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WASTE MANAGEMENT IMPROVEMENT IN CITIES USING IOT

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Abstract: **Our country is facing vast challenges in the environment due to waste generation some of them were: inadequate waste collection, transport, treatment, and disposal. One of the important challenges is from its inception till its disposal. Our country can't cope with the current systems by an increasing urban population with the volumes of waste, and this result on the public and environmental health pollution. Unhygienic conditions are created due to the flooding of the dustbins each day. This paper is for the commenting of the challenges, barriers, and opportunities for the betterment of collection, and segregation in the field of waste management. When it senses the nearby trash the dustbin that function automatically, and it is built through a prototype. Dustbins are placed all over the city, and delivered with low cost embedded method to help in tracking of the garbage bins. The Blynk app indicates through SMS as soon as dustbin has reached its maximum level, to the unwanted management department. An immediate action would be taken by the alarmed authorities once the position of the bin is sent via the Internet. The proposed system is developed by using ultrasonic sensors, nodemcu, servo motor, Blynk app**.

II. INTRODUCTION

An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious.

All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

The very simplest embedded systems are capable of performing only a single function or set of functions to meet a single predetermined purpose. In more complex systems an application program

that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded system. The ability to have programs means that the same embedded system can be used for a variety of different purposes. In some cases a microprocessor may be designed in such a way that application software for a particular purpose can be added to the basic software in a second process, after which it is not possible to make further changes. The applications software on such processors is sometimes referred to as firmware.

The simplest devices consist of a single microprocessor (often called a "chip"), which may itself be packaged with other chips in a hybrid system or Application Specific Integrated Circuit (ASIC). Its input comes from a detector or sensor and its output goes to a switch or activator which (for example) may start or stop the operation of a machine or, by operating a valve, may control the flow of fuel to an engine.As the embedded system is the combination of both software and hardware

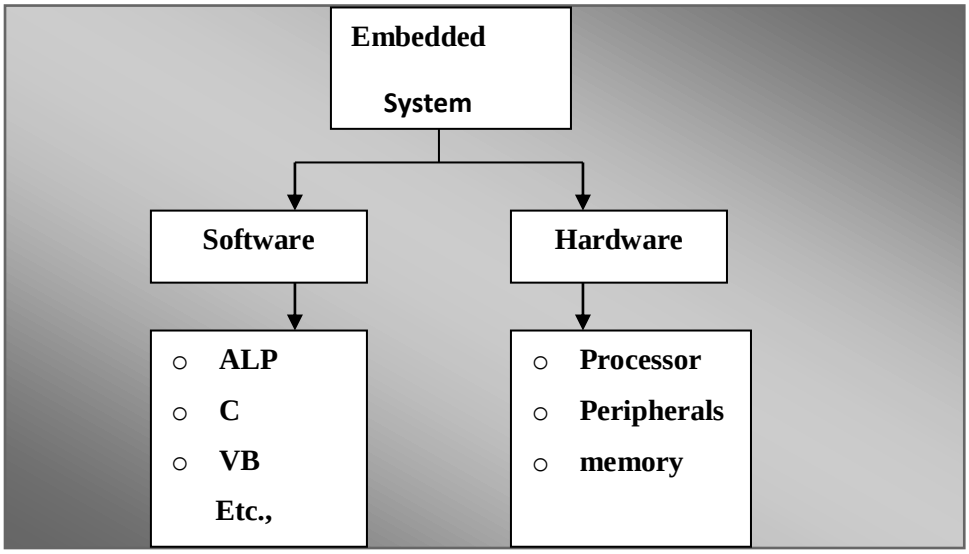


Figure: Block diagram of Embedded System

Software deals with the languages like ALP, C, and VB etc., and Hardware deals with Processors, Peripherals, and Memory.

1.1 Harvard Architecture

Computers have separate memory areas for program instructions and data. There are two or more internal data buses, which allow simultaneous access to both instructions and data. The CPU fetches program instructions on the program memory bus.

The Harvard architecture is a computer architecture with physically separate storage and signal pathways for instructions and data. The term originated from the Harvard Mark I relay-based computer, which stored instructions on punched tape (24 bits wide) and data in electro-mechanical counters. These early machines had limited data storage, entirely

contained within the central processing unit, and provided no access to the instruction storage as data. Programs needed to be loaded by an operator, the processor could not boot itself.

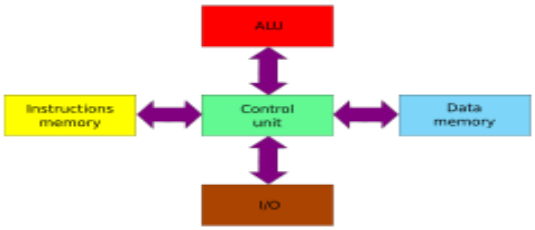
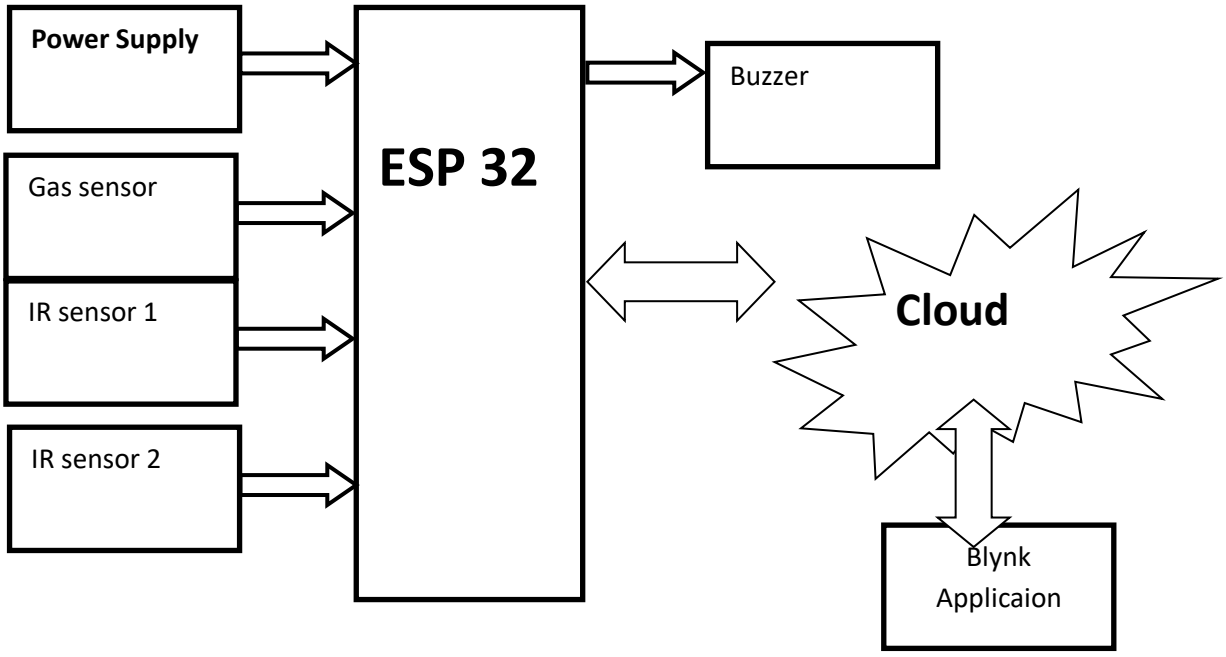


Figure: Harvard Architecture

II. PROPOSED METHOD



Internet of Things **(IOT)**

The Internet of Things (IOT) refers to the use of intelligently connected devices and systems to leverage data gathered by embedded sensors and actuators in machines and other physical objects. IOT is expected to spread rapidly over the coming years and this convergence will unleash a new dimension of services that improve the quality of life of consumers and productivity of enterprises, unlocking an opportunity that the GSMA refers to as the 'Connected Life'. For consumers, the IoT has the potential to deliver solutions that dramatically improve energy efficiency, security, health, education and many other aspects of daily life.

For enterprises, IOT can underpin solutions that improve decision-making and productivity in manufacturing, retail, agriculture and other sectors. Machine to Machine (M2M) solutions - a subset of the IOT – already use wireless networks to connect devices to each other and the Internet, with minimal direct human intervention, to deliver services that meet the needs of a wide range of industries. In 2013, M2M connections accounted for 2.8% of global mobile connections (195 million), indicating that the sector is still at a relatively early stage in its development. An evolution of M2M, the IOT represents the coordination of multiple vendors' machines, devices and appliances connected to the Internet through multiple networks.

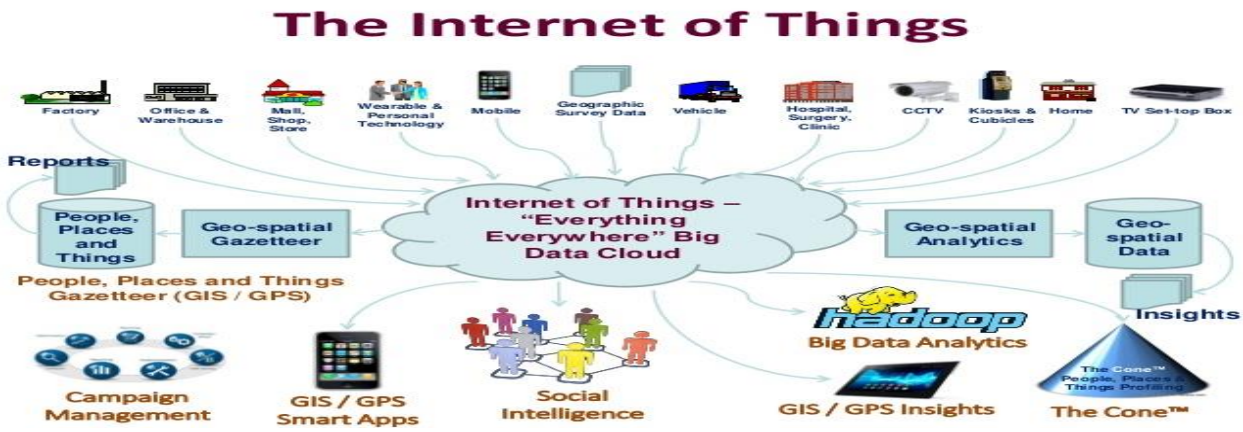
2.1 Understanding the Internet of Things

While the Internet of Things (IOT) will ultimately have an enormous impact on consumers, enterprises and society as a whole, it is still at an early stage in its development. As mobile operators and their partners pilot new services across multiple sectors, ranging from health to automotive, they have identified several distinctive features of the Internet of Things. A common understanding of the distinctive nature of this nascent opportunity should help hasten the development of this market.

2.2 The Internet of Things can enable the next wave of life enhancing services across several fundamental sectors of the economy.

As the Internet of Things evolves, the proliferation of smart connected devices supported by mobile networks, providing pervasive and seamless connectivity, will unlock opportunities to provide life-enhancing services for consumers while boosting productivity for enterprises. As can be seen in Figure 5 below, thirteen industry sectors are likely to show significant adoption of IoT services.

In cities, the development of smart grids, data analytics and autonomous vehicles will provide an intelligent platform to deliver innovations in energy management, traffic management and security, sharing the benefits of this technology throughout society.



2.3 IOT Service Segmentation

While the potential impact of the IoT is considerable, a concerted effort is required to move beyond this early stage. In order to optimise the development of the market, a common understanding of the distinct nature of the opportunity is required.

Another important characteristic of IoT services can be the deployment of a large number of the same type of devices and applications. Each device and application performs the same activity and transports information to a service centre at the same time. Regardless of the amount of data transmitted by each device, this simple operation could cause network congestion. Mobile networks need to provide several mechanisms to protect and better utilise their capabilities for delivering such M2M/IoT services. Mechanisms for remotely managing such devices and applications could allow intelligent scheduling, which would facilitate an appropriate application development and reduce the vulnerability of the network to application misbehavior.

An additional feature of the IoT market is, that in some scenarios, devices and applications may be deployed and actively work for a large number of years, operating on batteries or using limited power. In this case, the communication module needs to consume very little energy to guarantee a longer device lifetime.

In summary, the IoT will require mobile networks to offer a much more diversified set of capabilities, while providing protection mechanisms for identifying and blocking any application misbehavior and guaranteeing all other services. Mobile operators are working to identify these requirements and develop appropriate capabilities in order to support the vast range of IoT applications.

2.3 ESP8266Node MCU

The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266itselfis a self-contained WiFi networking solution offer in gas a bridge from existing microcontroller to WiFi and isalsocapableofrunning self-contained applications.

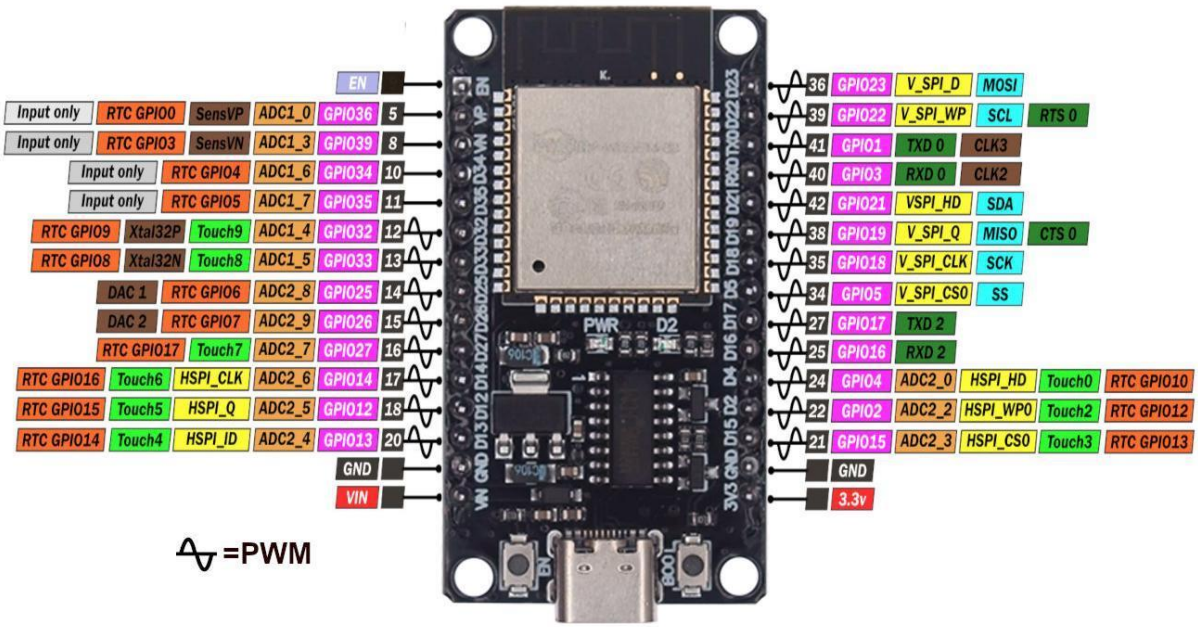
This module comes with a built-in USB connector and Aric assortment of pin-outs. With micro USB cable ,you can connect Node MCU dev kittoy our laptop and flashit without any

. Specification

- Voltage:3.3V.
- Wi-Fi Direct(P2P),soft-AP.
- Currentconsumption:10uA~170mA.
- Flashmemoryattachable:16MBmax(512Knormal).
- Integrated TCP/IP protocolstack.
- Processor: Tensilica L10632-bit.
- Processorspeed:80~160MHz.
- RAM:32K+80K.
- GPIOs:17(multiplexed with other functions).
- Analogto Digital:1inputwith1024stepresolution.
- +19.5dBmoutputpowerin802.11bmode
- 802.11support:b/g/n.

- MaximumconcurrentTCPconnections:5.

2. Pin Definition:



2.4 IR SENSOR:

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region.

The wavelengths of these regions and their applications are shown below.

Near infrared region — 700 nm to 1400 nm — IR sensors, fiber optic

Mid infrared region — 1400 nm to 3000 nm — Heat sensing

Far infrared region — 3000 nm to 1 mm — Thermal imaging

The frequency range of infrared is higher than microwave and lesser than visible light.

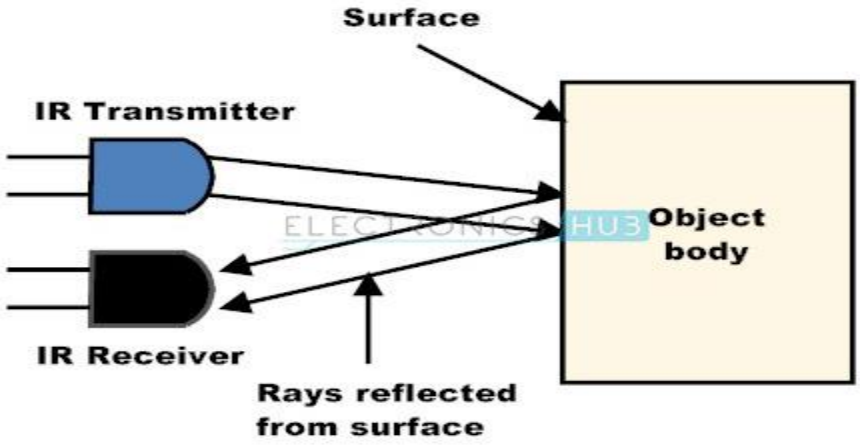
For optical sensing and optical communication, photo optics technologies are used in the near infrared region as the light is less complex than RF when implemented as a source of signal. Optical wireless communication is done with IR data transmission for short range applications.

An infrared sensor emits and/or detects infrared radiation to sense its surroundings.

The working of any Infrared sensor is governed by three laws: Planck's Radiation law, Stephen – Boltzmann law and Wien's Displacement law.

Planck's law states that "every object emits radiation at a temperature not equal to 00K". Stephen – Boltzmann law states that "at all wavelengths, the total energy emitted by a black body is proportional to the fourth power of the absolute temperature". According to Wien's Displacement law, "the radiation curve of a black body for different temperatures will reach its peak at a wavelength inversely proportional to the temperature".

The basic concept of an Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver. There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength can be used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response. Optical lenses made of Quartz, Germanium and Silicon are used to focus the infrared radiation. Infrared receivers can be photodiodes, phototransistors etc. some important specifications of infrared receivers are photosensitivity, detectivity and noise equivalent power. Signal processing is done by amplifiers as the output of infrared detector is very small.



When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

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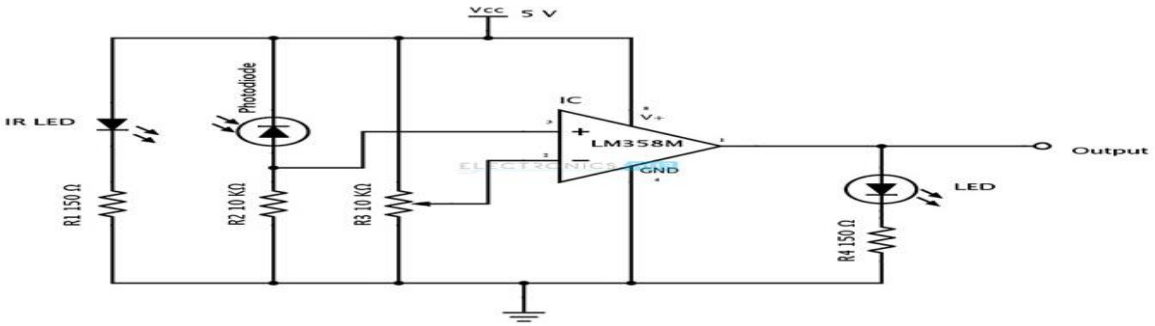
Obstacle Sensing Circuit or IR Sensor Circuit

A typical IR sensing circuit is shown below.



It consists of an IR LED, a photodiode, a potentiometer, an IC Operational amplifier and an LED.

IR LED emits infrared light. The Photodiode detects the infrared light. An IC Op – Amp is used as a voltage comparator. The potentiometer is used to calibrate the output of the sensor according to the requirement.

When the light emitted by the IR LED is incident on the photodiode after hitting an object, the resistance of the photodiode falls down from a huge value. One of the input of the op – amp is at threshold value set by the potentiometer. The other input to the op-amp is from the photodiode's series resistor. When the incident radiation is more on the photodiode, the voltage drop across the series resistor will be high. In the IC, both the threshold voltage and the voltage across the series resistor are compared. If the voltage across the resistor series to photodiode is greater than that of the threshold voltage, the output of the IC Op – Amp is high. As the output of the IC is connected to an LED, it lightens up. The threshold voltage can be adjusted by adjusting the potentiometer depending on the environmental conditions.

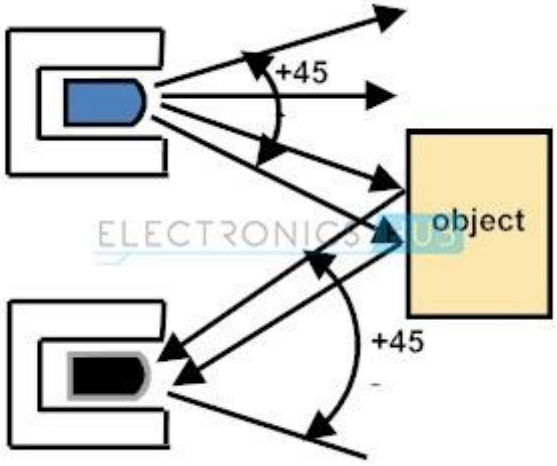
The positioning of the IR LED and the IR Receiver is an important factor. When the IR LED is held directly in front of the IR receiver, this setup is called Direct Incidence. In this case, almost the entire radiation from the IR LED will fall on the IR receiver. Hence there is a line of sight communication between the infrared transmitter and the receiver. If an object falls in this line, it obstructs the radiation from reaching the receiver either by reflecting the radiation or absorbing the radiation.

It is universal that black color absorbs the entire radiation incident on it and white color reflects the entire radiation incident on it. Based on this principle, the second positioning of the sensor couple can be made. The IR LED and the photodiode are placed side by side. When the IR transmitter emits infrared radiation, since there is no direct line of contact between the transmitter and receiver, the emitted radiation must reflect back to the photodiode after hitting any object. The surface of the object can be divided into two types: reflective surface and non-reflective surface. If the surface of the object is reflective in nature i.e. it is white or other light color, most of the radiation incident on it will get reflected back and reaches the photodiode. Depending on the intensity of the radiation reflected back, current flows in the photodiode.

If the surface of the object is non-reflective in nature i.e. it is black or other dark color, it absorbs almost all the radiation incident on it. As there is no reflected radiation, there is no radiation incident on the photodiode and the resistance of the photodiode remains higher allowing no current to flow. This situation is similar to there being no object at all.

The positioning and enclosing of the IR transmitter and Receiver is very important. Both the transmitter and the receiver must be placed at a certain angle, so that the detection of an object happens properly. This angle is the directivity of the sensor which is +/- 45 degrees.

The directivity is shown below.



In order to avoid reflections from surrounding objects other than the object, both the IR transmitter and the IR receiver must be enclosed properly. Generally the enclosure is made of plastic and is painted with black color.

GAS SENSOR:

1.
2. A sensor is a technological device that detects / senses a signal, physical condition and chemical compounds.
3. It is also defined as any device that converts a signal from one form to another.
4. Sensors are mostly electrical or electronic.
5. Gas sensor is a subclass of chemical sensors.
6. Gas sensor measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure its concentration. Each gas has a unique breakdown voltage i.e. the electric field at which it is ionized. Sensor identifies gases by measuring these

voltages. The concentration of the gas can be determined by measuring the current discharge in the device.

1. Gas sensors main aim is to sense hazardous gases that evolve its surroundings
2. Gas sensor detects the concentrations of combustible gas in the air and ouputs its reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm.The sensor can operate at temperatures from -20 to 50°C and consumes less than 150 mA at 5 V.
3. High sensitivity to LPG, Propane and Hydrogen.

TYPE:

1. Metal Oxide Based Gas Sensors
2. Metal oxide sensors are also known as chemiresistors.
3. The detection principle of resistive sensors is based on change of the resistance of a thin film upon adsorption of the gas molecules on the surface of a semiconductor.
4. The gas-solid interactions affect the resistance of the film because of the density of electronic species in the film.

2.5 Capacitance Based Gas Sensors

1. They measure the change in dielectric constant of films between the electrodes as a function of the gas concentration.

2. The capacitive sensor relies on inter-digitated electrode structures, which correspond to the two plates of a standard capacitor, to monitor changes of the dielectric coefficient of the film.

3. The simple theory behind it is if the dielectric constant of the film is lower than that of the analyte, the capacitance will increase and vice versa.

2.6 Acoustic Wave Based Gas Sensors

1. Sound based gas sensors are known as acoustic wave based gas sensors.

2. To launch the acoustic waves, this type of sensor use piezoelectric material either in the thin film form or in bulk form which has one or more transducers on its surface.

2.7 Carbon monoxide gas sensor

1. It can either be battery-operated or AC powered.

2. Mostly the sensor will not sound an alarm at lower concentrations (e.g. 100 ppm). The alarm will sound within a few minutes at 400 ppm. So the function is specific to concentration-time. Figure shows simple carbon monoxide sensor.

2.8 Carbon monoxide gas sensor (Contd.)

Carbon monoxide sensor can be of different types such as:

1. Semiconductor sensor

2. Electrochemical sensor

3. Digital sensor

4. Biomimetic sensor (chem-optical or gel cell sensor)

III. BUZZER

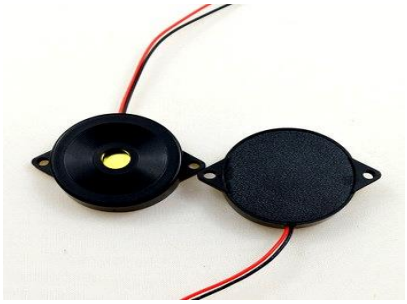
A **buzzer** or **beeper** is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows.

It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong . Often these units were anchored to a wall or ceiling and used the ceiling or wall as a

sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Son alert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

In game shows it is also known as a "lockout system," because when one person signals ("buzzes in"), all others are locked out from signaling. Several game shows have large buzzer buttons which are identified as "plungers".

The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep.



IV. CONCLUSION

The most important objective of this project is to ensure the safety and security of the vehicle. As security systems are becoming an unavoidable necessity in life, our proposed system provides safety of vehicle and detects theft efficiently at a very low cost. The main purpose of this project is to prevent vehicle theft and to lock the engine. The proposed system mainly aims to provide a low-cost theft detection system. Also the proposed system aims to safeguard their vehicle from theft.

REFERENCES

1. An IOT based Anti-Theft detection and notification system for vehicles, S. Priyadarshini, Associate System Engineer TCS, Chennai, 2020.

2. Design of an Anti-Theft alarm system for vehicles using IoT, Jorge Arellano-Zubiate, Lima, Peru, 2021.

3. An advanced vehicle tracking system based on aurdiono electronic shields and web map browser, Mustafa Sabah Taha, Mohammed Hashim Mahdi, 2021.

4. Vehicle theft detection and remote engine locking system, Madhu M Nayak (Assistant Professor, CSE Dept), Published In:2020.

5. Vehicle anti-theft system using fingerprint recognition technique, B. Santosh Kumar (Assistant Professor, CSE Dept.) ,2017.

6. C. Ram Kumar, B.Vijayalakshmi, C. Ramesh, S. Chenthur Pandian, Vehicle Theft Alert and Tracking the Location using RFID and GPS, vol.3, no 12, pp 2- 28, 2013.

7. A. SomnathKarmude and G.R. Gidveer, Vehicular Identification and Authentication System using Zigbee, International Journal of Engineering Research and Technology, vol.3, no. 11, 2014.

8. N. Abu, J. H. Rumel, H. Rokeb, P. Shuv, Y. Rashed and Adibullah, Design and Implementation of Car Anti-Theft system using Microcontroller, International Journal of Scientific & Engineering Research, vol. 4(3), 2013.

9. K. S. Alli, C. Ijeh-Ogboi and S. L .Gbadamosi, Design and Construction of a Remotely Controlled Vehicle AntiTheft System via GSM Network, International Journal of Education and Research, vol. 3(5), pp 405-418, 2015.

10. Mrs.shubhangimali, professor J.A.shaikh " Fingerprint based authentication and security system using GSM and GPS technology" International Journal of Engineering Trends and Technology (IJETT) – Volume-45 Number8 -March 2017.