

## IOT based theft detection system using SMTP protocol

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**ABSTRACT:** Security industries have a large number of security systems but with certain limitations. These systems can be vandalized in different ways, are costly and requires heavy maintenance. Our proposed work is cost effective, is power efficient and is also capable of working on Wi-Fi technology. The objective of the proposed system is to design an Ultrasonic Sensor based Theft System and displays its result on any device like Mobile, Laptop or Tablet via Email. It is created by using NodeMCU as a microcontroller unit used for processing. The setup consists of an Ultrasonic Sensor which calculates the distance between the intruder and the Sensor. When the distance between the intruder and sensor becomes less than 100cm, the Ultrasonic Sensor triggers and immediately sends an Email alerting the owner of the premise.

**Keywords:** MCU (Microcontroller unit), NodeMCU, ESP8266, Ultrasonic Sensor, IOT (internet of things), SSID (Service Set Identifier).

### I. INTRODUCTION

The growing crime rates across different parts of the world reflects the bitter reality, hence security of our premises whether it may be our home or office is of utmost importance. The market is flooded with many types of security systems for households and businesses. A few security systems which are used worldwide are Closed Circuit Television (CCTV), laser fence, temperature, biometric and pressure sensors. However, they have significant shortcomings in their practical implementation and use.

A major disadvantage for CCTV cameras is that they can only monitor a limited area and the CCTV can be vandalized in various ways. The angle of the camera can also be changed without any authorization. The laser security system works only if the laser is obstructed. If the intruder passes without obstructing the laser, it is considered as a failure. In order to secure a larger area, we need more lasers and corresponding sensors. Pressure,

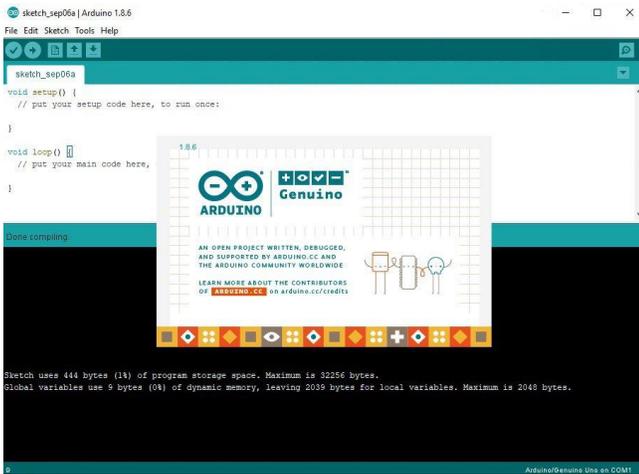
Biometric and Temperature Sensors are quite costly and require heavy maintenance. Our proposed work focuses on using IOT technology to configure the theft system and to alert the owner via Email on their mobile phones/laptop/tablets which decreases the overall cost of the system.

NodeMCU is a development board of ESP8266 Wi-Fi module. ESP8266 module can operate as a station, so it can connect it to the Wi-Fi network. [5]. The Wi-Fi network is connected by using SSID (Service Set Identifier) and a Password. SSID is usually the name of the internet network you select when connecting a device to the Wi-Fi [1].

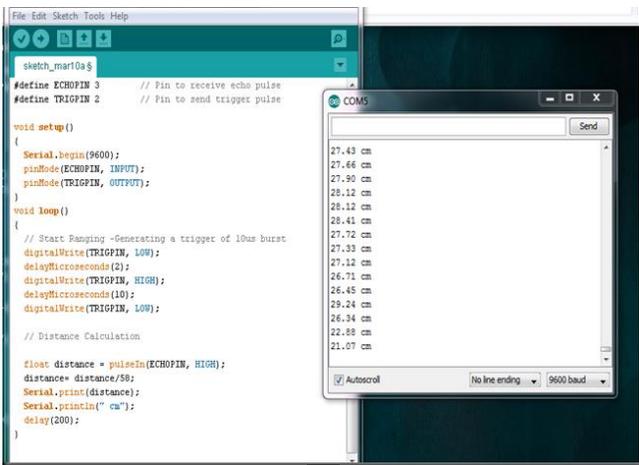
An Ultrasonic device is also used in our work. An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound) and the receiver (which encounters the sound after it has travelled to and from the target) [2].

### II. SOFTWARE DESCRIPTION

The Arduino Integrated Development Environment (IDE) is a cross platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards. Arduino Software IDE is used for coding NodeMCU.



(a)



(b)

Fig. 1: (a)&(b) Arduino IDE Software

The configuration of NodeMCU does not require any internet connection. After the configuration of the NodeMCU, it is simply connected with Ultrasonic Sensor and an electrical supply is given to the NodeMCU. Ultrasonic Sensor will emit the sound wave through transmitter and will encounter the sound using receiver. This transmitter and receiver are already inbuilt in the Ultrasonic Sensor.

**III. HARDWARE DESCRIPTION**

Ultrasonic Sensor is used for distance measurement in our work. HC-SR04 is an ultrasonic sensor module which is based on the principle of measuring the properties of sound waves with frequency above the human audible range [7]. The Ultrasonic transmitter transmits an ultrasonic wave when triggered by NodeMCU at its TRIG pin, then this wave travels in air and as it gets objected by any material then it is reflected back towards the sensor. This reflected wave is observed by the Ultrasonic receiver module and processed [6]. In order to calculate the distance between the

sensor and the object, the sensor measures the time it takes between the emissions of the sound by the transmitter to its contact with the receiver. The formula for this calculation is:

$$\text{distance} = \text{speed} \times \text{time} \tag{1}$$

where speed of sound = 343 meters/second

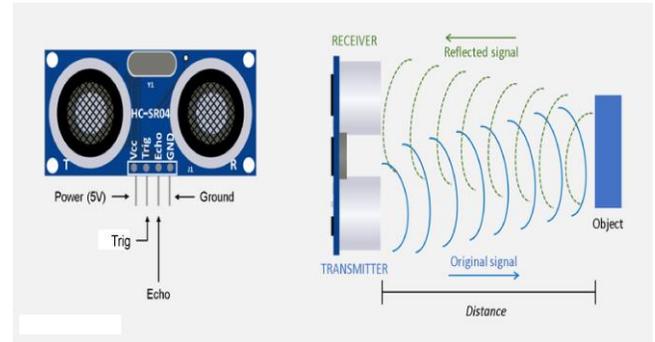


Fig. 2: Ultrasonic Sensor and functioning of ultrasonic sensor

NodeMCU is an open source software and hardware development environment that is built around a very inexpensive system called the ESP8266. It contains all the crucial elements of the modern computer: CPU, RAM, Networking (Wi-Fi) and even a modern operating system [8].

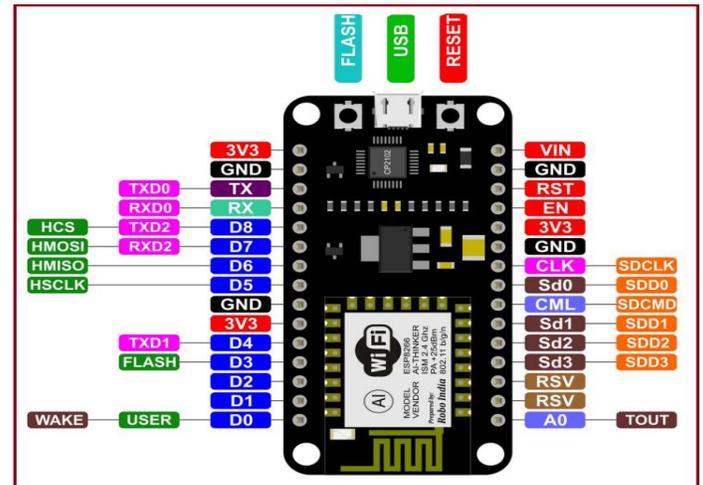


Fig. 3: NodeMCU

The Ultrasonic Sensor has high frequency and high sensitivity therefore it can easily detect external objects. These sensors can easily interface with any type of microcontroller and are highly accurate in comparison to other sensors. These sensors are easy to use, not dangerous for during operation for nearby objects, person, equipment

or material. NodeMCU is also a low-cost microcontroller unit and also has integrated support for Wi-Fi network. Reduced size of the board and low energy consumption is a huge advantage of NodeMCU over other microcontroller units [3].

#### IV. WORKING

NodeMCU is configured using Arduino IDE. Configuration of NodeMCU does not require any internet connection. A library function “**Gsender.h**” will be configured into NodeMCU which will enable us to initiate **Simple Mail Transfer Protocol (SMTP)**. It is a set of communication guidelines that allows software to transmit an electronic mail over the internet. The Wi-Fi network will be connected with the NodeMCU by using SSID (Service Set Identifier) and a Password.

After the configuration of NodeMCU, it is then connected with the Ultrasonic Sensor (HC-SR04) and an electrical supply is given to the Model. Ultrasonic Sensor will trigger only if any object/person comes within its range. Once any object/person comes within its range, sensor will immediately trigger and will send an Email to the owner of the premise, hence informing them about the intruder.

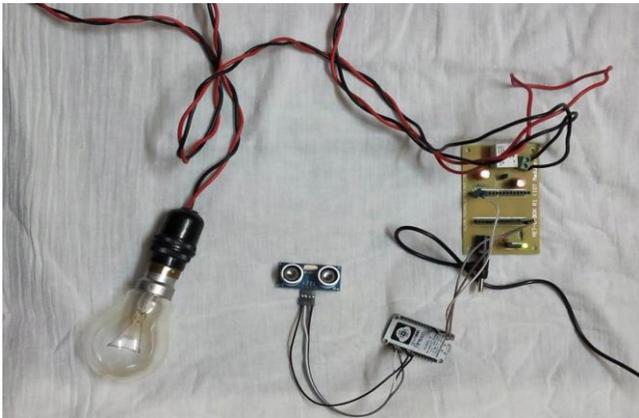


Fig.4: Hardware of the Project

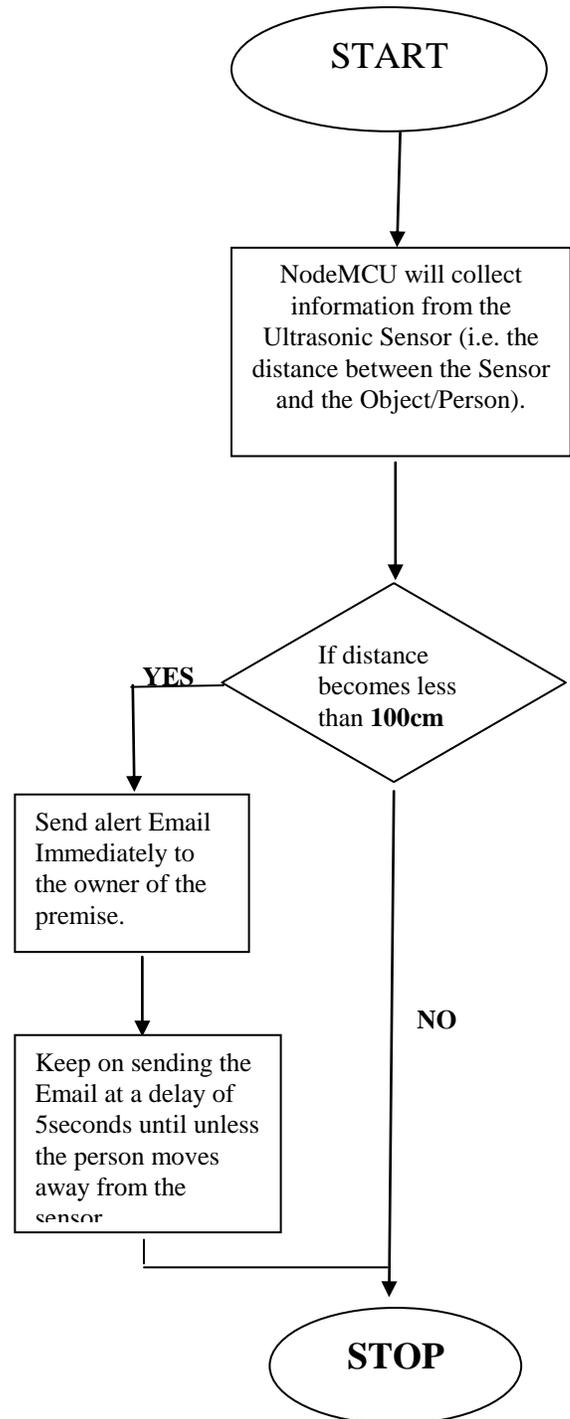


Fig. 5: Flowchart of Working



**Fig. 6: Receiving the Intruder alert mail using SMTP protocol**

The hardware of the project is shown above in Fig.4. It consists of Ultrasonic Sensor, NodeMCU and wires for connections.

One of the special features in the proposed work is that NodeMCU will keep on sending the Email at a delay of 5seconds until unless the person moves away from the sensor such that the distance between the sensor and the person becomes greater than 100cm.

The Ultrasonic Sensor takes values in m/s so for our convenience; it is converted into cm/s by dividing m/s by 29. After calculating the distance, it is required to be divided by 2 because the distance travels twice, firstly it travels from the **“Trigger pin”** when it is sent, and second when it strikes back i.e. when it is received back by the **“Echo pin”**[1],[4].

## V. CONCLUSION

Security of our premise is of utmost importance. Due to the increase in burglary cases in different parts of the world, industries dealing with home security have come up with a large number of ideas in order to increase home security. They have introduced equipment’s like CCTV, laser fence, temperature, biometric and pressure sensors. However, these equipment’s have significant shortcomings in their practical implementation and are not cost effective as well. Our proposed system makes use of NodeMCU device, which is capable of sending Email on smartphones in case of intrusion which makes our system portable. Since proposed work requires only a sensor and MCU hence it is cost effective, is power efficient and is also capable of working on Wi-Fi technology.

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