A Project
Report On

Manhole Detection and Monitoring System

Submitted to

Sant Gadge Baba Amravati University, Amravati

Submitted in partial fulfillment of
the requirements for the Degree of
Bachelor of Engineering in
Electronics and Telecommunication Engineering

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(Recognized by AICTE, Accredited by N.B.A, New Delhi)

Certificate

This is to certify that the project report entitled **"Manhole Detection and Monitoring System"** is hereby approved as a creditable study carried out and presented by

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in a manner satisfactory to warrant of its acceptance as a pre-requisite in a partial fulfillment of the requirements for the degree of Bachelor of Engineering in Electronics & Telecommunication Engineering of Sant Gadge Baba Amravati University, Amravati during the Session 2022-23.

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Abstract

A smart city is the future goal to have cleaner and better amenities for the society. Smart underground infrastructure is an important feature to be considered while implementing a smart city. Drainage system monitoring plays a vital role in keeping the city clean and healthy. Since manual monitoring is incompetent, this leads to slow handling of problems in drainage and consumes more time to solve. To mitigate all these issues, the system using a wireless sensor network, consisting of sensor nodes is designed. The proposed system is low cost, low maintenance, IoT based real time which alerts the managing station through message when any manhole crosses its threshold values. This system reduces the death risk of manual scavengers who clean the underground drainage and also benefits the public. This project presents a method to detect manholes on a location basis. Its implementation can be supplemented with avoidance of the path of the manhole in times of emergencies and adversities.

Keywords: Drainage monitoring system, IOT, Monitoring smart city

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We would like to take this opportunity to express our heartfelt thanks to our guide **A.N. Dolas** Faculty of Electronics and Telecommunication Department for his esteemed guidance and encouragement, especially through difficult times. His suggestions broaden our vision and guided us to succeed in this work. We are also very grateful for his guidance and comments while designing part of our project and learnt many things under his leadership. Also we would like to thank to **Prof. (Dr.) M. N. Tibdewal**, Head of Electronics and Telecommunication Department, all teaching and non-teaching staff of EXTC Department for their encouragement and suggestions for our project.

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Abbreviations

IoT Internet of Things

CPU Central Processing Unit

GSM Global System for Mobile Communication

GPRS General Packet Radio Service

List of Figures

Contents

1. INTRODUCTION

An integral part of any drainage system is the access points into it when it comes to cleaning, clearing, and inspection. Metropolitan cities have adopted underground drainage system and the city's municipal corporation must maintain its cleanliness. If the sewage maintenance is not proper, ground water gets contaminated causing infectious diseases. Blockages in drains during monsoon season, causes problems in the routine of the public. Hence, there should be a facility in the city's corporation, which alerts the officials about blockages in sewers, their exact location. It mainly acknowledges in the field of alerting the people about the gas explosion, increase in the water level and the temperature level. It uses IoT to make the drainage monitoring system in a highly automotive by using sensor for detecting and sending alerts through GSM to the authorities. This project overcomes the demerits by detecting drainage water blockage by installing water flow rate sensors at the intersection of nodes. When there is a blockage in a particular node, there is variation in the flow of drainage water which when cross the set value will display the alert in the managing station. Also other demerits are solved by detecting temperature variations inside the manhole and alerting the same to the managing station. Also, flow rate sensors are used to detect the over flow of the drainage water and alerting the same to the managing station through automatic message.

2. LITERATURE SURVEY

1. Sheeba Kulsum & T. Komala

Sheeba Kulsum & T. Komala presents a smart city is the future goal to have cleaner and better amenities for the society. Smart underground infrastructure is an important feature to be considered while implementing a smart city. Drainage system monitoring plays a vital role in keeping the city clean and healthy. Since manual monitoring is incompetent, this leads to slow handling of problems in drainage and consumes more time to solve. To mitigate all these issues, the system using a wireless sensor network, consisting of sensor nodes is designed. The proposed system is low cost, low maintenance, IoT based real time which alerts the managing station through message when any manhole crosses its threshold values. This system reduces the death risk of manual scavengers who clean the underground drainage and also benefits the public.

2. Wesam moneer Rasheed, Raed Abdulla, Low Yee San

Manhole recognition and monitoring is one of the essential needs for modern society, particularly smart city plan. The idea of this project roots in fact that missing or stolen manholes results in various road accidents and it shrinks the quality of city. The major challenge in this research is to investigate a method in recognition of manholes and further investigation on the condition of manhole on road. The report can be simultaneously updated in IoT platform which can be further used with other applications such as WAZE or Google MAP.

3. Mane Nimbaler Chougule Ghatage Saundatte

Mr.Mane Harshavardhan Vijay ,Mr.Nimbaler Swapnil Sanjay , ChouguePushpraj Babaso , Mr.Ghatage Abhishek Dundappa , Ms.Saundatte M .G presents Today situation is very critical for Municipal party to handle this situation our project is very useful to municipality by this project work of the municipality make very easy and smooth Li environmental condition is not good today's suddenly rain is come and level of drainage is increased buy this some accident is orca then the system is very useful manhole detection and monitoring system using iot by this system we detect the manhole condition and monitoring this without any man this system is based on iot therefore no any physical contact with man.

4. Varun Krishna Nallamothu, Saahith Medidi, Swetha Priyanka Jannu (2022)

A Drainage Monitoring System plays significant amount of role to keeping towns and cities healthy and clean. Most of the manholes are open without any observations that cause accidents. In India many cities adopted emptying underground system because it is vital. All the man-holes don't seem to be in a position of secure. Many man-holes were in broken condition. With these broken man-holes, there were some probabilities of incidence to accidents within the roads. As result, emptying standing will be checked on daily basis. Irregular inspections may cause overflow and clog emptying systems, So manual monitoring was incompetent and leads for handling slow with issues while emptying it may consume more time. After going research with these issues, we've built an IoT based man-hole system that monitors temp, gases, water level. These broken manholes are threat to public safety.

5. Prof. Dr. Sandeep M. Chaware

Prof. Dr. Sandeep M. Chaware et al. presents Garbage Monitoring system, which monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. System Architecture, in which system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The proposed system uses Arduino family microcontroller (The LPC2131/32/34//38 microcontrollers are based on a 16/32-bit ARM7TDMI-S CPU with real-time emulation), LCD screen, Wi-Fi modem(The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interface) for sending data and a buzzer, GSM (used to send message to the garbage depot if the Garbage Can exceeds the set threshold level) Ultrasonic Sensor (Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back).

OBJECTIVES

1. **Enhance Public Safety:**

- Detect and alert authorities about open or damaged manholes to prevent accidents and injuries.
- Ensure proper maintenance and structural integrity of manholes to minimize risks to pedestrians and motorists.
- Provide real-time data and alerts to emergency response teams for prompt action in case of emergencies.

2. **Improve Maintenance Efficiency:**

- Remotely monitor the condition of manholes to identify maintenance needs.
- Prioritize maintenance activities based on real-time data and criticality of the manhole.
- Optimize resource allocation and reduce maintenance costs by proactively addressing issues.

3. **Optimize Urban Planning and Development:**

- Collect data on manhole usage patterns, traffic flow, and other relevant factors to inform urban planning decisions.
- Optimize the location and design of manholes in new infrastructure projects to improve functionality and safety.
- Consider drainage requirements and pedestrian/vehicular traffic when determining manhole placement.

4. **Enable Real-time Monitoring and Management:**

- Utilize sensors and advanced algorithms to provide real-time status updates of manholes.
- Integrate with urban management platforms to gain a comprehensive view of infrastructure performance.
- Enable proactive decision-making, resource allocation, and emergency response planning.

5. **Minimize Disruptions to Urban Traffic:**

- Prevent road closures and traffic congestion caused by unplanned manhole maintenance.

- Identify potential issues in advance and schedule maintenance during low-traffic periods.
- Optimize maintenance routes to minimize disruptions and maximize operational efficiency.

6. Facilitate Data-Driven Decision-making:

- Collect and analyze data on manhole conditions, usage, and maintenance activities.
- Generate insights for informed decision-making regarding infrastructure maintenance and upgrades.
- Utilize historical data to identify trends, patterns, and areas for improvement in urban infrastructure management.

7. Improve Collaboration and Communication:

- Facilitate seamless communication between different stakeholders, including municipal authorities, utility providers, and emergency response teams.
- Enable data sharing and collaboration to address infrastructure issues more efficiently.
- Enhance transparency and accountability in managing manholes and related infrastructure.

8. Enhance Resilience and Sustainability:

- Detect and address potential vulnerabilities in manhole infrastructure to improve overall resilience.
- Contribute to the sustainable management of urban infrastructure by optimizing resource utilization and minimizing disruptions.

9. Provide a Scalable Solution:

- Design the system to be scalable and adaptable to different urban environments and infrastructure types.
- Accommodate future expansion and integration with evolving technologies and urban management systems.

3. METHODOLOGY

Existing method

Today's drainage systems is not high-tech. So whenever there is blockage it is difficult to figure out the exact location of the blockage. Also, early alerts of the blockage are not received. Hence detection and repairing of the blockage become time consuming. It becomes very inconvenient to handle the situation when pipes are blocked completely and garbage cleaning. Due to such failure of drainage line and overflow of garbage people face a lot of problems.

Drawbacks:

- No Automation is available
- Monitoring of drainage manually is difficult.

PROPOSED METHOD

In the proposed method, development of IoT based drainage and manhole monitoring system is designed. This system monitors temperature, manhole lid position. Maximum levels are set and sensors keep monitoring the changing conditions. As the levels reach a maximum set point the sensors detect and send the signal to controller, where it commands the IoT network to generate alerts to the municipal corporation.

Block diagram:

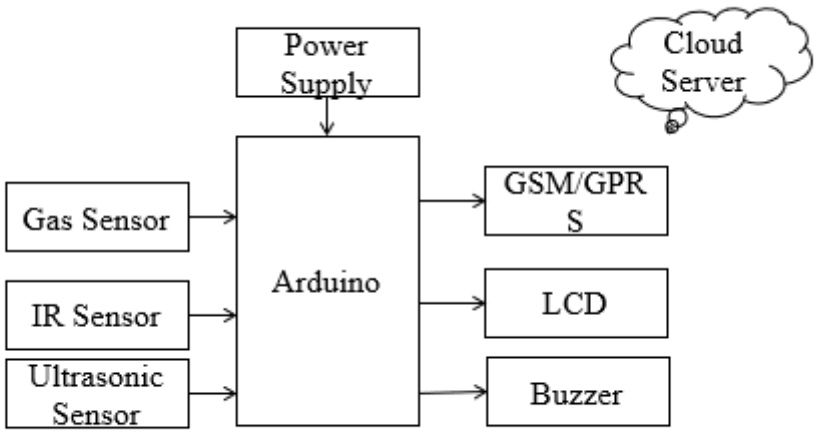

Fig 4.1: Proposed Method Block Diagram

4. HARDWARE REQUIREMENTS

Arduino:

Arduino Uno is a very valuable addition in the electronics that consists of USB interface, 14 digital I/O pins, 6 analog pins, and Atmega328 microcontroller. It also supports serial communication using Tx and Rx pins.

There are many versions of Arduino boards introduced in the market like Arduino Uno, Arduino Due, Arduino Leonardo, Arduino Mega, however, most common versions are Arduino Uno and Arduino Mega. If you are planning to create a project relating to digital electronics, embedded system, robotics, or IoT, then using Arduino Uno would be the best, easy and most economical option.

Fig 5.1 : Arduino Types

It is an open-source platform, means the boards and software are readily available and anyone can modify and optimize the boards for better functionality.

The software used for Arduino devices is called IDE (Integrated Development Environment) which is free to use and required some basic skills to learn it. It can be programmed using C and C++ language.

Some people get confused between **Microcontroller and Arduino**. While former is just an on system 40 pin chip that comes with a built-in microprocessor and later is a board that comes with the microcontroller in the base of the board, bootloader and allows easy access to input-output pins and makes uploading or burning of the program very easy.

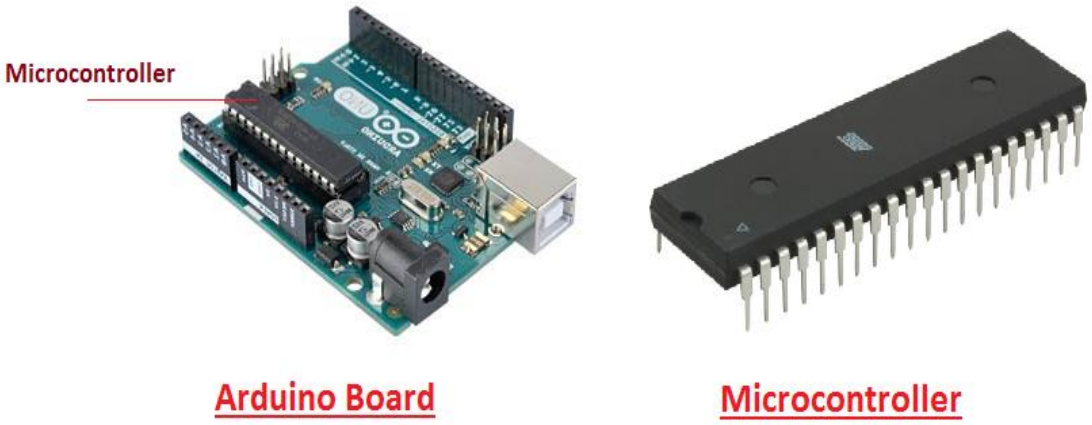

Fig 5.2 : Auduino Board and Microconroller

While learning microcontroller requires some expertise and skills.

Nevertheless, we can say every Arduino is basically a microcontroller but not every microcontroller is an Arduino.

Introduction to Arduino

- **Arduino Uno** is a microcontroller board developed by Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328.
- First Arduino project was started in Interaction Design Institute Ivrea in 2003 by David Cuartielles and Massimo Banzi with the intention of providing a cheap and flexible way to students and professional for controlling a number of devices in the real world.
- The current version of Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output.
- It allows the designers to control and sense the external electronic devices in the real world

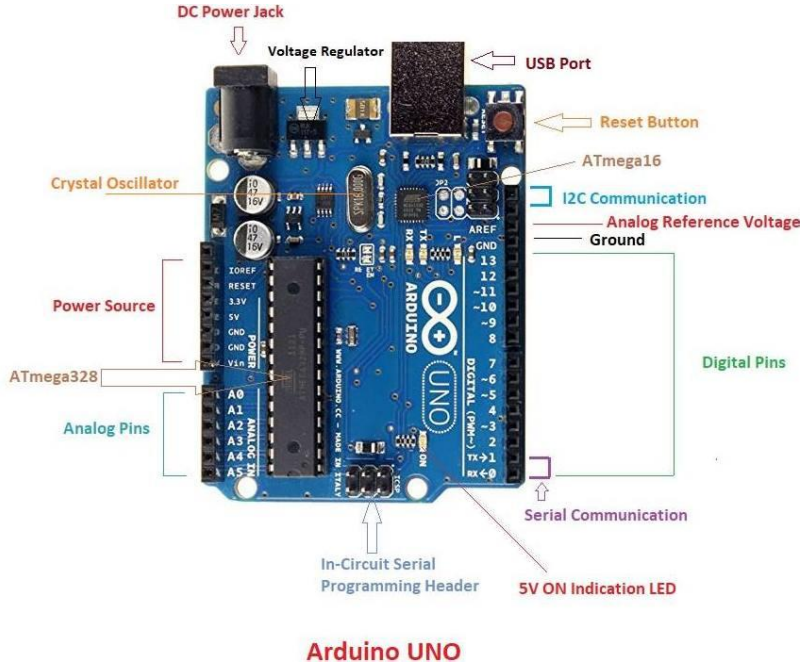

Fig 5.3 : Arduino UNO

- This board comes with all the features required to run the controller and can be directly connected to the computer through USB cable that is used to transfer the code to the controller using IDE (Integrated Development Environment) software, mainly developed to program Arduino. IDE is equally compatible with Windows, MAC or Linux Systems, however, Windows is preferable to use. Programming languages like C and C++ are used in IDE.
- Apart from USB, battery or AC to DC adopter can also be used to power the board.
- Arduino Uno boards are quite similar to other boards in Arduino family in terms of use and functionality, however, Uno boards don't come with FTDI USB to Serial driver chip.
- There are many versions of Uno boards available, however, Arduino Nano V3 and Arduino Uno are the most official versions that come with Atmega328 8-bit AVR Atmel microcontroller where RAM memory is 32KB.
- When nature and functionality of the task go complex, Mirco SD card can be added in the boards to make them store more information.

MQ2 sensor:

In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. Gas sensors are very important part of such systems. Small like a nose, gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state.

Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current.

Fig 5.4 : MQ2 Senser

The **gas sensor module** consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it.

Ultrasonic sensor

An ultrasonic sensor transmit ultrasonic waves into the air and detects reflected waves from an object. There are many applications for ultrasonic sensors, such as in intrusion alarm systems, automatic door openers and backup sensors for automobiles.

Accompanied by the rapid development of information processing technology, new fields of application, such as factory automation equipment and car electronics, are increasing and should continue to do so. Using its unique piezoelectric ceramics manufacturing technology developed over many years, Murata has developed various types of ultrasonic sensors which are compact and yet have very high performance. The information contained in this catalog will help you to make effective use of our ultrasonic sensors.

Fig 5.5 : Ultrasonic sensors.

HC-SR04 Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

HC-SR04 Ultrasonic Sensor - Working

As shown above the HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school

formula that

Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below

Fig 5.6 : Ultrasonic receiver module.

Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor.

GSM/GPRS Module

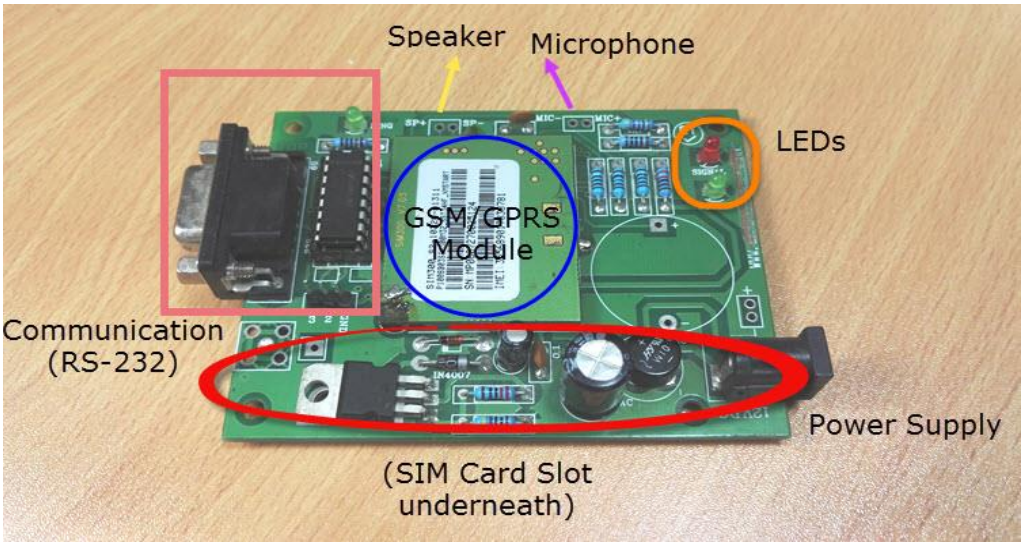

Fig 5.7 : GSM / GPRS Module

GPRS Modules are one of the commonly used communication modules in embedded systems. A GPRS Module is used to enable communication between a microcontroller (or a microprocessor) and the GPRS Network. Here, GSM stands for Global System for Mobile Communication and GPRS stands for General Packet Radio Service.

A GPRS MODEM comprises of a GPRS Module along with some other components like communication interface (like Serial Communication – RS-232), power supply and some indicators. With the help of this communication interface, we can connect the GSM GPRS Module on the GPRS MODEM with an external computer (or a microcontroller).

GPRS Modules allow microcontrollers to have a wireless communication with other devices and instruments. Such wireless connectivity of microcontroller opens up to wide range of applications like Home Automation, Home Security Systems, Disaster Management, Medical Assistance, Vehicle Tracking, Online Banking, E – Commerce etc. to name some.

What is GPRS?

GPRS or General Packet Radio Service is an extension of the GSM Network. GPRS is an integrated part of the GSM Network which provides an efficient way to transfer data with the same resources as GSM Network.

Originally, the data services (like internet, multimedia messaging etc.) in the GSM Network used a circuit – switched connection. In this type, the access time for the network are long and the charges for the data were based on the connection time. Also, this type of connection is not suitable for transmitting bursts of data.

With the integration of GPRS, a packet – switching based data service, in to the GSM Network, the scene of data services has changes. In GPRS based packet – switching networks, the user device doesn't hold the resources for a continuous time but efficiently uses a common pool.

The access time in GPRS is very small and the main advantage is that it allows bursts of data to be transmitted. Also, the charges for data are based on the usage and not on the connection time.

GPRS Module

A GPRS Module is an IC or chip that connects to the GSM Network using a SIM (Subscriber Identity Module) and Radio Waves. The common radio frequencies in which a typical GSM Module operates are 850MHz, 900MHz, 1800MHz and 1900MHz.

Since it is not possible to interface a GPRS Module directly to an external device like a microcontroller, we need a setup like shown in the following image.

It consists of the GPRS Module, slot for inserting a SIM Card, RS-232 Interface for connecting with computer or a microcontroller, signal status LED, power supply and a provision for connecting microphone and speaker.

Each GPRS Module is unique and it can be differentiated by its IMEI Number. IMEI or International Mobile Equipment Identity Number is a 15 – digit unique number associated with mobile phone, satellite phones and other GSM Network devices.

LCD:

LCD (Liquid Crystal Display) is the innovation utilized in scratch pad shows and other littler PCs. Like innovation for light-producing diode (LED) and gas-plasma, LCDs permit presentations to be a lot more slender than innovation for cathode beam tube (CRT). LCDs expend considerably less power than LED shows and gas shows since they work as opposed to emanating it on the guideline of blocking light.

A LCD is either made with a uninvolved lattice or a showcase network for dynamic framework show. Likewise alluded to as a meager film transistor (TFT) show is the dynamic framework LCD. The uninvolved LCD lattice has a matrix of conductors at every crossing point of the network with pixels. Two conductors on the lattice send a current to control the light for any pixel. A functioning framework has a transistor situated at every pixel crossing point, requiring less current to control the luminance of a pixel.

Some aloof network LCD's have double filtering, which implies they examine the matrix twice with current in the meantime as the first innovation took one sweep. Dynamic lattice, be that as it may, is as yet a higher innovation.

A 16x2 LCD show is an essential module that is generally utilized in various gadgets and circuits. These modules more than seven sections and other multi fragment LEDs are liked. The reasons being: LCDs are affordable; effectively programmable; have no restriction of showing exceptional and even custom characters (not at all like in seven

fragments), movements, etc.

A 16x2 LCD implies 16 characters can be shown per line and 2 such lines exist. Each character is shown in a lattice of 5x7 pixels in this LCD. There are two registers in this LCD, in particular Command and Data.

The directions given to the LCD are put away by the order register. An order is a direction given to LCD to play out a predefined assignment, for example, introducing it, clearing its screen, setting the situation of the cursor, controlling presentation, and so forth. The information register will store the information that will be shown on the LCD. The information is the character's ASCII incentive to show on the LCD.

Data / Signals / Execution of LCD

Now that was all about the signals and the hardware. Let us come to data, signals and execution.

Two types of signals are accepted by LCD, one is data and one is control. The LCD module recognizes these signals from the RS pin status. By pulling the R / W pin high, data can now also be read from the LCD display. Once the E pin has been pulsed, the LCD display reads and executes data at the falling edge of the pulse, the same for the transmission case.

It takes 39-43μS for the LCD display to place a character or execute a command. It takes 1.53ms to 1.64ms except for clearing display and searching for cursor to the home position.

Any attempt to send data before this interval may result in failure in some devices to read data or execute the current data. Some devices compensate for the speed by storing some temporary registers with incoming data.

There are two RAMs for LCD displays, namely DDRAM and CGRAM. DDRAM registers the position in which the character would be displayed in the ASCII chart. Each DDRAM byte represents every single position on the display of the LCD.

The DDRAM information is read by the LCD controller and displayed on the LCD screen. CGRAM enables users to define their personalized characters. Address space is reserved for users for the first 16 ASCII characters.

Users can easily display their custom characters on the LCD screen after CGRAM has been set up to display characters.

LCD Display:-

Fig 5.8: LCD – Front View

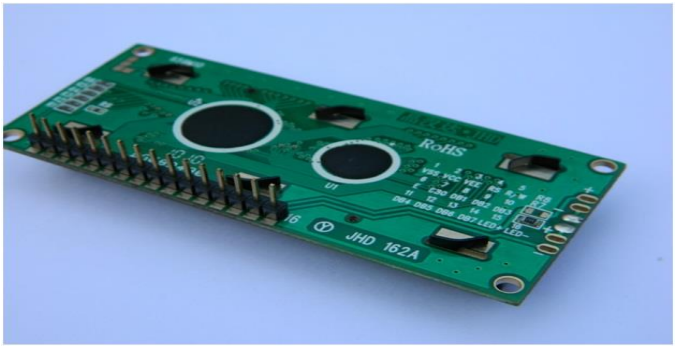

Fig 5.9 : LCD – Back View

Pin Diagram:

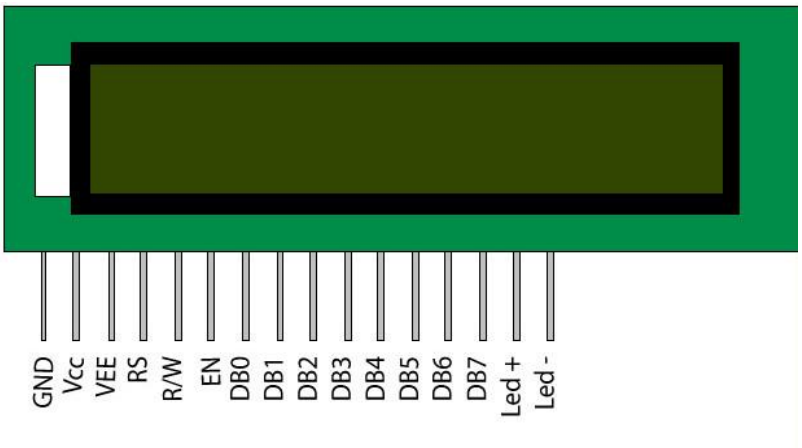

Fig 5.10 : Pin Diagram

Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Table 5.1 : Pin Description

Block Diagram of LCD Display:-

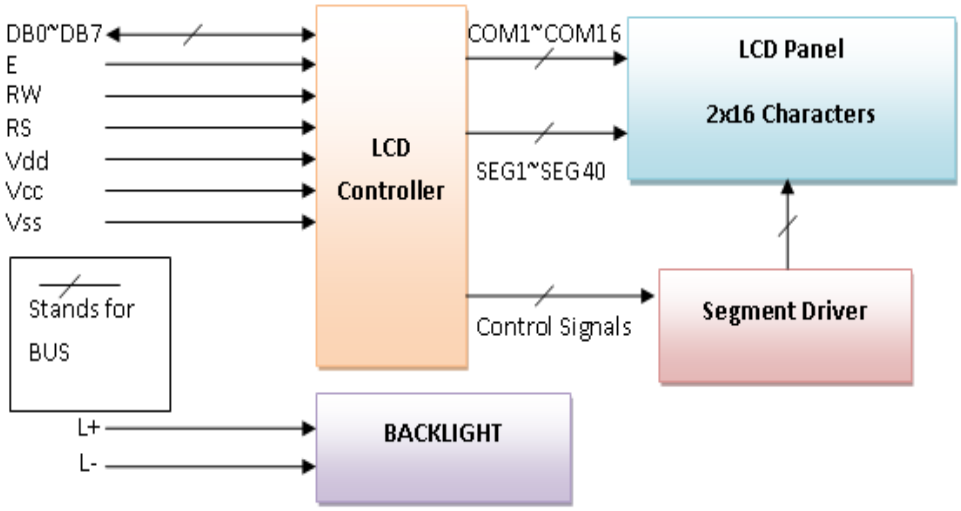

Fig 5.11 Block Diagram of LCD Display

Buzzer :

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play.

Fig 5.12 : Buzzer

Buzzer Features and Specifications

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

How to use a Buzzer

A **buzzer** is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customized with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

Transformer:

A transformer is a static electrical gadget that exchanges control between at least two circuits. A fluctuating current creates a changing attractive motion in one transformer curl, which thus actuates a differing electromotive power over a second loop twisted around a similar center.

Without a metallic association between the two circuits, electrical vitality can be exchanged between the two loops. The enlistment law of Faraday found in 1831 portrayed the impact of prompted voltage in any curl because of the changing attractive flux surrounded by the coil.

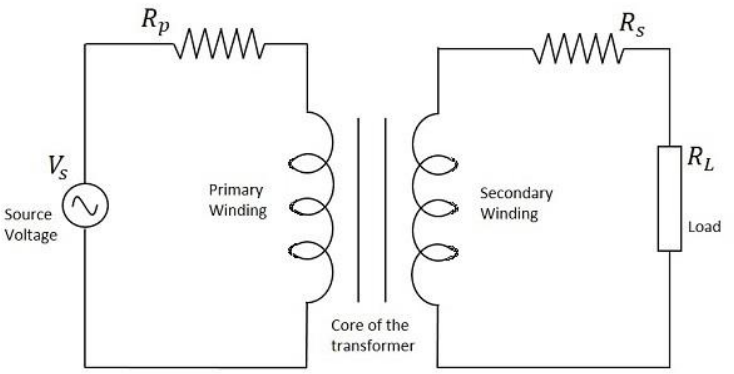

Fig 5.13 : Circuit of transformer

Fig 5.14 : Transformer

Rectifier:

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification, since it "straightens" the direction of current.

Rectifiers have many uses, but are often found to serve as components of DC power supplies and direct power transmission systems with high voltage. Rectification can be used in roles other than direct current generation for use as a power source.

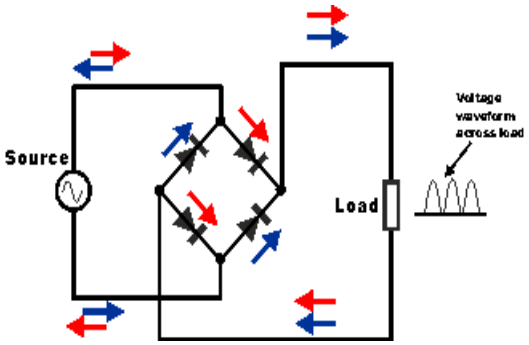

Fig 5.15 : Circuit of rectifier

Fig 5.15.1: Rectifier

Voltage regulators:

The 78XX voltage controller is mainly used for voltage controllers as a whole. The XX speaks to the voltage delivered to the specific gadget by the voltage controller as the yield. 7805 will supply and control 5v yield voltage and 12v yield voltage will be created by 7812.

The voltage controllers are that their yield voltage as information requires no less than 2 volts. For example, 7805 as sources of information will require no less than 7V, and 7812, no less than 14 volts. This voltage is called Dropout Voltage, which should be given to voltage controllers.

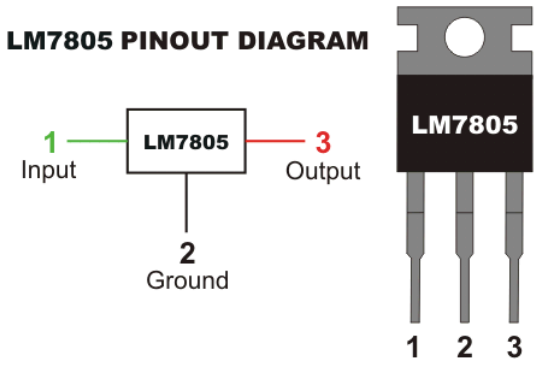

Fig 5.17: 7805 voltage regulator with pinout

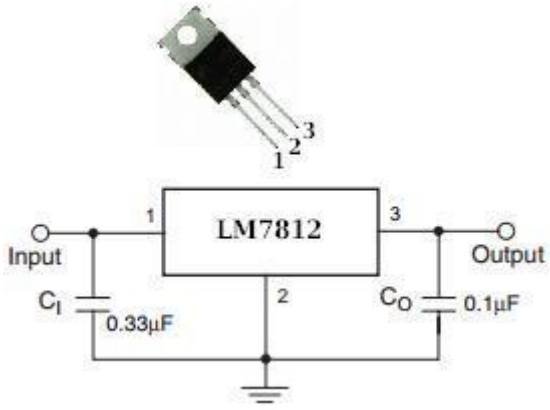

Fig 5.17.1: 7812 voltage regulator with pinout

5. SCHEMATIC PROCESS

Power Supply: The system is typically powered by a stable power source, such as a battery or an external power adapter, supplying the necessary voltage and current to operate the components.

Arduino Microcontroller: The Arduino acts as the main control unit, responsible for coordinating the entire system. It receives inputs from different sensors, processes the data, and controls the output devices accordingly.

Gas Sensors: The system incorporates gas sensors, such as the MQ2 sensor and a gas sensor module. These sensors detect the presence of combustible or toxic gases that may accumulate in manholes. They measure gas concentrations and send analog or digital signals to the Arduino.

Ultrasonic Sensor: An ultrasonic sensor is used to detect the physical presence of an open manhole or pit. It emits ultrasonic waves and measures the time taken for the waves to bounce back after hitting an obstacle. The Arduino calculates the distance based on the time and determines if a manhole is open or closed.

GPS Module: A GPS module can be included to provide location information for the manhole monitoring system. It retrieves latitude and longitude coordinates, which can be used for tracking the exact location of manholes and integrating them with a geographical information system (GIS).

GSM/GPRS Module: The system utilizes a GSM/GPRS module to establish a cellular network connection. This allows for communication with a central monitoring system or authorized personnel. The Arduino uses this module to send data, alerts, or notifications about manhole conditions, gas concentrations, or GPS coordinates.

Data Processing: The Arduino receives data from gas sensors, ultrasonic sensors, and GPS modules. It processes this data using appropriate algorithms and compares it with predefined thresholds or conditions. If any hazardous situations are detected, the system proceeds to the next stage.

Alarm and Display: To provide real-time feedback, the system includes an output display, such as an LCD (Liquid Crystal Display). The LCD can show gas concentration levels, manhole status (open/closed), and system status. Additionally, an audible alarm, such as a buzzer, can be triggered to alert nearby individuals or workers of hazardous conditions.

Communication: The GSM/GPRS module facilitates communication between the manhole monitoring system and a central monitoring station or authorized personnel. The Arduino uses this module to send regular status updates, emergency alerts, and location information. It can also receive commands or instructions remotely for system control or troubleshooting.

Central Monitoring System: The central monitoring system receives data transmitted by the manhole monitoring devices deployed in different locations. It collects and processes the data from multiple devices, allowing operators to monitor the overall status of manholes, gas levels, and other relevant information. The central monitoring system may include a web-based interface or dedicated software for visualization and management.

Data Storage and Analysis: The system may incorporate a database or data storage mechanism to record historical data from the manhole monitoring devices. This allows for data analysis, trend identification, and the generation of reports or statistics. It can aid in decision-making, preventive maintenance, and identifying patterns or anomalies in manhole conditions.

The schematic process of the manhole detection and monitoring system involves sensor data acquisition, processing, alarming, display, and communication with a central monitoring system. The system aims to improve safety by providing real-time monitoring and timely alerts about gas concentrations, open manholes, and location information.

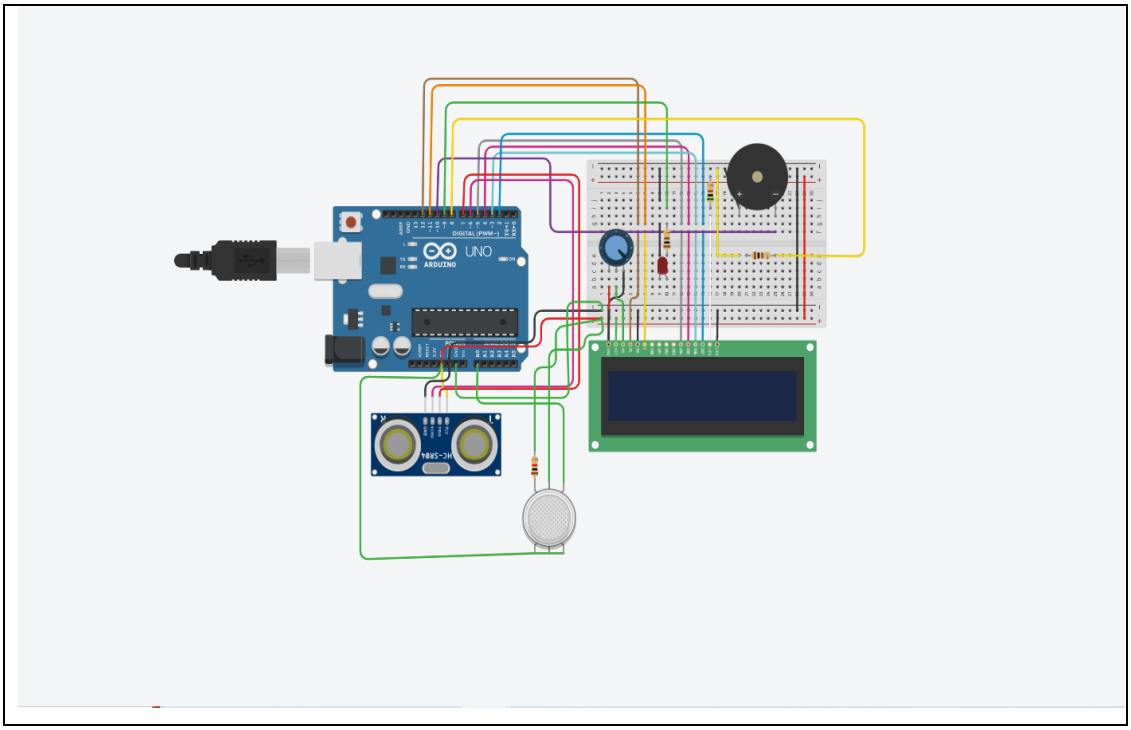

Fig 5.1 Project Schematic Diagram

6. Explanation and Working

The working principle of the manhole detection system:

The gas sensors continuously monitor the gas concentration levels in and around the manholes. The sensors send the gas concentration data to the Arduino.

The ultrasonic sensor detects the presence of open manholes by measuring the distance to obstacles. It sends the distance data to the Arduino.

The GPS module retrieves latitude and longitude coordinates to determine the precise location of manholes.

The Arduino processes the data received from the sensors and determines if there are hazardous conditions, such as high gas concentrations or open manholes.

If a hazardous condition is detected, the Arduino triggers the appropriate output devices, such as the LCD and the buzzer.

The GSM/GPRS module enables communication between the manhole detection system and a central monitoring station or authorized personnel. The Arduino sends alerts, notifications, or other relevant information to the designated recipients.

The central monitoring system receives and processes the data transmitted by multiple manhole detection systems, providing real-time monitoring and enabling prompt actions to ensure safety.

The circuitry and working principle of a manhole detection system involve continuous monitoring of gas concentrations, detection of open manholes using ultrasonic waves, integration of GPS for precise location tracking, and communication with a central monitoring system for real-time alerts and monitoring.

The manhole detection system uses the IR sensor, gas sensor, ultrasonic sensor, buzzer, LCD, and GSM module, all connected to the Arduino microcontroller. Each component detects specific conditions or events, and the Arduino processes the sensor data, triggers appropriate actions (such as sounding the buzzer, displaying messages on the LCD, or sending SMS messages), and ensures the safety of the manhole surroundings.

IR Sensor: The IR sensor is connected to pin 2 of the Arduino as a digital input. It detects the presence of an object or obstruction and provides a digital value (0 or 1) to the Arduino. When the IR sensor detects a value of 0, indicating an object in its range, it triggers an action.

Gas Sensor: The gas sensor is connected to analog pin A3 of the Arduino. Gas sensors are used to detect the presence of specific gases in the surrounding environment. The sensor provides an analog voltage output proportional to the gas concentration. The Arduino reads this voltage through the analog pin and processes it to determine the gas level. If the detected gas concentration exceeds a certain threshold, an action is triggered.

Ultrasonic Sensor: The ultrasonic sensor consists of two pins: trig (transmit) and echo (receive). The trig pin is connected to pin 3 of the Arduino, while the echo pin is connected to pin 4. The ultrasonic sensor emits ultrasonic waves and measures the time it takes for the waves to bounce back from an object. The Arduino calculates the distance based on this time measurement. If the distance is within a specific range, indicating a close proximity to a manhole or obstruction, an action is triggered.

Buzzer: The buzzer is connected to pin 5 of the Arduino. When triggered by a specific condition, such as a detected object by the IR sensor, high gas concentration from the gas sensor, or close proximity to a manhole detected by the ultrasonic sensor, the Arduino sends a signal to pin 5 to activate the buzzer. This results in an audible sound alerting nearby individuals.

LCD: The LCD (Liquid Crystal Display) is connected to the Arduino using multiple pins. The RST (Reset) pin is connected to pin 13, the EN (Enable) pin is connected to pin 12, and the data pins (d4, d5, d6, d7) are connected to pins 11, 10, 9, and 8, respectively. The Arduino sends appropriate data and commands to the LCD to display relevant information. For example, when a manhole is detected by the IR sensor or high gas concentration is detected, the Arduino can send messages like "Manhole Detected" or "Smell Detected" to be displayed on the LCD.

GSM Module: The GSM module's Rx (Receive) and Tx (Transmit) pins are connected to the Arduino's Tx and Rx pins, respectively. This allows communication between the Arduino and the GSM module. The GSM module enables the system to send SMS messages or make calls to a specified phone number. When triggered by specific conditions, such as a detected manhole or increased waste water, the Arduino can send a message like "Manhole Detected" or "Wastage Increase" to the desired phone number using the GSM module.

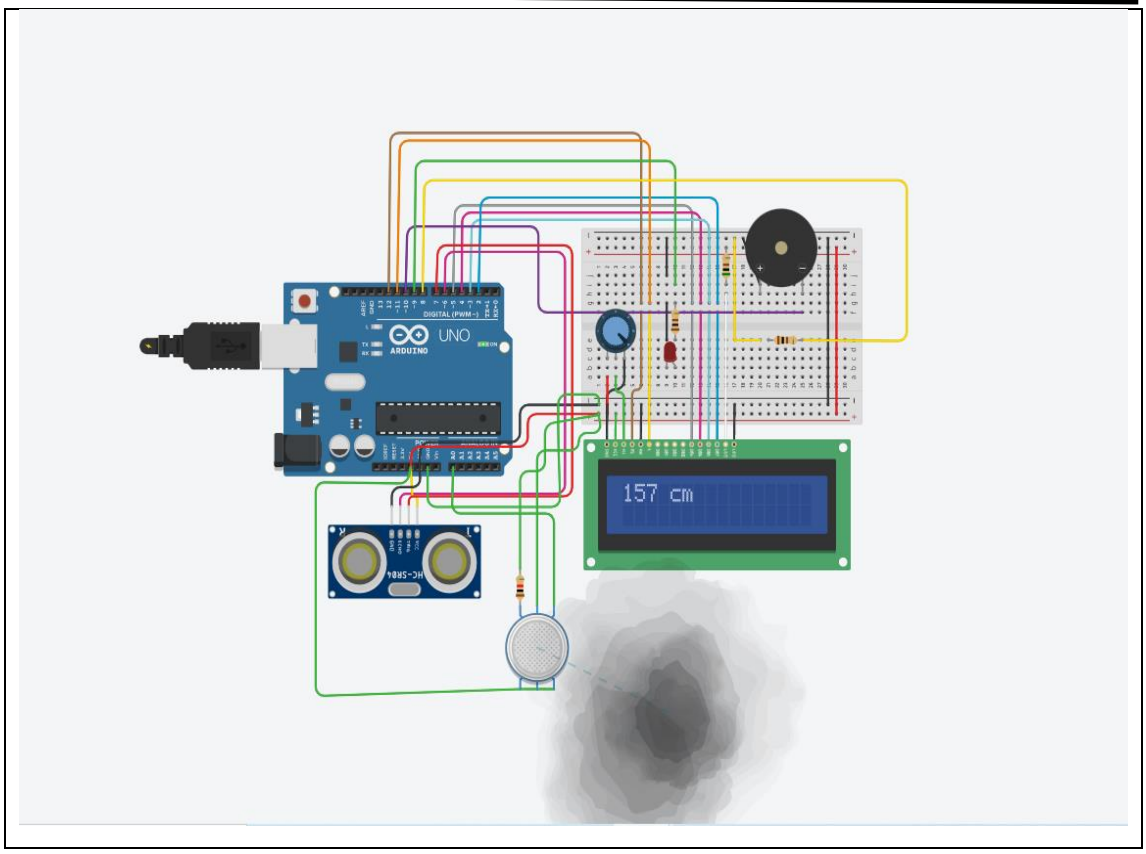

Fig 6.1 Working of the project schematic

7. RESULT AND DISCUSSION

The main purpose of the Manhole detection and Monitoring System using IOT is to reduce the usage of the resources and efforts and to improve the city's smart vision. By using a sensor and GSM the environment is clean and hygienic and ensures environmental cleanliness. Improper disposal and storage of harmful gases creates problems for public health and pollution. Smart Garbage Monitoring System using IOT is developed using ultrasonic sensor as distance measuring sensor, GPS will help in sending the location of the manhole and GSM will help in sending the message to the person device and authorities with the current location. The Manhole detection and Monitoring System using IOT was developed using Arduino IDE as IDE Tool and Google API as software tool.

This project proposes totally different ways of watching and maintaining the manhole system. It explains manhole identification in real time. It monitors various parameters like toxic gases, temperature, and water levels in the manhole using the technology of Internet of Things. These parameters are monitored continuously and updated through GSM. By receiving alerts from sensors, government officials can take necessary actions. In this way, unnecessary trips to monitor the status of manholes can be avoided, and only done as needed.

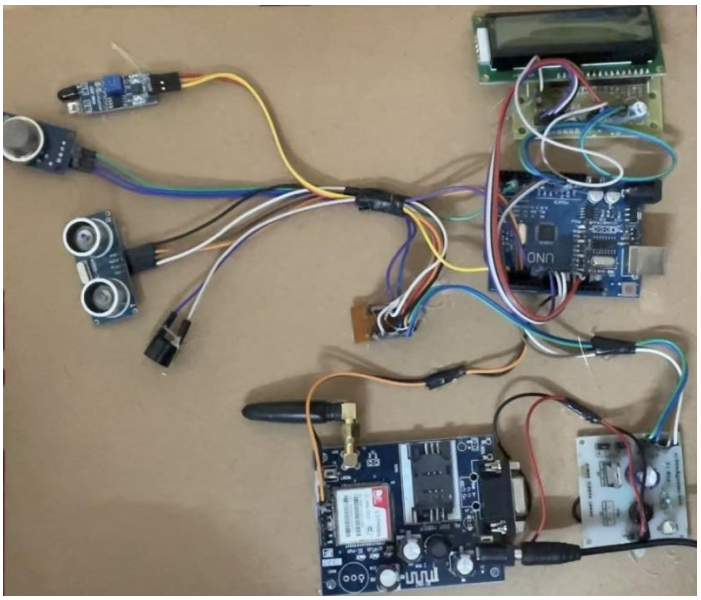

Fig 7.1 Hardware of System

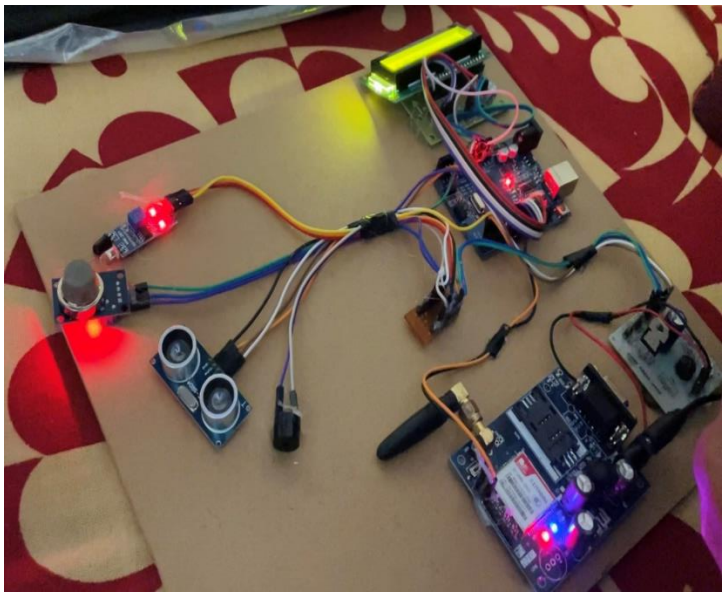

Fig 7.2 Running System

APPLICATIONS

One of the primary applications of this system is in the field of public safety. Manholes, though essential for urban infrastructure, can pose serious risks if left unmonitored or poorly maintained. Accidents involving open or damaged manholes can lead to injuries or even fatalities. The Manhole Detection and Monitoring System uses sensors to detect the status of manholes, such as their open or closed position, integrity, and structural stability. In case of any abnormalities, the system immediately alerts the concerned authorities, allowing them to take prompt action and mitigate potential hazards.

Furthermore, the system also contributes to efficient maintenance and management of manholes. Traditional methods of manual inspection and maintenance are time-consuming, expensive, and often inefficient. With the Manhole Detection and Monitoring System, authorities can remotely monitor the condition of manholes and prioritize maintenance based on real-time data. This proactive approach helps prevent costly repairs and minimizes disruptions to urban traffic flow. By streamlining maintenance operations, the system enables efficient allocation of resources and enhances the overall management of urban infrastructure.

Another valuable aspect of the Manhole Detection and Monitoring System is its ability to optimize urban planning and development. The system collects and analyzes data on manhole usage patterns, traffic flow, and other relevant factors. This information can be utilized by urban planners to make informed decisions regarding the placement and design of manholes in new or existing infrastructure projects. By considering factors such as pedestrian traffic, vehicular movement, and drainage requirements, planners can optimize the location and layout of manholes, ensuring better functionality and safety.

Additionally, the system can integrate with existing urban management platforms, enabling a comprehensive view of the city's infrastructure. By integrating manhole data with other data streams, such as traffic management systems or utility networks, authorities can gain valuable insights into the overall health and performance of urban infrastructure. This integrated approach facilitates efficient decision-making, resource allocation, and emergency response planning.

CONCLUSION

The Manhole monitoring needs to be cleaned when it is filled to maintain a hygienic environment. Our manhole monitoring system contains Arduino, Ultrasonic sensor, IR. The system monitor the manhole level and it reaches the particular level it sends the notification and if manhole is open then notification alert. This notification system helps the municipality to monitor the opening of manholes. If the drainage wastes are not cleaned it sends the message to higher authority. Our model overcomes the entire problem in smart manhole alert.

8. REFERENCES

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