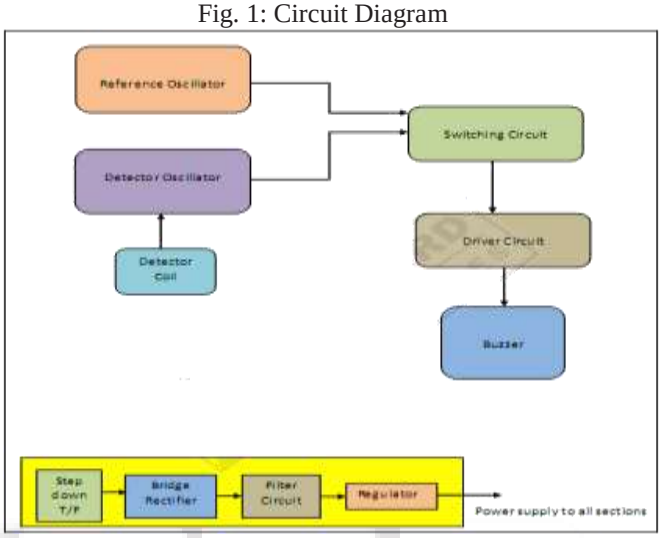

Fig. 2: Overview of Smart Home

V. RESULTS AND DISCUSSION

One hundred and twenty-eight articles met thesearch criteria and were retrieved and reviewed.Articles that did not pertain to research studies or to the school setting, or did not include research questions pertaining to the use/presence of metal detectors were excluded. Conversely, to maximize breadth, all articles that included metal detectors, either as part of a larger survey or as part of a composite measure of school security, were included in the final review, as were a wide range of sampling and study designs.Of the studies reviewed, 7 met inclusion criteria.These included 5 studies that examined perceptions related to metal detectors and 2 that focused on associations between metal detectors and violent behavior.

An inductionloop is electromagnetic communica tion or detection system which uses a moving magnet to induce an electrical current in a nearby wire. Induction loops are used for transmission and reception of communication signals, or for detection of metal objects in metal detectors or vehicle presence indicators. A common modern use for induction loops is to provide hearing assistance to hearing-aid users.

The proposed system is tested on the model of the smart homes(which is as shown in the above discussions).the laser rays using Wi-Fi technology based security system detects the motion of intruders and sends SMS to the nearby police station. This system is more convenient and easy to use. This system can also be developed with the latest improvements in the technology.

The developed laser based security system gives good response to the sensor and sends SMS when it detects the intruders entering the house premises. The time taken by the system to deliver the SMS is dependent on the coverage area of the range of the specified mobile network. If the mobile is in the range of the system then the SMS is delivered in 25-30 seconds.

VI. CONCLUSION

This work highlights what is currently known about the effects of metal detectors on school violence, Student behavior's, and student and staff perceptions of safety. In reviewing what is known, the questions that remain unanswered by the existing body of literature are also highlighted. Based on these findings, we conclude that there is insufficient evidence to draw a conclusion about the potential beneficial effect of metal detector use on student and staff behavior or perceptions; furthermore, some research suggests that the use of metal detectors in schools is associated with lower levels of students' perceptions of security in school and higher levels of school disorder. Future research should use objective data and appropriate controls to evaluate the impact of metal detector use on rates of weapon carrying, violent behavior, and violence-related injuries.

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