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FACULTY OF ENGINEERING,
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Metal Detector

Final Report

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Abstract

The concept behind this project of "Metal Detector" is to ensure avoiding any illegal or unauthorized entry of metallic objects, bombs, knives, guns within the luggage bags of the person carrying them in public places like theatres, shopping malls, parks, airports, hotels, railway stations etc.

It is a low-cost metal detector using a IC 555 circuit.

This project gives an overview of metal detector working principle and applications.

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Ch1. Introduction

1.1 Why Did We Choose This Project Idea?

Before starting any project you should focus on the goal you want and develop a plan to achieve it , by another meaning "start with the end in your mind" and the end in our mind is (Metal detector instrument).
In order to decide what to do and why you are doing it , you need to know–and I mean really know–why it's worth doing. You need to run your ideas by smart, and choose your idea based on different factors that we had to put in our minds like it has to be :

- An idea that interests you
  We had Chosen an idea that seems interesting to us in the first place. If you do not have any interest in your idea you will not be able to do it in the best possible manner, Your interest in the idea means that you will happily work on it and have better end result.
- An idea that is important in our modern life
  We had chosen the metal detector instrument as we know its importance in our lives and the many reasons it is used for that will be mentioned in this report.
- An idea which aim to interest different types of customers
  The metal detector instrument is used in many fields as (security , industry ,…. etc) so it aims to get attention from many types of customers.
  So we had chosen our idea based on many points of view as we find it something that we would be willing to work hard on it and achieving our goal.

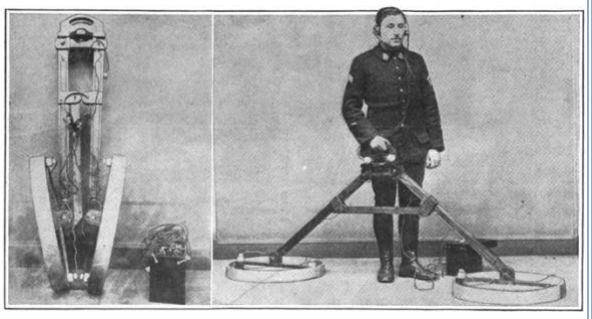
⇒ Those are some reasons why we had chosen our project idea which is "**METAL DETECTOR INSTRUMENT**"

1.2 Literature review

HISTORY OF METAL DETECTOR

Gustave Trouvé, a French electrical engineer, invented the first metal detector in 1874. He designed it to detect and remove bullets and other metal objects from people. In 1881, after United States President James Garfield was assassinated, Alexander Graham Bell attempted to create a metal detector similar to Trouvé's device. Using his device, Bell attempted to locate the bullet inside President Garfield. The metal coils of James Garfield's bed confused Bell's metal detector, and the attempt to find the bullet was unsuccessful.

During World War II & World war I, metal detectors were extremely useful as land mine detectors.



An early metal detector, in 1919,used to find unexploded bombs in France after World War I

Józef Kosacki, a Polish Army engineer, invented the first portable metal detector in 1941. Lieutenant Kosacki was stationed in Scotland at the time when Nazi forces occupied Poland. His design featured a long wand and dish, similar to modern portable detectors, but the electronics were housed in a large and heavy backpack. During World War II, the Allies used hundreds of thousands of land mine detectors based on his design.

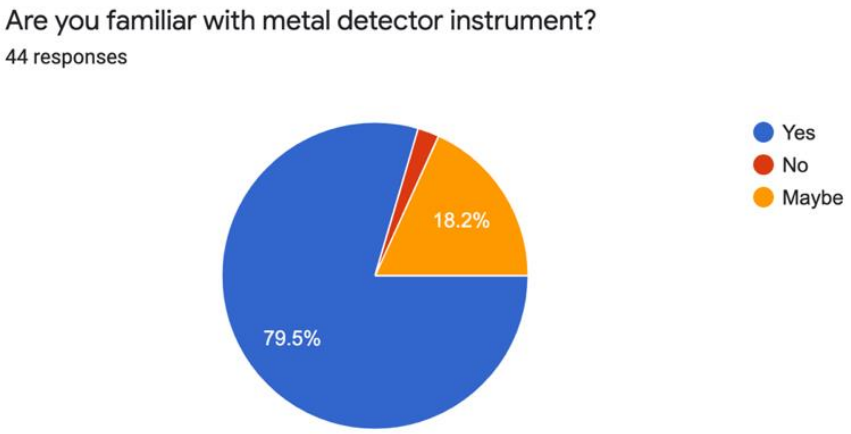
In 1925, Gerhard Fisher applied for the first metal detector patent. He was working on a radiowave navigation system when he discovered that the results were thrown off when his device was near rocks with a lot of metal. He realized he could use this to create a metal detector and applied for a patent on it, He reasoned that if a radio beam could be distorted by metal, then it should be possible to design a machine which would detect metal using a search coil resonating at a radio frequency. Although Gerhard Fischer was the first person granted a

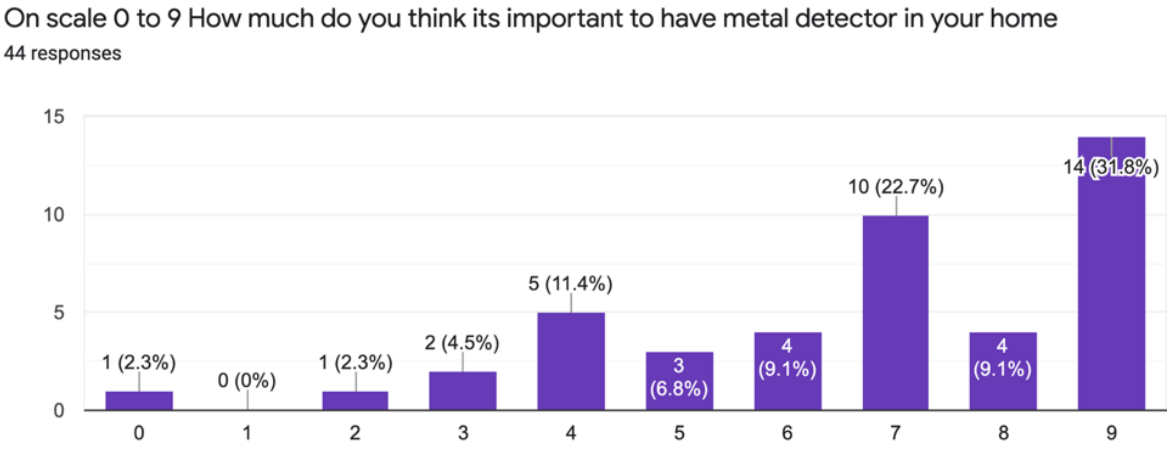
patent for a metal detector, the first to apply was Shirl Herr, a businessman from Crawfordsville, Indiana. His application for a hand-held Hidden-Metal Detector was filed in February 1924, but not patented until July 1928.

A military historian used it for the first time in 1958. Don Rickey used a metal detector to map the location of the Little Bighorn Battle. Metal detectors were first used at airports in the United States in 1972. Outokumpu, a Finnish company, created the first walk-through security detectors.

1.3 Survey

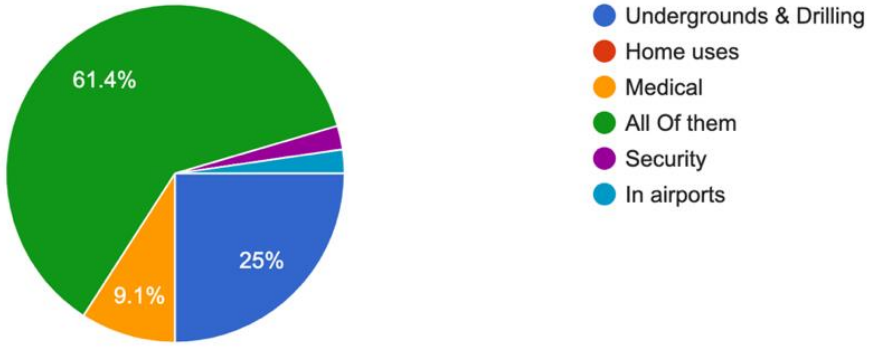
In order to measure our target audience awareness about the metal detectors, we conducted a survey to know to what extent our target audience are familiar with usage and the importance of the metal detectors, and if they know about its different usages not only in the technical arena but also in their daily lifestyle , and here we present a part of survey results





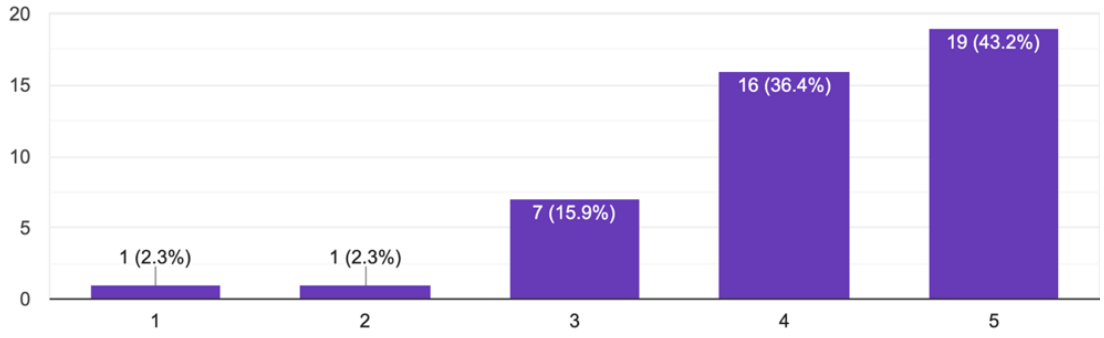
Which field you think metal detection might be useful?

44 responses



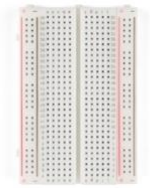
How likely are you to recommend this product to others?

44 responses

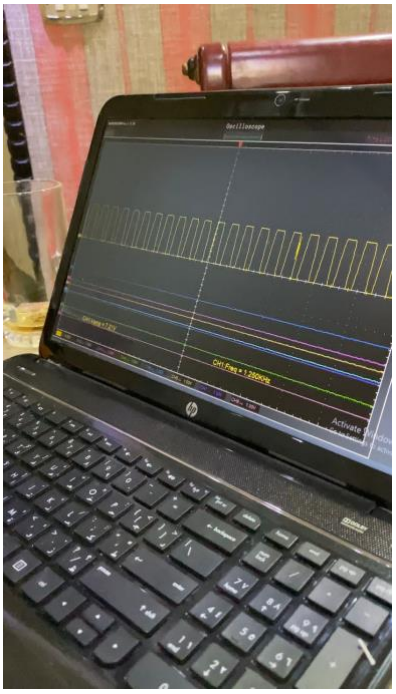


Ch.2 System description

2.1 Components

Components		Components	
Breadboard		IC 555	
Coil		9V Battery	
Speaker 8Ω		Rheostat	
Resistor 2Ω		Resistor 20Ω	

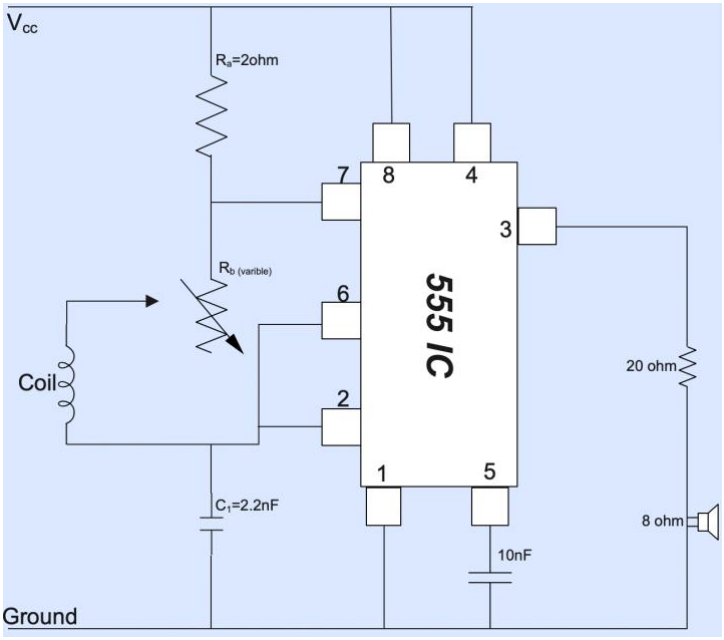
2.2 General Information and Idea of Work:



In A-stable circuit, frequency of output is dependable on three variables (R_a , R_b , C_1)
We used Osilloscope to measure frequency by changing values components of circuit to reach hearable sound by the speaker.
When we used R_a=2 , R_b=rheostat , C_1=2.2 nF frequency became 1.235 kHZ
We connected the coil series to the rheostat , when electric current flow through the coil , it creates magnetic field all around it .if you sweep the detector above a metal ,it cuts in the field causing change in the frequency dependable variable values for a while which cause changing in frequency which change the sound of the speaker

2.3 Circuit Diagram

A-Stable Circuit



$$Frequency = \frac{1.44}{(R_a+2R_b)\times C_1}$$

Ch3 Life Application

3.1 Fields and uses

Our metal detector project ought to be important for many field and clients in lots of areas it is able to be used widely including : security,trying to find manufacturing metals in industry,Archaeology, treasure hunting ,hidden gadgets, or metal items buried underground.

Industrial metal detectors are used withinside the food, beverage, plastics, chemical substances and packaging industries.

Food and pharmaceutical industries, detect metal in products due to presence of metallic pieces

Also the hobby is seeking out precious metals like gold, silver, and copper of their herbal forms.

Metal detectors are used to look for discarded or lost precious gadgets including jewelry, cellular phones and cameras.

Military has used metal detector to pinpoint buried land mines

Discovering the past, searching deserts & historical places willing to find some of the ancient pieces left underground by our ancestors and still buried , they are out of our eyesight but not out of metal detector range.

In civil engineering, unique steel detectors are used to locate reinforcement bars interior walls. or manufacturers , that may be used to discover or detect steel gadgets close by or buried underground including silver or golden cash or small jewelry and so forth

Land mine detector

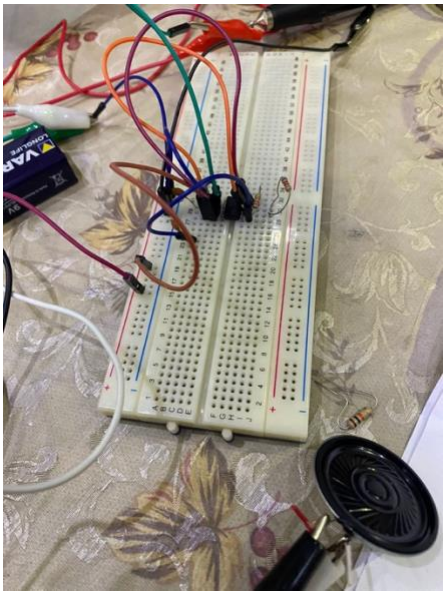
Airport and Building Security and Public Places: To check whether guns, knives, or other weapons are being transported.

Metal detectors may be used for several navy uses, which may be summarized as follows:

1. Exposing the mines planted withinside the fields for the duration of the struggle fare or after the give up of the struggle fare
2. Detect risky explosives and cluster bombs risky to human beings`s lives
3. Hand-held metal detectors may be used to go looking human beings for weapons and explosives

Ch4: Conclusion

To conclude what we have said in this chapters given the previously mentioned points, we developed our metal detector measure to the range of *'one millimeter'*, so when we approach any metal nearby the afore referred distance, it changes the frequency of the sound coming from the speaker to announce the detection of a metal.



Ch5 Improvement

1. Increase the frequency of the metal detector's search cycle.
   For most detectors, there is an ideal frequency range. You can learn about how we calculate this range from the handbook or a short online search, as well as the impacts of frequencies below and above it, and some recommendations on how to maximize your finds with different metal detectors.

2. Use a metal detector coil with more sensitivity.
   A more sensitive metal detector coil could mean the difference between locating a precious item and missing it entirely. If you're looking for anything buried deep beneath tree roots or in moist soil, for example, a more sensitive coil can help. When looking in trashy locations such as parking lots or beaches where there is a lot of rubbish metal laying around, sensitivity is also important.

3. They may be upgraded to waterproof to permit the consumer to look for submerged gadgets in region of shallow water

4. Determine the type of the detected metal

References

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- 555-timer-circuits.com. 2022. *Metal Detector Circuit*. [online] Available at: < http://www.555-timer-circuits.com > [Accessed 23 May 2022].
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