NOTRE DAME UNIVERSITY BANGLADESH

DLD Hardware Project Report

Course Title: Digital Logic Design Lab

Course Code: CSE-2106

Project Name: Handheld Metal Detector

Batch: CSE-20

Submitted by:

Istiak Alam **ID: 0692230005101005**

Md Hemal Ahmed **ID: 0692230005101013**

Rejuana Azad **ID: 0692230005101008**

Submitted to:

Afsana Sharmin Shanta
Lecturer, NDUB

Project Name : Handheld Metal detector

Project Description :

Metal detector is a very common device that is used for checking people, luggage or bags in shopping malls, hotels, cinema halls, etc. to ensure that person is not carrying any metals or illegal things like guns, bombs etc. Metal Detectors detect the presence of metals.

There are different types of metal detectors like handheld metal detectors, walk through metal detectors and ground search metal detectors. Metal detectors can be created easily and the circuit for a basic metal detector is not that complex. We have constructed this project as Handheld metal detector.

Components :

- 1 x TDA0161 Proximity Detector IC
- 2 x 47nF Capacitors (Ceramic Capacitor code 473)
- 1 x 1 KΩ Resistor (1/4 Watt)
- 1 x 330 Ω Resistor (1/4 Watt)
- 1 x 100 Ω Resistor (1/4 Watt)
- 1 x 5 KΩ Potentiometer
- 1 x 2N2222A (NPN Transistor)
- 1 x 5V Buzzer
- Coil (copper wire of 26 AWG is taken, and it is wound into a coil of diameter 5 – 6 cm and 140 – 150 turns)
- Additional Components (for LED)
    - 1 x 220 Ω Resistor (1/4 Watt)
    - 1 x 5mm LED

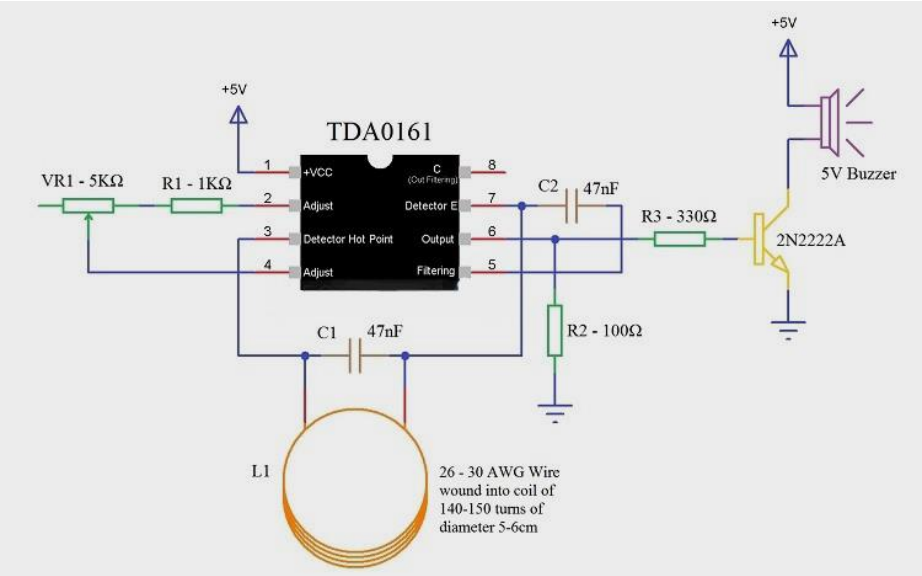

Figure 1 Circuit Diagram

Metal Detector Circuit Explanation :

- When the LC circuit that is L1 and C1 has got any resonating frequency from any metal which is near to it, electric field will be created which will lead to induces current in the coil and changes in the signal flow through the coil.
- Variable resistors are used to change the proximity sensor value equal to the LC circuit, it is better to check the value when there is coil not near to the metal. When the metal is detected the LC circuit will have changed signal. The changed signal is given to the proximity detector (TDA 0161), which will detect the change in the signal and react accordingly. The output of the proximity sensor will be of 1mA when there is no metal detected and it will be around 10mA when coil is near to the metal
- When the output pin is high the resistor R3 will provide positive voltage to transistor Q1. Q1 will be turned on and led will glow and buzzer will give the buzz. Resistor r2 is used to limit the current flow.

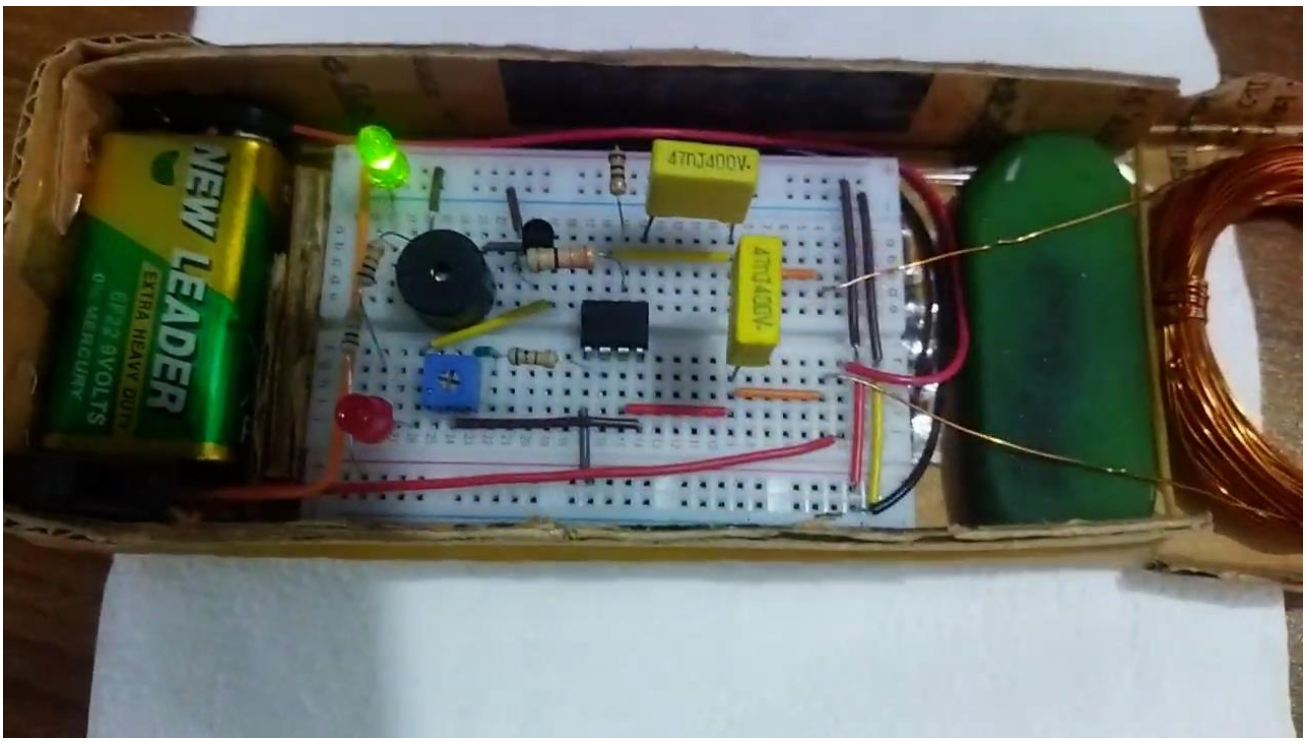

Figure 2 Applied Circuit

Working :

The LC Circuit, which consists of L1 (coil) and C1, is the main metal detector part of the circuit. With the help of this LC Circuit, which is also called Tank Circuit or Tuned Circuit, the TDA0161 IC acts as an oscillator and oscillates at a particular frequency.

When the LC circuit detects any resonating frequency from any metal which is near to it, electric field will be created which will lead to induces current in the coil and changes in the signal flow through the coil. Variable resistor is used to change the proximity sensor value equal to the LC circuit, it is better to check the value when the coil is not near any metal object. When the metal is detected, the LC circuit will have changed signal.

The changed signal is given to the proximity detector (TDA 0161), which will detect the change in the signal and react accordingly. The output of the proximity sensor will be less than 1mA when there is no metal detected and it will be around 10mA (usually greater than 8mA) when coil is near to the metal.

When the output pin is high, the resistor R3 will provide positive voltage to transistor Q1. Q1 will be turned on and LED will glow (not shown in the circuit) and buzzer will be activated.

Advantages :

- The Proximity Detector IC TDA0161 based Metal Detector Circuit is a very simple and easy to construct metal detector that can be used to detect small metals in our homes, offices and gardens.
- There is need for any microcontroller as the Proximity Sensor will be sufficient to implement the project

Disadvantages :

- The main disadvantage of this Metal Detector Circuit is the range of detection. The metal object must be at a distance of 10mm for the detector to detect it.

Applications :

- This simple Metal Detector can be used to identify metals like iron, gold, silver etc.
- Since it is a simple project, we can use this in our home to scan for nails, metal scraps etc. which are not easily spotted by naked eye.

Figure 3 Metal Detector