

SMART DRAINAGE MONITORING AND HEALTH MONITORING SYSTEM OF MANUAL SCAVENGER USING IOT AND ONTOLOGY APPROACH

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering degree in
Electronics and Telecommunications

By

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of K.DARSHINI (37250003) and M.MARI ANANTHI (37250013) who carried out the project entitled "SMART DRAINAGE MONITORING AND HEALTH MONITORING SYSTEM OF MANUAL SCAVENGER USING IOT AND ONTOLOGY APPROACH" under my supervision from November 2020 to April 2021.

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DECLARATION

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DATE : 19/04/2021

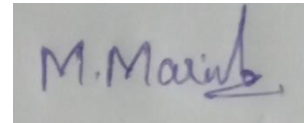
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ABSTRACT

- Several cities have implemented an below the earth sewage design, and it's the responsibility of the Government to ensure that our cities remain healthy, clean, and secure. If the drainage system is not properly maintained, fresh water may become polluted with waste water, resulting in the spread of infectious diseases. Sanitation workers and Human Scavengers are not aware by since poisonous gases are odourless when exposed for long periods of time, they can cause severe illness. Several fatal accidents have occurred in recent decades due to a lack of proper gas leakage detection systems. In order to address all of these issues, an effective sewer monitoring system is needed. Different Gas sensors placed in the monitoring system helps us to monitor the level of the toxic gases and when a threshold is reached an alert system is triggered. Sensors like pulse sensors, and respiratory sensor help to monitor the health of the Human scavengers or the sanitation workers.

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CHAPTER 1

I. INTRODUCTION:

The Drainage infrastructure and setup since the period of high economic growth in the country has to be being replaced, and work should be done upon and upgraded to be undertaken to maintain a safe and secure water sewerage environment. This work needs to be undertaken efficiently but the drawbacks usually are small number of workers and a tight budget. In light of this, work on sewage monitoring and drainage overflow control systems goes beyond day-to-day facility operation and maintenance to include maximising the value of operational technology (OT) data obtained through these programmes will luckily overcome the problems facing sewerage infrastructure and water supply, as well as contribute to the protection of the water environment. With the growing possibilities for sensing, tracking, and regulating with the Internet of Things (IoT) in recent years, more accurate information and sources, such as image data, are being considered. Image data was not traditionally used as sensing data, but with the advent of IOT, anything is possible.. This report gives examples of these possibilities in a structured form and explains what is it that enables IoT data gathered by monitoring and control systems to be used on an IoT platform. Creative technologies like An optical fibre sensing device for use within sewage pipes (a historically difficult application) has also been made possible, as has the use of images and audio data as new sensing media.

In large cities with millions of residents, the underground drainage system is extremely important. It can be found almost anywhere, including urban, rural, and suburban areas. Because of the surplus wasted rain water and waste water, the underground drainage system is known as the source for land drought. Drainage conditions should be tracked on a regular basis to ensure proper operation. There isn't a drainage monitoring team in every area. As a result, sewage control is not done on a daily basis. The sewage system's inconsistent control leads to drainage blockages, which result in sewage water overflowing and flooding in the city. Monitoring by hand is often slow and time consuming. It necessitates a large number of committed people and manpower who can only document small and inefficient reports. This exists & may have significant consequences for the city's sewage lines. obstructive If proper cleaning steps are not taken, waste material can cause a rise in the water level as well as the production of various harmful gases in sewer drains,

which can be fatal. Since the drainage system is not computerised these days, it is difficult to tell whether a blockage is happening in a sewer at a specific site. Furthermore, sewage in wastewater and sewer lines can sometimes emit various poisonous gaseous substances which are unhealthy and can cause severe illnesses if inhaled in significant amounts by humans, and these issues are commonly faced by Human Scavengers. The number of drainage staff who have died as a result of these dangerous conditions has risen alarmingly in recent decades. Since timely warnings of a blockage or overflow of drainage water, a rise in the volume of such gases, or an increase in water level aren't received, detecting and fixing the problems becomes difficult and time consuming. Wireless Sensor Networks (WSN) are a form of monitoring technology that employs node sensors and a wireless network system. Each sensor node in a wireless sensor network is made up of a data processor (microcontroller), memory (programme, data, flash memory), NRF transmitter receiver, and a power or main system, with sensors. As compared to wired networks, WSN systems are accurate, cost efficient, scalable, and reliable, and are expected to replace hybrid or mixed infrastructure.

The IoT monitoring system and network that can detect dangerous gases has been developed as a measure to help the drainage workers who risk their life. This system ensures reduced hazards in the workplace of the sanitation workers due to these contaminants. The sanitation employees' mortality rate have increased during the previous few decades. Post to attaining fatal levels, due to a lack of adequate waste disposal and exhaustion results in the death of drainage cleaning staff from health issues and injuries and illnesses including influenza, dysentery caused by sudden yet prolonged harmful exposure of gases. Septic pipelines are structures that are commonly found from housing areas, residential areas to industrialized urban and suburban areas, providing flow and treatment of waste materials. Usually, sewage gases are the end byproduct of decomposing of natural wastes & compost produces & assimilates noxious trash which produces toxic fumes. Traces of acid and gases of carbonic and alkane series and other traces of SO₂, hydrogen sulphide, methane, NH₄, and CO gases are found in the drainage tank and drainage outlets. Gas sensors are used to identify and quantify the amount of toxic gas in the sewage system, as well as to send out a warning. The paper aims to provide timely monitoring and tracking of sewage or to keep an eye on the level of gas presence in the septic system.

The system explained in this paper will be executed for sewage waste in different locations like rural as well as urban. The system being also an industrial plant, can be designed to work properly in every household or industry through dynamic style specifications and designing. Ubidots IoT platform can be operated from all over the world through the internet for remote monitoring and displaying detected values on the Ubidots webpage. The system also realizes the advancement of the IOT framework as the tools and gadgets for developing and controlling this entire installation. The setup approach gives a easy as well as a complex sewerage environment setting solution than previous existing systems that not account to monitoring in real time of the changes in gas concentrations and water levels. It is due the flux of the sewage water varies in a wide range with respect to time and is based upon lot different attributes such as quality of filter, energy stored and sewage plant disorder. The said approach tracks the variables continuously such that minute by minute evaluation is detectable in isolated areas due to electronic monitoring that paves way for a firm interpretation of CH₄(methane), CO(Carbon monoxide) as well as other sewage contaminants and even the other gutter releases and helps to monitor and efficiently alerts the concerned authority to sanitize municipal management, which was lacking factor from previous setups.

Water is an inevitable supply to life. Fresh rivers carry water to farms, homes, industries, to businesses. They nourish and rejuvenate the entire habitat, revives the surroundings and provides an additional natural flow regime to waterbodies. Water for the environment is especially utilized for distinct outcomes for flora and fauna by facilitating the right volume of water at the proper time for their growth. Water is an inevitable element to aid the soundness of waterbodies & in turn supporting the relying communities. Proper water maintenance will successively satisfy human needs. Water is vital to balance a rich and tough stream system for the environment. Usable, pure water includes waterbodies like waterbed and streams, ponds etc comprising entirely 70% of the water available on the planet. The movement of H₂O is one of the indicators of purity and energy. For example moving water is highly pure than stagnant water. Turbulent water often contains remains of tiny quantities of gas and inorganic materials and has high energy. The irregular monitoring impacts on the drainage block that refers to flooding in the neighborhood. Blockage causes sudden increase in the water level and if unnoticed, with days produce amount of harmful

gaseous materials. The present waste water system isn't technology efficient and is time consuming to locate blocked sewer as well as in the detection of blockages.

The sources of Sewage water are mostly grey water from sinks, showers, etc and black water from toilets with the human wastes, flushed soaps and detergents. Drainage usually moves from the plumbing area in a building into a sewer or a drainage outlet, which is connected into an onsite sewage facility.

1.1 BACKGROUND OF THE PROBLEM/EXISTING SYSTEM

Untreated wastewater discharged directly via a sewer environment into the atmosphere before ending up in waste water treatment facilities is known as sewage overflow. It is because of blockage in the sewage pipe or by excessive rainfall. It is mainly seen in prospering countries with comprehensive waste water treatment systems, as well as in some developing countries. This overflow is collected in ponds on the roads, causing disease and foul odours to spread. People literally cross the overflowing road before the public services interfere. Furthermore, due to a delay in passing details to the authorities in the municipality company, these facilities are not provided immediately or on short notice.

1.2 OBJECTIVES OF PROPOSED WORK

The setup's main goals are to create intuitive and hygienic systems through an efficient administration framework that includes instantaneous monitoring of waste water levels. Simultaneously monitoring the water flow rate, and sending an computerized mail. In addition to email alert, an alert system will get triggered prior to the overflow of the water.

1.3 DESIGN OF SYSTEM

Waste water management system is the method or mechanism by which water, sewage or other aqua are drained from a location and to ensure the correct working of drainage, its state should be eyed periodically. However, human monitoring in all nooks and corners that a person can't attend to is extremely arduous. This has an effect on the clogging of sewage pipes, resulting in water overspillage, which is a fitness concern. To address all of these problems, we built and implemented a wireless sensor network system. It's a number of small data-gathering instruments.

Node is the term for these sensing units. The proposed system is a low-cost, low-maintenance, long-life web-based real-time system that sends a text message to the municipal officer whenever a manhole reaches a certain threshold value. This method has a significant effect on the residents' and employees' wellbeing when it comes to underground drainage cleaning. It also prevents the spread of infection caused by mosquitoes, provides a safe and healthy atmosphere, and controls diseases such as malaria, dengue fever, and diarrhoea. The device eliminates the chance of an uncovered manhole causing an accident.

In big towns with huge population, the waste water system is very important. The drainage management system in most cities is supervised manually, which is costly and involves a large number of sanitation workers who can only record minimal reports with inefficient accuracy. It is also difficult for government officials to determine the precise location of a manhole that is experiencing issues such as blockage caused by unwanted waste products, an abrupt rise in the volume of water, and other poisonous gases such as methane and carbon monoxide, etc. If proper cleaning steps are not taken on a regular basis, these gases are toxic and can cause serious health issues if inhaled in large amounts. Since most drainage systems are not computerised, it's difficult to tell whether a blockage is happening in a specific area, and early warnings of blockages aren't received. As a result, detecting the blockage and repairing it takes time. Such issues will wreak havoc on the city's daily routine. The system also describes the different functions that are used for controlling the underground drainage system, water level, water flow rate, and toxic gas content. If there is a blockage in the drainage system and sewage begins to overflow, the sensor system, which is interfaced with a microcontroller such as an Arduino, can detect it and transmit the data to the Corporation authority via GSM (Global System for Mobile). Section II examines the literature review, which reveals various approaches to underground drainage control. Section III outlines the approach that explains how the proposed system works. The workings of the various components are described in Section IV.

CHAPTER 2

2.LITERATURE SERVEY:

2.1 USING INTERNET OF THINGS IN MONITORING AND MANAGEMENT OF DAMS IN SERBIA

Author: Rastko Martać¹, Nikola Milivojević¹ , Vladimir Milivojević¹ , Vukašin Ćirović¹ , Dušan Barać²

This paper looks at how the Internet of Things can be used to track and manage dams in the Republic of Serbia. Large dams serve as reservoirs and are significant, but the risks associated with them must also be considered. In order to use reservoir or dam facilities for dam water control in the Republic of Serbia, information about them must be gathered. Based on existing systems, an information system has been built and developed, enabling the use of smart n/w sensing elements. This explains the overall capabilities in IOT applications in specific reservoir protection and overall framework. A information obtaining system for transcieiving data with sensing elements in the observing module network is set up to incorporate large number of sensors.In case a problem occurs an alerting system gets triggered. The values of security parameters vary from what is predicted.

The anticipated security parameters do not exist. Yash Narale et al. [1] published a research paper on Underground Drainage Monitoring System Using Internet Of Things, describing the importance of smart underground drainage infrastructure in keeping the city clean, secure, and healthy. The microcontroller in this device is an ARM 7. It collects data from a network of sensors that are connected to the microcontroller, and the results are sent to government officials as alerts via GSM, with the location of the sewer pipe determined using GPS. There is no need to use GPS because it uses more electricity, and GSM will send warnings along with the location. The Internet Of Things framework was implemented by Gaurang Sonawane et al. [2] to offer an Intelligent Real-Time Drainage Monitoring System. A microcontroller, the Atmega 328, is used to gather data from a gas sensor, a level sensor, and a pipe blockage sensor. The control module measures the condition of the manhole and detects any blockages between two manholes, as well as detects a

rise in the concentration of different toxic gases in the sewer. A research paper on Internet of Things, which presents the monitoring of city resource peculiarities to help in city growth. This tool has a Raspberry Pi3 microcontroller with sensing devices such as that collect data and communicate it to the Raspberry Pi3, which then sends the data to the appropriate government authorities through email.

2.2 NETWORK TRAFFIC CLASSIFIER WITH CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS FOR INTERNET OF THINGS

Author: Manuel Lopez-Martin ; Belen Carro ; Antonio Sanchez-Esguevillas ; Jaime Lloret

Network monitoring and management has gained a lot of popularity in the recent times. The monitoring is focused on communication configuration features such as ports, number of bytes transmitted per packet. Since understanding the network service allows you to learn and foresee a lot about a current network, NTC is critical.

This is especially applicable the recent technologies in the world of internet where Network Traffic Classifier can assist in the separation of heterogeneous system and service activity. Network Traffic Classifier based on a deep learning approaches and modules for the Internet of Things in this research journal.

2.3 AN INTEGRATED SYSTEM FOR REGIONAL ENVIRONMENTAL MONITORING AND MANAGEMENT BASED ON INTERNET OF THINGS

Author: Shifeng Fang ; Li Da Xu ; Yunqiang Zhu ; Jiaerheng Ahati ; Huan Pei ; Jianwu Yan ; Zhihui Liu

Environmental monitoring has obtained a lot of glances as a result of atmospheric and climatic change, and an integrated information system is considered extremely useful. Learning on weather variations & resulting consequences, this research paper presents a novel method for environmental monitoring and management.

2.4 DESIGN AND APPLICATION OF WATER ENVIRONMENT SCADA FOR TUOJIANG RIVER

Author: Yin Kuang; Yong Zhang

A three-tier control and data obtaining system was established to protect the ecosystem of the Tuojiang River. Information from field instruments was sent to a PC via RS-232 in the monitoring station. Different proposals for data transfer and

acquisition between the monitoring station and the central station were suggested due to geographical and economic conditions. It is depended upon SCADA. The system has been in operation for two years and has proven to be effective, accurate, and capable of producing real-time results.

Li Xiaoman et al [12] proposed a ZigBee Wireless Sensor Network-based framework for aquaculture watching & maintenance to set up aquaculture remote sensors and organise the transmitted data.

2.5 MONITORING SMART CITY APPLICATIONS USING RASPBERRY PI BASED ON IOT

Authors: Prof. S A.Shaikh 1, Suvarna A. Sonawane.

Description: Aim of Intelligent city growth to keep track of city's resource environment. Prerequisite is to convert to secure cities that have fast services and the most up-to-date facility tools to incorporate the Internet of Things (IoT) definition, which allows for simple wireless communication. The device is made up of sensing elements that collect various types of data and send it to Raspberry Pi3 controller. E-mail systems are used to transfer the controller's acquired output to the control room.

2.6 AUTOMATED INTERNET OF THINGS FOR UNDERGROUND DRAINAGE AND MANHOLE MONITORING SYSTEM FOR METROPOLITAN CITIES.

Author: Muragesh S. K1 and Santhosha Rao

The Internet of Things (IoT) is made up of worldly instruments and internet-enabled data transfer gadgets linked to sensing elements networks for information transfer and technology interference of the physical & digital worlds. IoT was born out of the idea that without machines, people could access data from objects and devices without having to communicate with them. However, it sought to solve the limitations of person handled erred data for cost efficiency, precision, and other general goals. A central feature of the IoT paradigm is the network of sensors. It explains producing and design of IoT application for below the earth Sewer Monitoring Setup also referred to as the UDMS. Cheap, low maintenance, quick setup, a large network of sensing elements, durability, and quality of service are all advantages of this design.

CHAPTER 3

3.1 AIM:

The project is to stress the importance of sewage monitoring and not only that but also the importance of human scavenger's health. Unfortunately in our country, the system of using humans to clean out sewers in residential areas as well as public areas exist for long time till we've known. In many western countries, there are robots and machines to perform such lethal as well as inhuman tasks, however in our country, slowly technology has seeped through sewage monitoring systems too but how ever technologies like the mentioned ones are not widely used.

The Government has recently passed a bill that prohibits the act of human scavenging, but still people are unaware and due to unemployment, many sanitation workers unaware of how this might affect their health also take part willingly for menial wage.

Therefore our project exist to help out this hypothetical situation, again with the use of technologies like embedded systems and Internet of Things.

Our projects help to control overflow of sewage water. The overflow of sewage water cause many malignant diseases like Dengue, Cholera, elephantiasis, etc. By Detecting the overflow of water in advance can help to control it.

Monitoring alone is an inefficient system. Therefore, an controlling subsystem i.e, an alert system is triggered to the corporation officials, so that the needful action is taken.

In our case a sanitation worker is sent in to take necessary steps.

In addition to this system, an toxic gases monitoring sensor array of methane and CO sensors is present so that if the amount of gases increase the threshold value, an alert system is triggered and the sanitation worker is prevented from entering the sewer.

This was implemented in this project because, there are countless news of sanitation workers facing severe illness and even death due to improper conditions and inhaling of these gases without protective gear.

In another aspect, to take necessary action the officials and the sanitation worker must know the location of the sewer in which the action has to be taken. Therefore with our inbuilt gps system, the accurate location of the sewer can also be known.

Another important part of the monitoring system is the monitoring and controlling the health of the sanitation worker.

The pulse rate and the respiration rate of the sanitation worker is constantly monitored and if there is any difference an alarm buzzer system is triggered and the person outside the sewer can help the sanitation worker on time.

3.2 SCOPE:

The Scope of our project can be implemented in almost any area with good internet connectivity as the whole project revolves around primarily Internet of things and in places where the infrastructure of embedded systems can be placed.

In our projects all the devices are internet enabled, therefore, the data transmission is seamless, low of cost and requires only primary low of cost infrastructure.

As the system contains primarily of sewage information, it does not require encryption or decryption, thus reduces the complexity of implementation of the project .

CHAPTER 4

4.SYSTEM DESIGN

4.1.EXISTING SYSTEM:

- Existing system includes IOT and embedded systems that efficiently watch the water level, concentration of gases present in the sewer and the usual alerting system.
- But what the existing system fails to propose is that it focuses only on the Detection and Monitoring part of the underground drainage system
- Internet of Things contain three parts namely: Detection, Monitoring as well as Controlling.
- The Proposed system presented in this journal discusses also about the usage of the controlling feature of the IOT in addition to the health monitoring of the sanitation worker
- The proposed system diminishes all the drawbacks in the Existing System.

4.1.1 PROBLEM STATEMENT

This paper discusses about the frequently faced problems in the Sewage Water Monitoring System:

- Overflow of drainage water from the sewer causing street flooding due to undetected unnoticed blockages in the sewer pipe.
- The Toxic gas fumes get trapped inside the sewer and become hazardous for sanitation workers to enter into the sewer to take necessary action
- Due to lack of computerization of the Sewage System, the location of the sewer is often undetectable
- Usually when it comes to sewage monitoring, high importance is given to the sewage system setup and very less importance is given to the health of the sanitation workers resulting in cleaner environments but increase in deaths of Sanitary workers due to inhaling of toxic gases and untimely help.

4.1.2 PROPOSED SYTEM:

- In our proposed system, we are using the Arduino Microcontroller, Ultrasonic sensor, Gas sensor, Heart beat sensor, Respiratory sensor , Node MCU, Relay, power supply.
- This control project assists preserving the city's underground drainage environment & will minimize amount of work needed of government workers. In order to make the device smart, sensing elements (ultrasonic sensor to measure water level, heartbeat, and gas sensors) are included.
- Furthermore, the signal and position of the manhole are sent to the concerned via Global system for mobile communication and Global Positioning System, allowing to quickly identify which sewer has the issue to take measures.
- • Additionally, using IoT, Arduino Uno gives the real time outputs of sensing elements in the sewer. On the LCD, there will also be a message.
- The sensors data are monitored through the IOT Cloud webpage. The updates are frequently happening at the time of sensors data variation
- The location of the sewage we can monitor through the IOT. At the same time we can get status of the sewage and health monitoring of that person via IOT
- We can give alert to the people if any problem via buzzer module which is connected with the Arduino
- We can control the exhaust fan via IOT at the time of poisonous gas detection

4.1.3 ADVANTAGES:

- Simple system to monitor the sewage and health parameters of the Human Scavenger
- Faster Response time
- Realtime updation in the IOT cloud web server
- Easy implementation
- Cost effective system

4.1.4 BLOCK DIAGRAM:

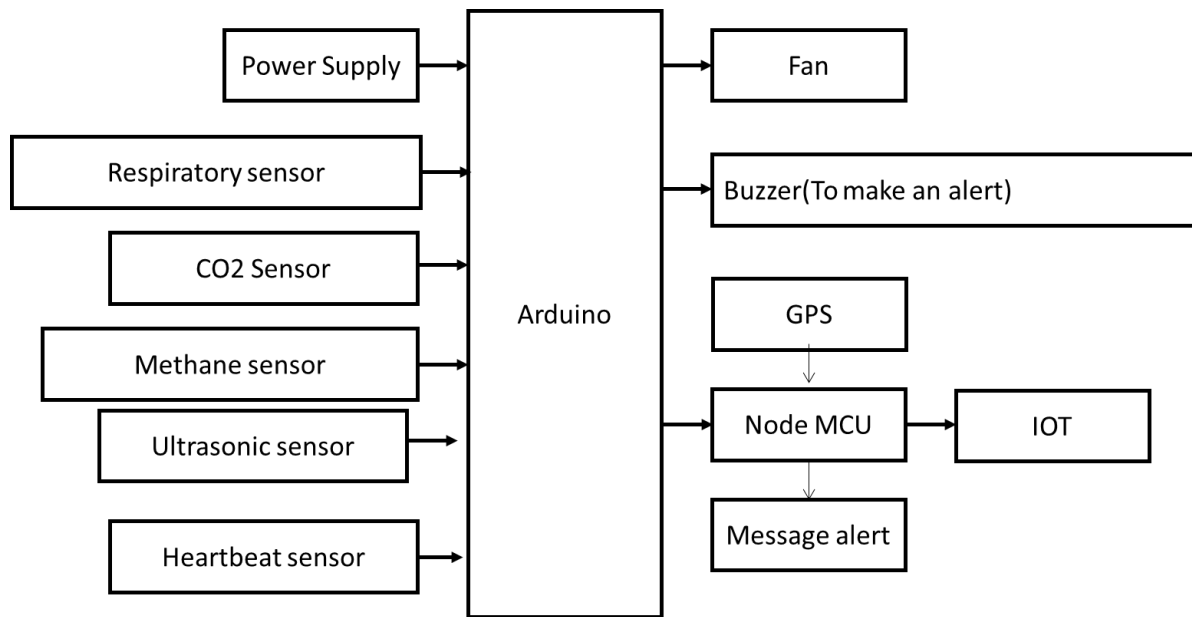


Fig 4.1.4 Block diagram

4.1.5 PROJECT IMPLEMENTATION

- The smart drainage system will have: Sensors to detect water due to blockage, and the toxic gases inside the sewer.
- The sensors can detect clogging inside the drainage system and provide location information as well as other data.
- The device can also detect the presence of toxic gases like methane (CH₄) and carbon monoxide (CO).
- If the volume of gases crosses the threshold, device will send a warning message to Corporation or the Sanitation Department, instructing them to take further action.
- Wireless Sensor Network (WSN) technology was used to design and implement the setup. Each node in a WSN can hold its personal datum & data of neighbouring nodes and send it to next node using hopping techniques.
 - The gateway node will store and send the entire data packet. It's also stored in the cloud to allow for real-time data access and tracking.

4.1.6 HARDWARE REQUIREMENTS

- Arduino
- Ultrasonic sensor

- Gas sensor
- Oxymeter sensor
- Heart beat sensor
- Buzzer
- Node MCU
- IOT MODULE
- Power supply
- Exhaust Fan
- Connecting cable

4.1.7 SOFTWARE REQUIREMENTS

- Arduino IDE
- EMBEDDED C.
- Proteus simulation tool
- IOT Cloud Software.
- Protégé Application

4.2 HARDWARE DESIGN

4.2.1 ARDUINO UNO AND ITS PROGRAMMING

It's a MC that can connect to sensors and monitor more things in the real world. Arduino is a hardware computing platform that is open-source development environment to uploading program codes.

This can communicate with sensors and switches in order to create interactive objects for both complex and simple applications. The board used to connect other computer-based applications. There are both preassembled and DIY arduino boards available. The Arduino open-source IDE framework is freely available for download.

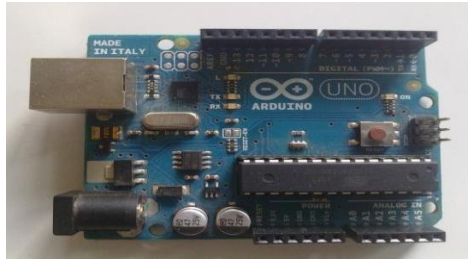


Fig 4.2.1 Arduino Uno

4.2.2 OVERVIEW

Programming and interfacing can be used to build and control external circuits and sensing elements and other manual inputs.

It can run Three lakh commands of C program /sec.

There are fourteen digital I/O pins and six analogue inputs on the Arduino frame.

Headers are provided for connecting connectors to I/O pins.

It's a condensed type of C/C++ programming language. The ability to build a programme in the Personal Computer, simply transfer file to Arduino, & have it stream involuntarily is a key feature of the Arduino.

When the reset button is pressed, all of the stored programmes are deleted.

The Uno is unique it uses a Atmega16U2 USB-to-serial adapter.

4.3 SUMMARY:

- ATmega328 microcontroller
- Voltage for operation: 5 Volt
- I/P V: 7-12 Volt (recommended)
- I/P V: 6-20 Volt (limits)
- 14 Dig. Input /Output Pins (has 6 Pulse Width Modulation output)
- Pin input 6 and 7 of the analogue input
- 40 milli Ampere DC Current per Input/Output Pin
- 50 milli Ampere DC Current for 3.3 Volt Pin
- 32 Kilo Byte (ATmega328) flash

- 2 Kilo Byte Static Random Access Memory (ATmega328)
- 16 MHz Clock Speed

4.3.1 PIN CONFIGURATION:

- The Arduino Uno works USB /external power supply.
- AC-to-DC adapter / battery can be used as external power.
- Battery into the POWER connector's Ground and Voltage in pin.
- Recommended suitable voltage: 6 to 20 volt from external supply

The following are the power pins:

- **VIN** is pin where the input voltage is connected when using an external power source (5V)
- **5 volts**: Receives 5V from regulator output. Power could be provided to the board through the DC power jack (7 - 12V), the USB connector (5V). Using the 5 Volt or 3.3 Volt pins to supply voltage passes away from the regulator and damages the board.
- **3V3**. Produces a 3.3 volt supply. Max current : 50 mA.
- **GND**
- **IOREF**. The IOREF pin voltage can pick the works in 5V or 3.3 V. This pin denotes the voltage reference on which the microcontroller works.
- **Memory**

ATmega328 board (32 KB + 0.5 KB bootloader memory) and 2 Kilo Byte of SRAM + 1 Kilo Byte of Electrically Erasable programmable read only memory.

.

Input and Output

Using the pinMode(), digitalWrite(), and digitalRead() keys, and other digital pins can be used as an input or output. They are work in 5 volts. Furthermore, certain pins have specific functions:

- **0 (RX) and 1 (TX) serial numbers (TX)**: For TTL serial data. These are wired to the ATmega8U2's corresponding pins.
- **PIN 2 and 3 - External Interrupts**: On low signal, a rising or dropping side, these pins can be used as interrupts.

- **Pins 3 ,5, 6, 9, 10, and 11 are PWM (Pulse width Modulation pins)**

With the analogue Write () feature, you can get an 8-bit PWM output.

- **SPI: SS (SS), MOSI (MOSI), MISO (MISO), 13 (MISO) (SCK).**

To interact with these pins, the SPI library is used.

- **LED: 13.** A built-in LED is connected to pin 13 by a wire. When pin is 1, the LED is On and vice versa when pin is).

The Uno has six analogue inputs A0 to A5. They measure ground to 5 volts by default, but AREF pin and analogue Reference () feature is used to adjust the upper end of their range.

- **TWI: A4 (SDA) and A5 (SCL) pins:** Used to help TWI signal exchange.

AREF PIN: The analogue inputs have a reference voltage. Used in conjunction with analogue Reference.

Reset: Set the microcontroller line to LOW to reset the microcontroller memory.

4.3.2 COMMUNICATION

I2C (TWI) and SPI contact are also provided by the ATmega328. The Wire library is included with the Arduino programme. SPI library is used for SPI communication. The Arduino IDE Help toolbar References section contains a list of programming statements.

The following are some of the order statements:

Include Servo.h>

in your sketch to inform the Arduino IDE that you want to use the Servo library. You can use the library's different functions to monitor one or more servos now that its functionality is open to you. You can use the write feature, for example, to rotate a servo to a particular location between 0 and 180 degrees. The code is as follows:

```
myServo.write(90);
```

This command brings a servo to its midpoint, or 90 degree location. Arduino sketches are very simple in structure and are relatively easy to read and understand. The Arduino software is divided into two parts: loop () and configuration (). There are functions in programming that do exactly what their names suggest: setup () configures the Arduino hardware, such as which I/O lines to use, etc.

4.4 ARDUINO SOFTWARE:

1. As shown below, open the Arduino IDE.

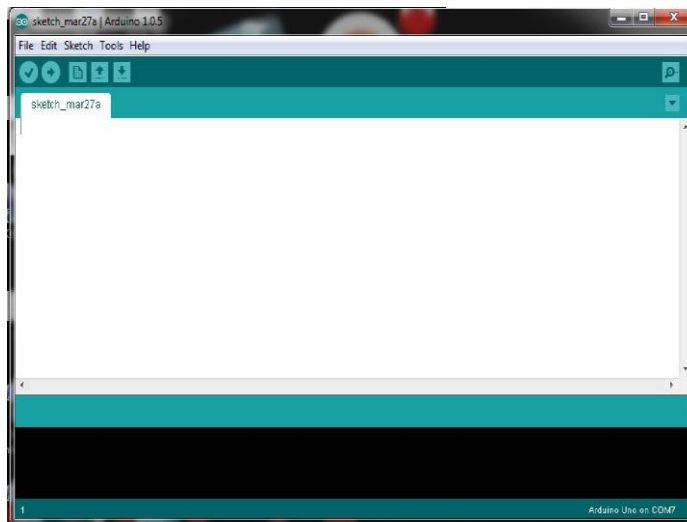


Fig 4.4 (a)Arduino IDE

2. From the tool, select the COM Port.

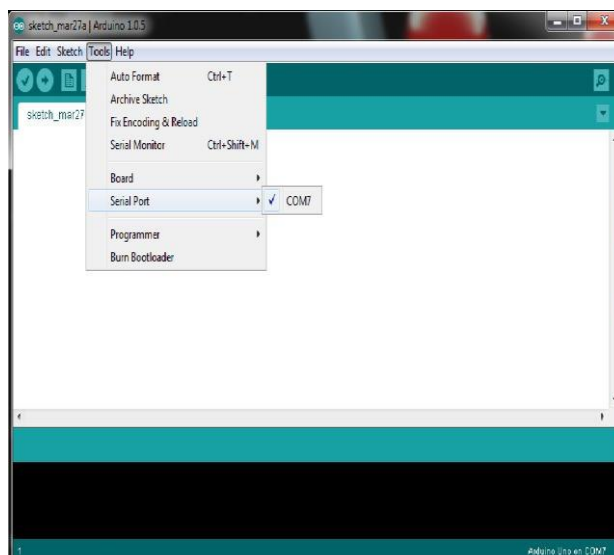


Fig 4.4 (b) Selecting the COM Port

3. As shown below, select the appropriate Arduino board from the Tools menu. Choose the appropriate Arduino surface.

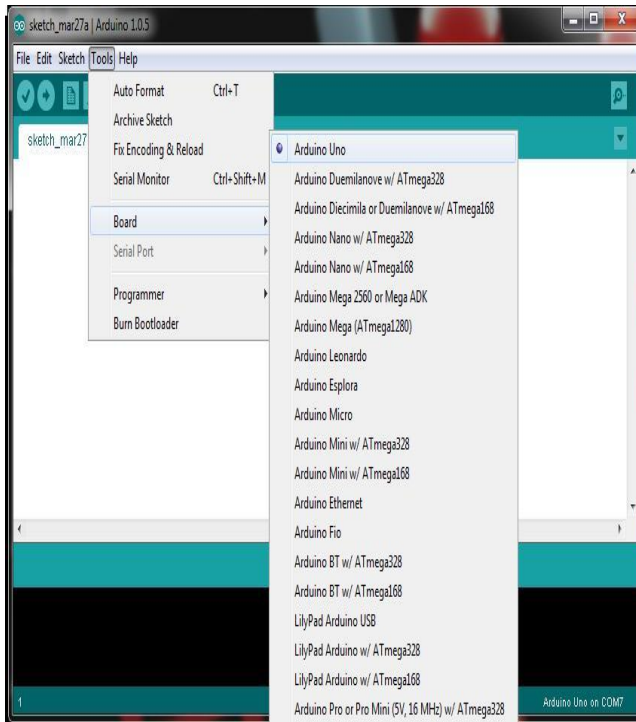


Fig 4.4 (c) Choosing the board

d) Switching to Arduino board

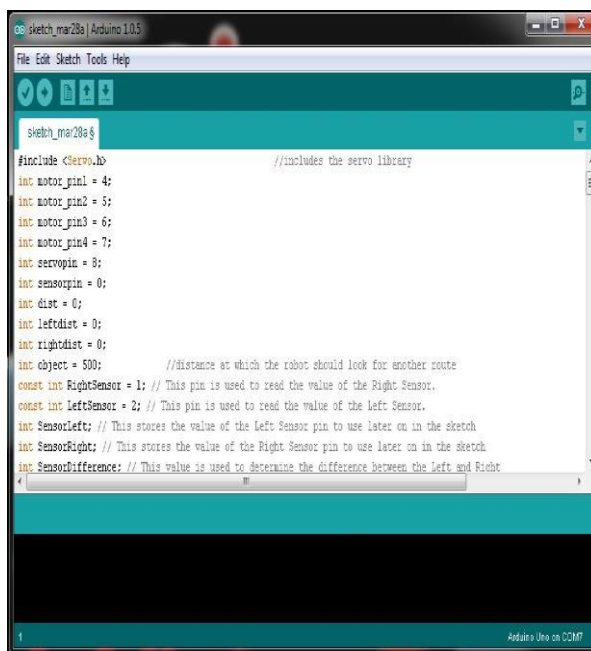


Fig 4.4 (d)) Switching to Arduino board

5. Compile the sketch and upload it to the Arduino board. uploading the sketch to the Arduino

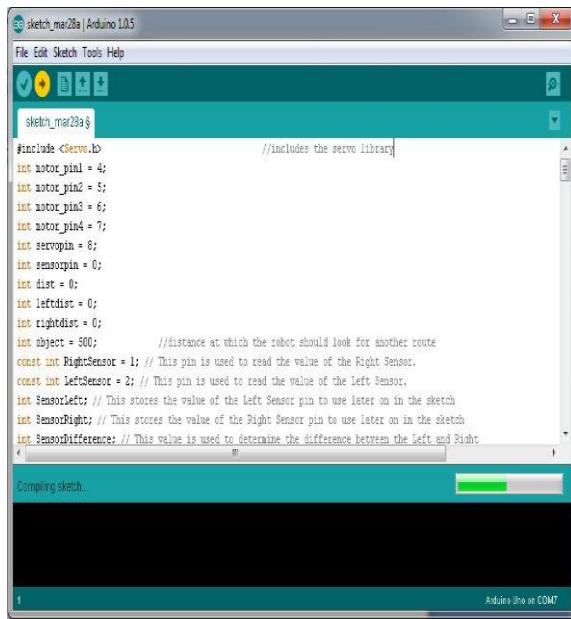


Fig 4.4 (e) Compile the sketch and upload it to the Arduino board

4.4.1 NODE MCU

NodeMCU is a firmware. It is also a development board. It uses LUA Language. It is used for IOT projects. It has a firmware that works on Espressif Systems' ESP8266 Wi-Fi SoC and hardware based on the ESP-12 board.

Programming NodeMCU ESP8266 with Arduino IDE:

NodeMCU is an open source platform. NodeMCU is a firmware. The “MCU” refers to “Micro controller unit”. The Arduino IDE will easily programme the NodeMCU Development Board.

Lua is the scripting language used by the firmware. Users must choose modules according to their design. Support for 32-bit ESP32 is added. The most popular hardware acts as a dual in-line and contains a USB, as well as the MCU and antenna.

4.4.2 BACKGROUND INFORMATION / HISTORY:

Shortly after the ESP8266 was released, NodeMCU was developed. The ESP8266 was first manufactured by Expressif Systems in 2013. Another modification was released to include an open-hardware platform. Later, MQTT client library was added to support the MQTT IoT rules with Lua to interact with the MQTT framework. Later u8glib was added allowing to drive OLED,Liquid Crystal Displays etc with ease.

NodeMCU had over 40 separate modules by the year 2016. Later, the "ESP8266 Core for the Arduino IDE" was created as a core for the WiFi module.

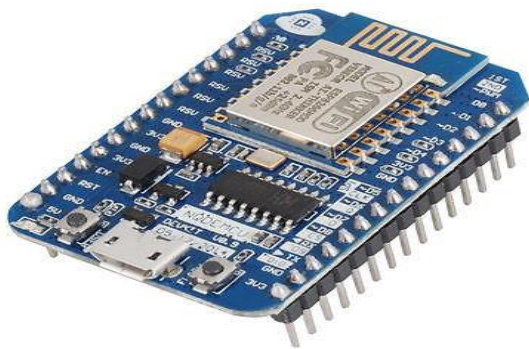


Fig 4.4.2 Node MCU

4.4.3 NODEMCU DEVELOPMENT BOARD/KIT

The ESP8266 wifi enabled chip is used in the NodeMCU Dev Kit/board. The chip is a affordable Wi-Fi chip with TCP/IP protocol. The Analog (A0) and Digital (D0-D8) pins on the NodeMCU Development Kit's board are similar to those on an Arduino. UART, SPI, I2C, and other serial communication protocols are supported.

We can link it to serial devices such as I2C powered LCD displays, MPU-6050 Gyro metre and Accelerometer, Magnetometer HMC5883, GPS modules, RTC chips, touch displays, SD cards, and a number of other external devices using these serial protocols.

4.4.4 STARTING WITH NODEMCU:

Wifi capability, analogue pins, digital pins, and serial communication protocols are all included on the NodeMCU Development board.

Knowing to code NodeMCU in kit will help us get started with working with NodeMCU for IoT applications. Custom readymade boards with the appropriate NodeMCU for specific projects are readily available.

4.4.5 PROGRAMMING FOR NODEMCU

Requirements for the IDE (Integrated Development Environment) for NodeMCU development as we continue with the setup of the ESP8266 with Node-MCU firmware.

a) NodeMCU using ESPlorer IDE

Open source , lightweight but LUA is used

b) NodeMCU using Arduino IDE

Comparitively easy to create in Arduino IDE with C/C++ Programming.

4.5 THE DIFFERENCE IN USING ESPLORER AND ARDUINO IDE

The Program is coded in C\C++ for Arduino and for NodeMCU and Lua if ESPlorer IDE is used for NodeMCU.

Generally NodeMCU is a Lua Interpreter. When Lua scripts are sended/uploaded on NodeMCU, commands/programs are executed in a sequential manner. The former takes more time than ESPlorer IDE to compile and upload/write it's complete firmware.

4.6 NODEMCU ESP8266 SPECIFICATIONS & FEATURES

- Tensilica 32-bit RISC CPU Xtensa LX106 microcontroller
- Input V: 7-12V
- Working V: 3.3V
- One UART, SPI ,I2C
- Flash: 4 MB
- Digital I/O : 16
- Analog Input: 1
- Clock Speed: 80 MHz • 64 KB SRAM • PCB Antenna
- USB (TTL)
- Lightweight module that suits neatly within your IoT projects

4.7 ULTRASONIC SENSORS

Bats are remarkable animals who are blind but have such fine vision that they can differentiate between objects even while travelling at high speeds. Its vision is clearer than ours, but not beyond our ability to seeing and comprehension. This technique in identifying objects and ranging has been made possible even by human with the advent of technology using ultrasonic sensors.

4.7.1 HISTORY:

- 4 Lazzaro Spallanzani discovered bats flew by using their ears rather than their eyes. Later discovery of sonography and Pierre Curie's work marked the start of modern ultrasound transducers. Later the first ultrasonic transducer was built, the hydrophone, to detect icebergs. During World War I, the hydrophone was used to track submarines by transmitting and receiving low frequency sound waves. In a similar vein to the SONAR, medical science began to be interested in ultrasonics. In the late 1930s to capture ultrasonic waves on film which later used to generate images of the brain to help tumour detection, and thus ultrasound imaging was born. Many scientists and researchers improved the different features of ultrasound sensors, allowing for the diagnosis of health ailments among other items. Techniques such as ultrasonic welding and nondestructive testing became common.

4.7.2 WORKING OF ULTRASONIC SENSORS:

- 4 Ultrasonic sensors are hardware instruments that measure space between the sensor and the object being detected by an electrical and mechanical energy transition as US waves. Ultrasonic waves spread through the medium as a series of compressions and rarefactions. Ultrasound refers to sound that reaches the human hearing range.

The Frequency Ranges of the Sound

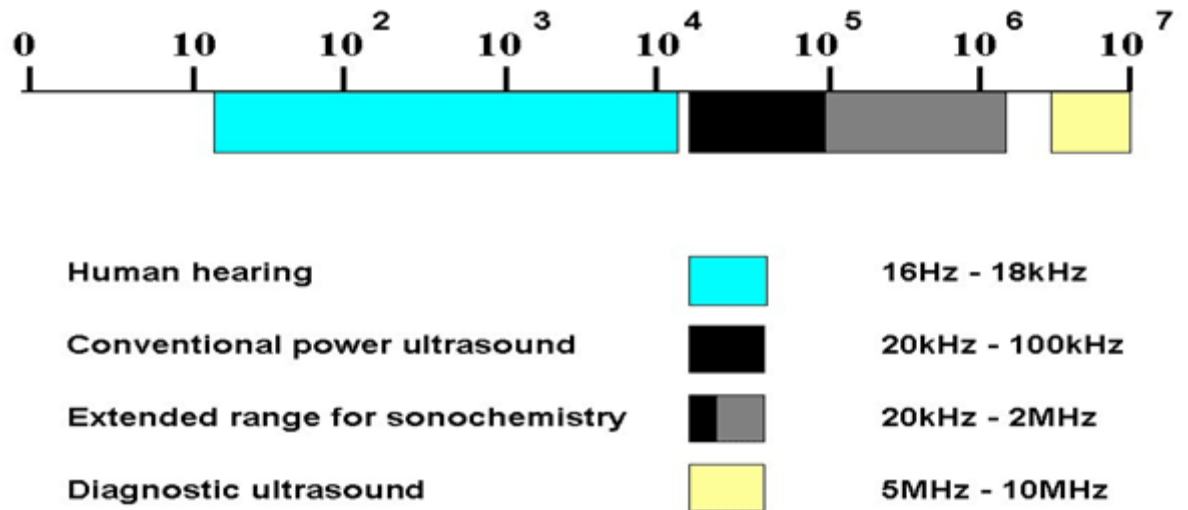


Fig 4.7.3 a) Frequency range of the sound

- 5 When ultrasonic waves reach a target object, the energy is reflected in an angle, which could be large as 180 degrees. As a result, the wave of incidence gets transmitted as echoes, which sensor senses. The distance of the object (L) can then be determined using the relationship between the US waves speed (v) and the distance to the object (L).

$$L = \frac{v t \cos \theta}{2}$$

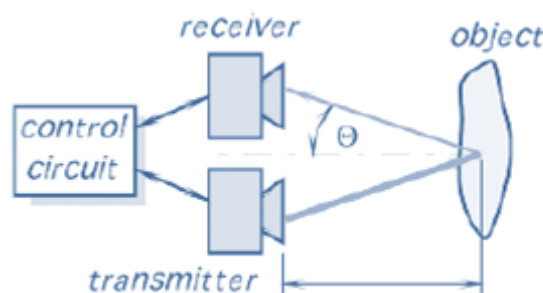


Fig 4.7.3 b) Travelling of Ultrasonic Waves

- 6 Here 't' = time it takes the wave to reflect, & 'theta' = angle. Doppler shift instruments are used while the target object is moving.

4.7.3 Generating Ultrasonic Waves

- 7 The production of waves manually necessitates the motion in a surface, such as a sheet, that causes compression and rarefaction in the medium in front of it. Ultrasonic waves have been produced using motor mode piezoelectric materials and magnetostrictive materials with different frequencies. These transducers are joined to oscillator, producing the appropriate frequency oscillation.
- 8 As waves of ultrasonic bounce the target to the ceramic, piezoelectricity, a reversible phenomenon induces electrical voltages. In pulsed mode, this allows a transducer to act as both a transmitter and a receiver. When sensors are used in manufacturing, they are typically in the form of arrays. Displays of various forms are used to visualize the performance of an ultrasonic sensor, with the form varying depending of transducer and purpose it serves. Manual sensor arrays and curvature sensors and phased electronic arrays generate a sectorized part of View, while line sensor arrays produce a linear field.
- 9 The signals from the vertical and horizontal movement of the transducer are tracked while the target is set in a particular medium to parameterize these sensors (water in general). The sensor becomes more alert as the beam pattern narrows. The angle between the transducer and the floor, on the other hand, grows as the beam diameter grows. The following beam patterns have been observed:

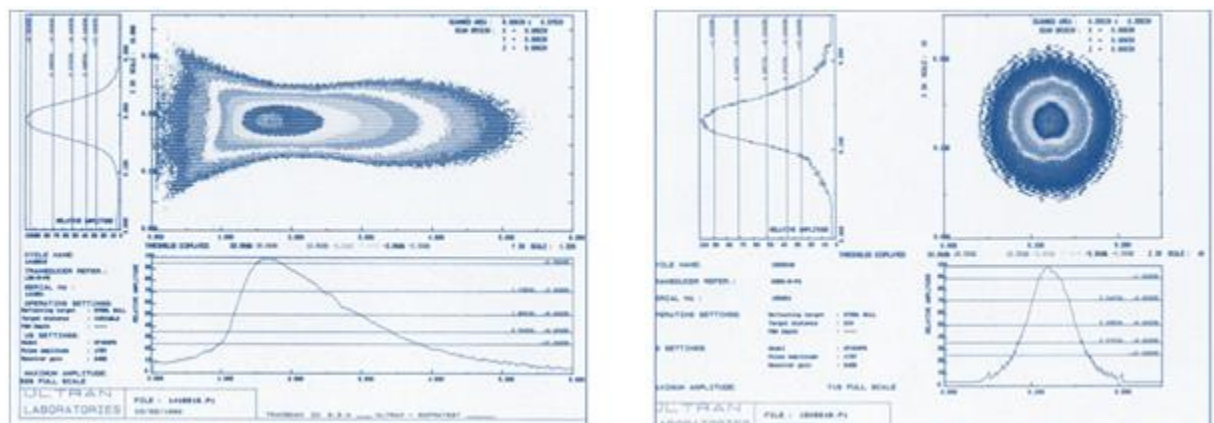


Fig 4.7.4 Generating Ultrasonic Waves

- 10 The parameters of an ultrasonic sensor, such as axial lateral resolution, grayscale, and such as Peak Frequency, Nominal Frequency, and Pulse duration, are all used to evaluate its accuracy. Sensitivity, Bandwidth Center Frequency, and Signal to Noise Ratio are all factors to consider (SNR).

4.7.4 IMPORTANCE OF ULTRASONIC SENSORS

- 11 Devices based on electromagnetic waves are too fast. Since ultrasonic waves travel at a slower rate than electromagnetic waves, they take much longer to calculate. As a result, ultrasonic measurements are easier and less costly. This would operate in areas where EM waves would not.
- 12 Ultrasonic instruments, which are focused on sound amplification, will be unaffected. These sensors often work well in wet conditions where the presence of water droplets induces refraction of optical beams. Ultrasonic rangefinders outperform IR rangefinders in terms of range and precision.

4.7.5 PROBLEMS & CONCERNS

- 13 Ultrasonic sensors are not without defects. If the temperature of a medium rises, so does the speed of sound in that medium. As a result, even though the target remains unchanged, it will appear that it has moved near to sensing element. Air can sometimes disrupt the wave's path, resulting in an incorrect measurement. High-pitched noises caused by whistling or hissing, operating near to the sensor's frequency, can reduce sensor performance or accuracy. The sensor's output is also influenced by electrical noise. There is also a 'dead zone' in ultrasonic systems where the sensor makes inaccurate readings. Since the transducer is not at rest at short distances, it is unable to distinguish between vibration caused by incident radiation and oscillation caused by electrical excitation. Due to the heat generated by high-intensity ultrasonic waves, human tissues will rupture.

CHAPTER 5

5 APPLICATIONS:

- 14 Ultrasonic sensors have been the subject of study, especially in medical imaging, where they are known as ultrasound. Acoustic shadowing and Acoustic Enhancement, two ultrasonic sensor artefacts, are being used to classify tissues, allowing for the separation between solid and cystic tissues. Ultrasonic sensors have also benefited industry in applications such as plastic welding, jewellery cleaning, remote sensing and telemetry, assisted parking systems, and so on. Ultrasonic rangefinders have long been a popular tool in robotics.

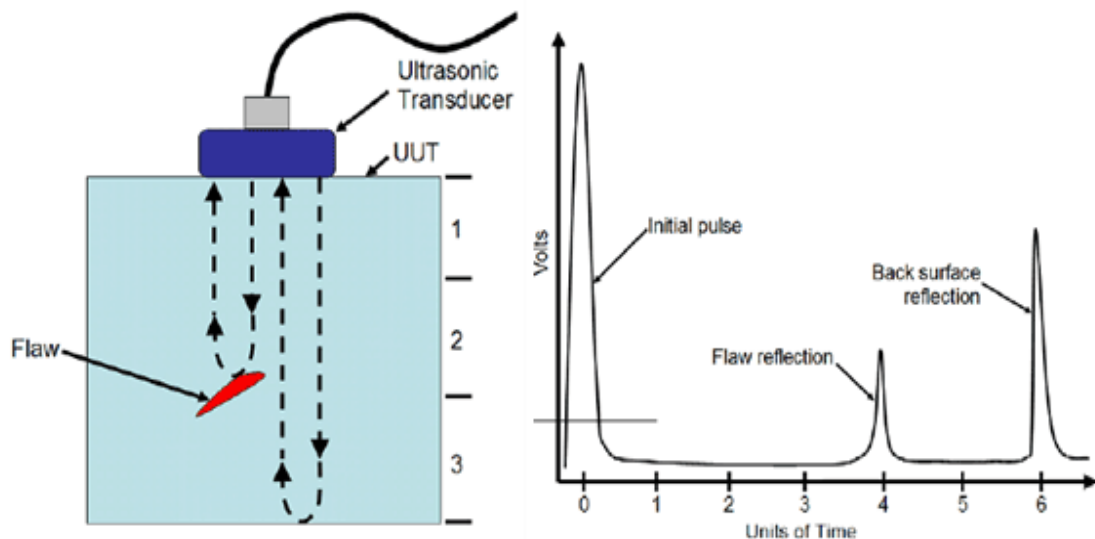


Fig 4.7.6 flaw Detection using Ultrasonic Sensor

- 5 Ultrasonic systems are supposed to provide an alternative to existing technologies that remove the effects of being subjected to EM-radiation when being scanned. These instruments use non-invasive methods to diagnose problems in a wide range of materials, including non-living and living tissues and materials.

5.1 HEARTBEAT SENSOR

- 6 Heartbeat is the sound of the heart valves contracting and expanding as blood flows from one chamber to the next. Heart beat count in a minute is known as the heart rate (BPM). Pulse is the heartbeat detected at every artery near skin.

5.1.1 Two Ways to Measure a Heartbeat

- 6 Manual Method: Pulse can be felt at the neck and the wrist. It is called the carotid and the radial pulse respectively.
- 7 Sensor method: Using sensors like heart beat sensor to measure heartbeat.

5.1.2 Principle of Heartbeat Sensor

- 8 The photo phlethysmography theory underpins the heartbeat sensor. It tests the shift of blood flow in an organ which results in a varying in the light. The heart pulses determines the blood thickness./

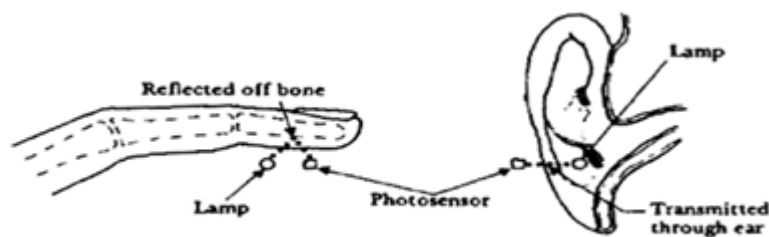


Fig 5.1.2 Principle of Heartbeat Sensor

5.1.3. Working of a Heartbeat Sensor

- 9 A photodetector and an LED make up the most simple heartbeat sensor. If skin comes in contact with light, it absorbs (in the case of hand skin) or transmits (earlobe). The blood absorbs light, while photodetector receives the emitted/reflected light. Blood flow of the sensed tissue determines how much light is absorbed. The output of the photodetector generates electrical signals that are proportional to the cardio rate.
- 10 The AC part of the wave that is superimposed on the DC signal and is synchronized with the artery pulses. As a result, the most important need is to isolate the AC portion.

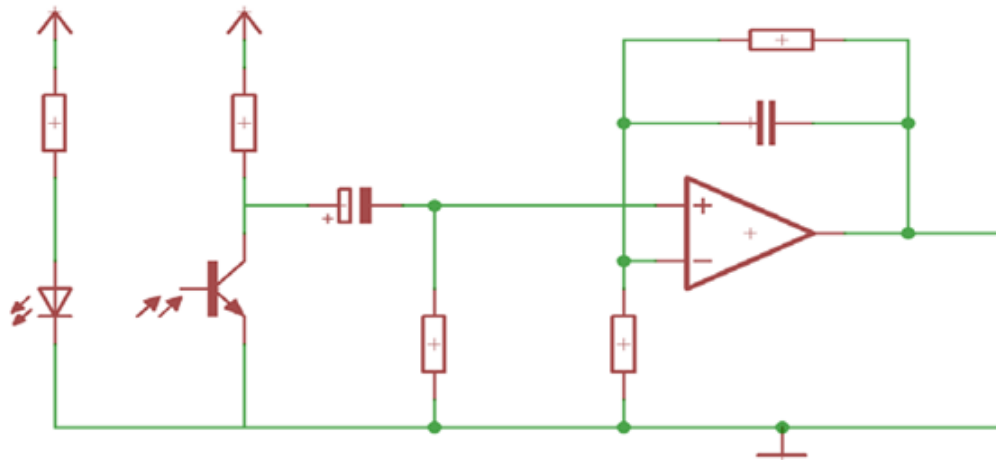


fig 5.1.3 Working of a Heartbeat Sensor

- 11 The output is passed through a two-level HPLP filter circuit, and changed to digital pulses using comparator or a simple Analog to Digital Comparator to obtain the AC signal. The heart beat rate is calculated using digital pulses fed into a microcontroller.
- 12 $BPM = 60 \text{ multiplied with } f$.
- 13 The pulse frequency is denoted by "f".

5.1.4.PRACTICAL HEARTBEAT SENSOR

- 4 A few examples Heartbeat in real life Sensor: PC-314 . It's made up of an infrared led and a light-dependent resistor (LDR) attached to a clip. The detector part of the clip is in contact with the skin and is connected to the organ (earlobe or finger).



Fig 5.1.4 Heartbeat Sensor

- 5 Another example is the TCRT1000, which has four pins.
- 6 Pin1: To supply the LED with power.
- 7 Pins 2 and 3 of the 7-pin connector are both grounded. The output is pin 4. Pin 1 is the enable pin, and activates the LED thus activating the sensor.

APPLICATION DEVELOPING YOUR OWN HEARTBEAT SENSOR SYSTEM:

- 8 A simple Heartbeat Sensor can be constructed using comparator IC LM358, an LDR, and a Microcontroller.
- 9 As light is shone on the tissue of the finger or earlobe, it is modulated and then transmitted, with a portion of the light being absorbed by the blood and the remainder being transmitted. The photodetector receives this modulated light.
- 10 The LDR is used as photodetector or photodiode. It operates as when light shines on a resistor, R changes. The resistance decreases inversely to the light intensity. As a consequence, the voltage drop around the resistor falls.
- 11 The output voltage from the LDR is compared to the threshold voltage, which is the voltage drop in the LDR. The comparator LM358's inverting terminal is connected to the potential divider setup, whereas other terminal is connected to the LDR.
- 12 When light is focused on human tissue, the intensity of the light is decreased. The resistance increases as the decreased light on the LDR, and the voltage drop increases. Signal bit 1 is produced at the comparator due to voltage drop in LDR and a signal bit 0 is generated when the voltage drop is less. These signals can be processed using a microcontroller and hence the heart rate can be measured.

5.2 GAS SENSORS

It's critical to keep track of the gases emitted in a given setup or device. Both home electrical and electronic equipment, such as ACs, refrigerators, and industrial protection setups, produce highly toxic gases, which must be monitored and detected using gas sensors. Gas sensors respond immediately to the presence of a gas, keeping the device aware of any changes in gas concentrations. When a gas is detected, it gets ionised before being adsorbed into the sensor. This produces a potential difference which refers to the difference in gas concentrations before and after sensing.

METHANE SENSOR:

A sensing element is present in the steel exoskeleton of the methane gas sensor module. By connecting leads, it is exposed to current (also known as heating current). Gases that come into contact with the sensing element become ionised and are adsorbed by it. This alters the resistance of the sensing element and hence the current flowing through it.

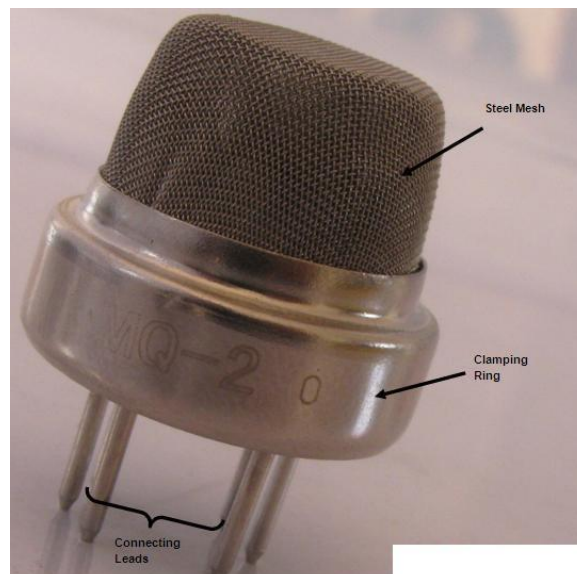


Fig 5.2.1 methane sensor

A steel mesh sheath, copper clamp, and connecting leads make this basic gas sensor module. The following are taken care of by the steel mesh:

- ✓ Protects the internal components of the sensor
- ✓ Protects the sensor from overheating and high gas pressure.

There are two layers to the steel mesh. A Cu-plated clamp fixes the sensor mesh. Connecting leads are thick for a secure connection, and enough heat is spread to the inside portion. Connecting leads are made of copper with tin coating on top. Four out of the six leads fetches signals, while the other two (1, 2) are used to heat the sensing portion.

A Bakelite base supports the sticks. The sensor's connecting leads have a tight grip on the foundation, which serves as an insulator. Sensing feature and link wiring make up the sensor's internal components.

The aluminium oxide ceramic hollow sensing element has a tin oxide coating. Tin oxide serves as a sensing coating because it is sensitive to adsorbing desired gas components, and the ceramic substrate improves the heating efficiency.

An conductive alloy Nickel-Chromium connects the leads responsible for heating the sensing portion. Platinum wires are used to connect the output signal leads, which transmit slight current variations in the sensor. Also Nickel-Chromium wires are connected in its hollow zone. The NiCr wires are spring-shaped and placed inside the element.

Each sensor must operate at a certain temperature in order for gas molecules to be ionised and adsorbed by tin oxide. The ceramic of the sensor gets heated by electricity flowing through NiCr wire. The element radiates heat in the vicinity, where gases interact with it and become ionised. Adsorbed molecules modify the tin dioxide layer's resistance. Changes in current flow are communicated to the heart, which regulates the operation of the gas sensor, through the output leads.

5.2.1 CO GAS SENSOR



Figure 5.2.2 CO Gas sensor

A carbon monoxide sensor senses CO gas to avoid carbon monoxide poisoning. Later, a single-station CO detector with a sound system was known as a carbon monoxide (CO) alarm.

CO is a colourless, odourless, and tasteless gas produced when carbon-containing materials are incompletely burned. Since it is nearly undetectable by humans, it is known as the "silent killer." Also low concentrations of CO can be harmful over time, while higher levels with shorter time can cause damage.

In the worst-case scenario, some CO sensors would sound an alarm, allowing people enough time to safely ventilate or evacuate the area. Some sensor and computerised systems can also warn emergency services to be dispatched.

CO sensors and smoke detectors are not interchangeable. Open flames, water and space heaters, blocked chimneys, car crashes, or grill fires inside a garage in residential areas are all popular causes of CO.

Since carbon monoxide has about the same density as air, CO detectors can be mounted in ceilings and floors. However, the manufacturer's directions for installation and mounting height should be followed.

CO has a 200-fold higher affinity for haemoglobin in the bloodstream than oxygen, causing oxygen depletion in the bloodstream.

5.3.1. IT BACKGROUND

The internet's primary aim is to provide a platform for instant obtaining of info about real world and other artifacts, like e-health, home security, warehouse management, and so on. To fully realize the web's future potential, a plan is needed. The Internet of Things (IoT) is one such vision through a layered architecture that connects real world and electronic gadgets for data acquisition.

The expression "Internet of Things" incorporates the phrases "internet" and "things." The term "internet" refers to a global network infrastructure that is scalable, configurable, interoperable, and based on standard communication protocols. Things are tangible or virtual objects with identities, physical resources, and virtual personalities, as well as intelligent interfaces. Sensor nodes, for example. Things that can provide information from the physical/virtual world through the Internet are referred to as IoT. There are three layers of every IoT programme: the hardware or physical layer, the application layer, and the middleware. Middleware serves as a connection between the hardware and application layers.

5.3.2 MOTIVATION

Since an IoT system can be used in a variety of settings, it must be able to access and handle a large number of heterogeneous devices or nodes. A major challenge in designing an IoT-based system is how to make the interface with many devices as easy as possible for inexperienced users. A middleware layer b/w systems is used as novice users may mitigate this concern. It is useful for shielding the complexities

of the gadgets used by providing end users with clear access to the devices.

5.3.3 DEFINITION

The Internet of Things (IoT) has recently gained traction in a variety of industries. IoT can incorporate physical devices into information networks in any industry or society. IoT can have a personal as well as a professional effect. Smart homes and office automation, home security, e-health, and assisted living are all influenced by IoT from the perspective of private users. Industrial automation, business process management, industrial manufacturing, logistics, and smart transportation will all be affected from a business viewpoint.

IOT means to the broader infrastructure that supports these information networks, which includes both software and hardware..We can use recognition technologies like RFID to identify devices.

IOT is “A global infrastructure for the Information Society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies”

Edge Technology layer

Embedded modules, sensor networks, and other hardware components make up the Edge Technology Layer nodes and RFID tags and several other devices. This can perform functions, like collecting and processing information from an environment.

Access Gateway layer

The data handling is the responsibility of the Access Gateway layer. This layer is in charge of publishing and subscribing to the relevant services offered by Things, as well as information routing and communication between platforms.

Middleware layer

Consolidating and filtering data obtained from hardware devices and nodes, processing information discovery, and providing access control to devices for applications are all essential functions of the Middleware layer.

Application layer

For processing different application services via middleware to various practical uses and end users.

5.3.4 UBIDOTS :

Ubidots is an IOT Platform that provides IOT Services for IOT Projects. It is used to transmit data to cloud from devices through internet. It has features like configuring alerts systems according the received real time data from internet enabled devices. It also has tools to modify and represent data according to our needs. It allows us to read and write data and provides detected values, in graphical ourtput and other insights. The data is also encrypted and thus secure transmission is possible. The Ubidots app as well as the website platform can enable us even to identify the location of the devices.

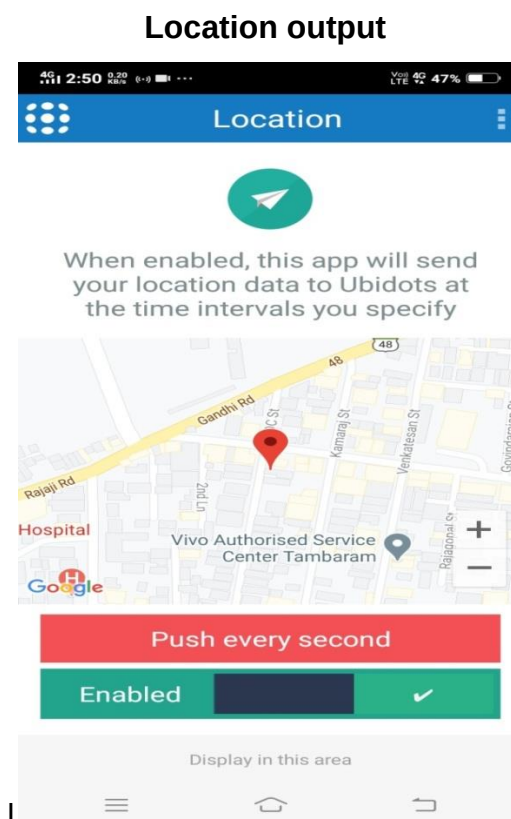


Figure 5.3.4 Location Output

5.4 ONTOLOGY:

- 4 Ontology is the concept in a subject area that shows the relations and properties between them. It shows how entities and objects are grouped and related. The entities can be grouped according to similarities or interrealations

or according to differences.

- 5 An ontology can be used to visualize theories like: monism, pluralism, idealism , dualism etc.

5.4.1 USES OF AN ONTOLOGICAL APPROCH:

- 6 These frameworks can represent , share and reuse knowledge across a the domain under study.
- 7 The describe relationships and interconnectedness between entities.
- 8 They are used as bases for modeling high-quality, linked and coherent data.

5.4.2 SOFTWARE REQUIREMENTS:

- Protégé Software
- Builtin or downloadable Visualization plugins.

5.4.3 ONTOLOGICAL APPROACH IN SEWAGE MONITORING:

- The Sewage monitoring and health monitoring of sanitation workers ontology flowchart depicts the technologies used in the proposed system.
- On a large scale implementation, for example, if city or an urban area is taken into consideration, there are widespread sewers, manholes and sewage treatment facility including sewer holes in residential areas, commercial areas, public lavatories.
- The ontological flowchart can be used to visualize the entire propped sytem on a large area when implemented practically.

5.4.4 VISUALIZATION USING PROTÉGÉ SOFTWARE:

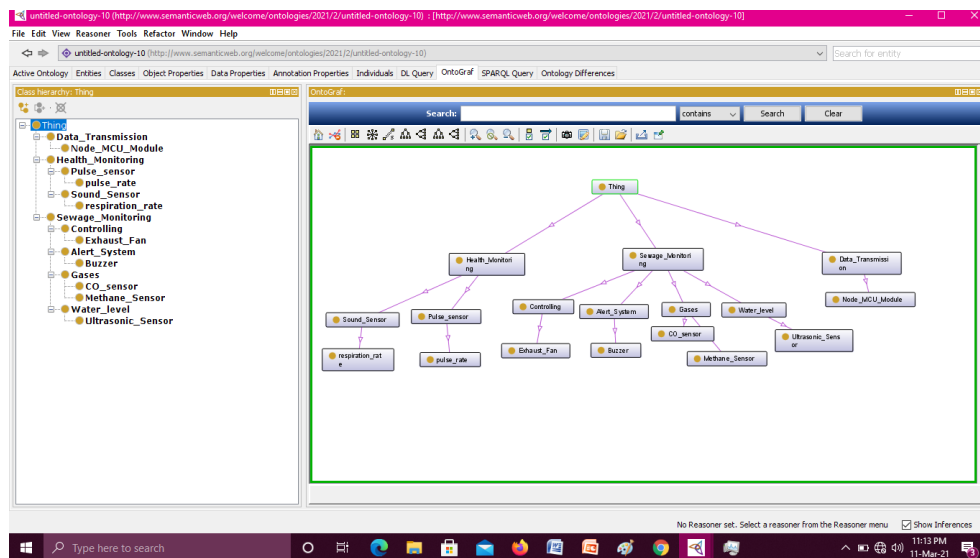


Fig 5.4.4 VISUALIZATION USING PROTÉGÉ SOFTWARE

6.RESULT AND CONCLUSION

6.1 EXPERIMENTAL SETUP

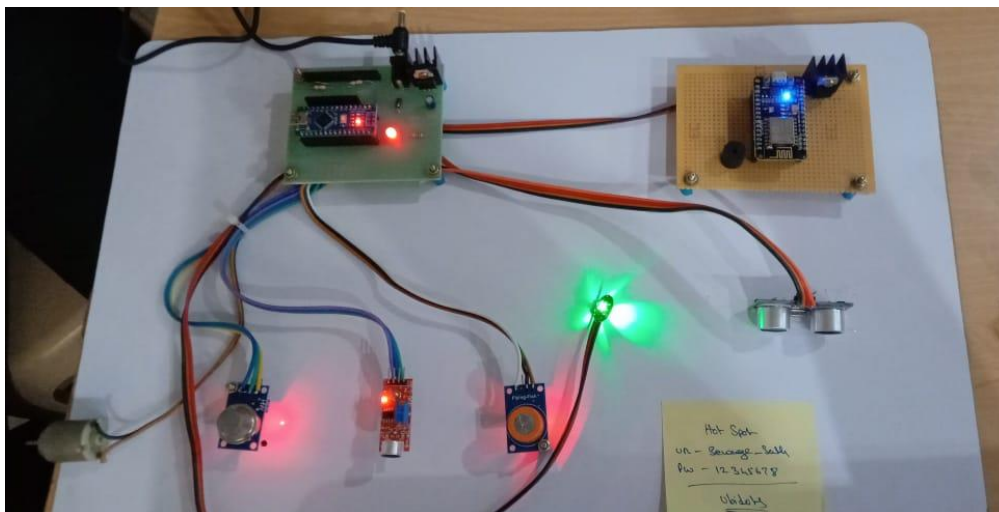


Fig 6.1 Sensor Readings as observed in the IOT Paltform Ubidots:

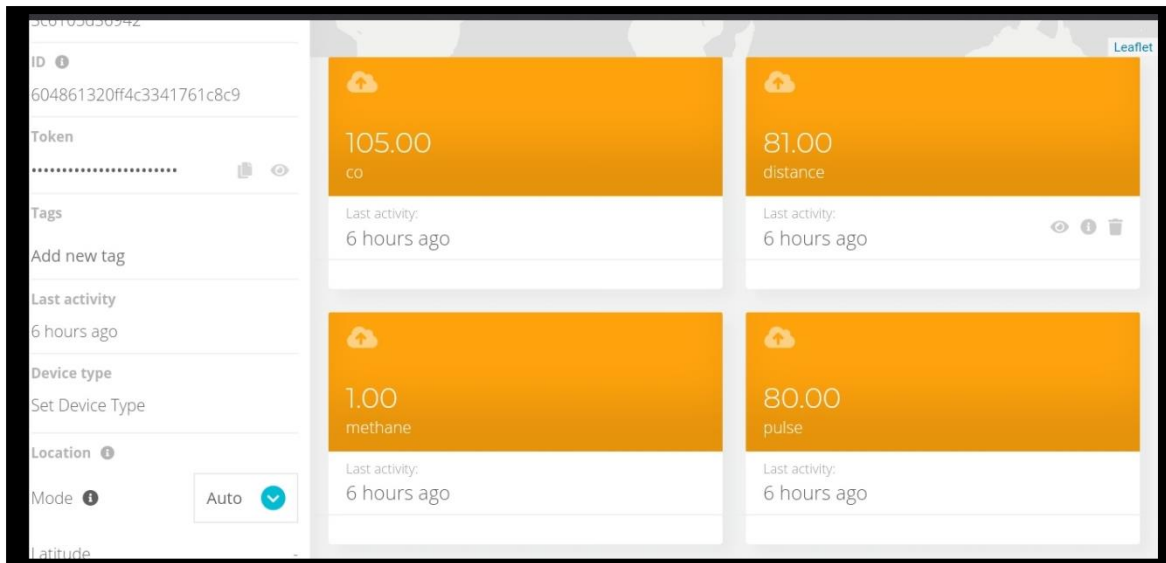


Fig 6.2 Sensor Readings as observed in the IOT Paltform Ubidots Set-1

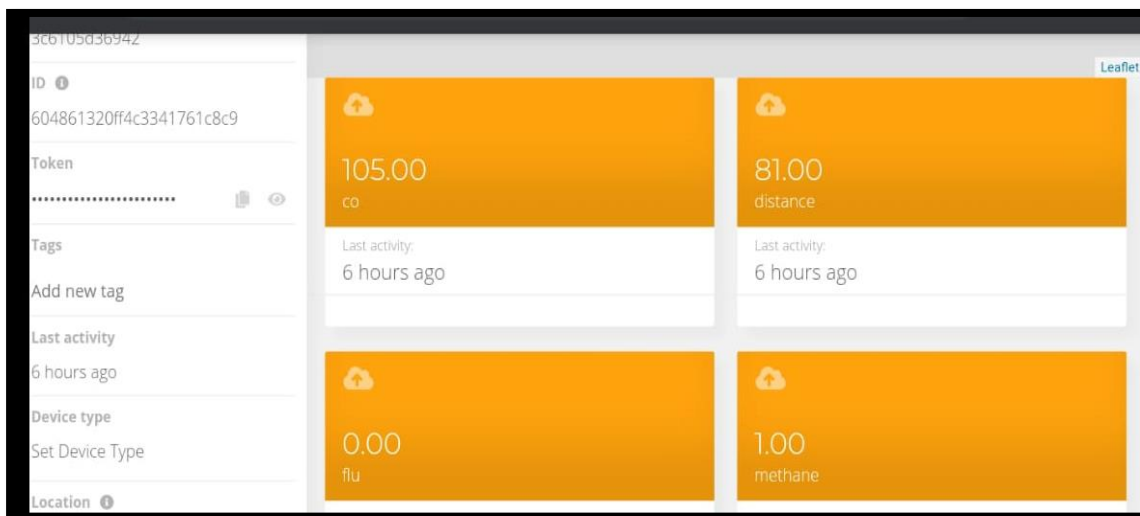


Fig 6.3 Sensor Readings as observed in the IOT Paltform Ubidots Set -2

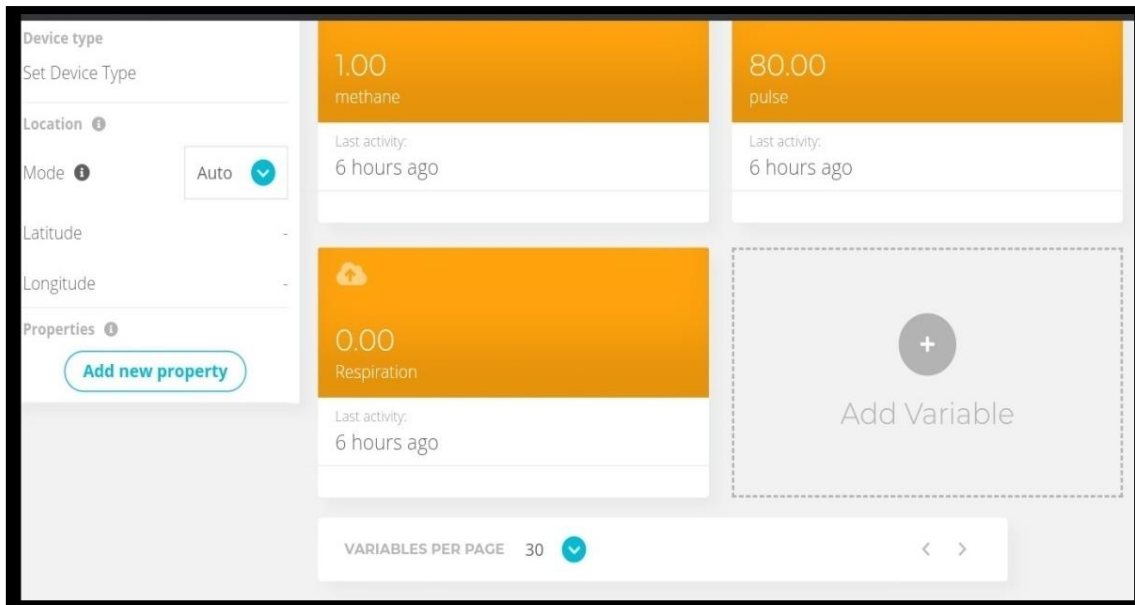


Fig 6.4 Sensor Readings as observed in the IOT Paltform Ubidots Set -3

GRAPHICAL OUTPUT :



Fig 6.5 GRAPHICAL OUTPUT Set -1



Fig 6.6 GRAPHICAL OUTPUT Set -2

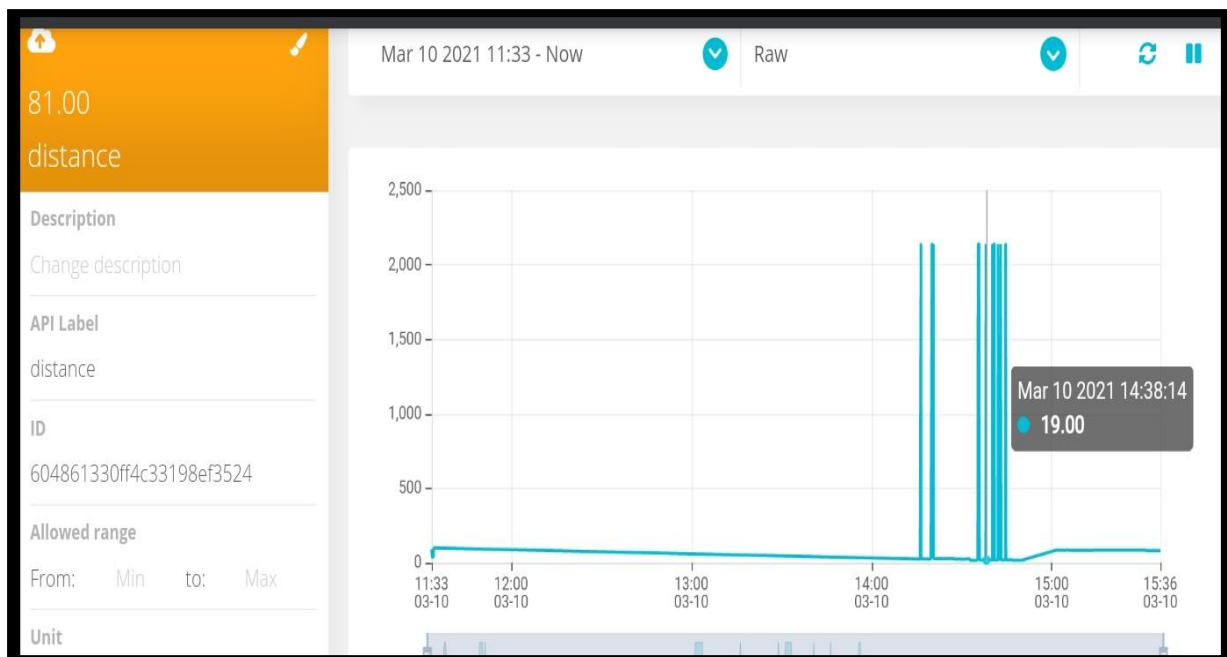


Fig 6.7 GRAPHICAL OUTPUT Set - 3

E-MAIL ALERT SYSTEM :

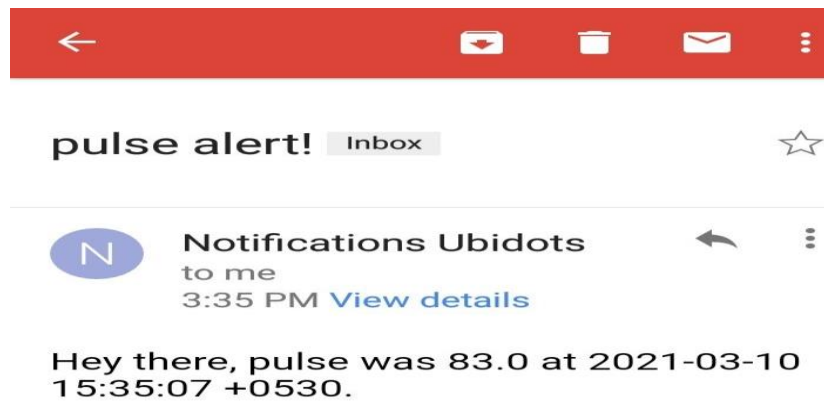


Fig 6.8 E-Mail Alert System

CHAPTER 6

6.RESULT AND CONCLUSION

Over flow of sewage on roads due to blockage in sewer that result in flooding of roads been a major problem in many developed,developing and under developed cities as well.

Complaints to the Sanitation department are often not properly answered or taken into account. A precautionary system is proposed where this concern of sewage overflow as well the death of the Human Scavenger dealing with the overflow can be prevented

The system design comprises of a sensors to sense the level as well the concentration of the sewer gases, to send a command a controller is used, a network of communication to transmit the real time data & to send timely alerts on the complaints on blockage or any issues regarding the health of the Human scavenger. An IOT webserver is maintained to view and record the data. The system continuously monitors all the parameters, and generates alarm signals if necessary via email alerting service to the authorities.

6.1 CONCLUSION AND FUTURE WORK

Underground Sewage monitoring is challenging problem.The health monitoring of Human scavengers is the need of the hour and it has been ignored for most of the previous decades. Different methods for controlling and maintaining the underground drainage system are proposed in this project as well the health monitoring of the Sanitation worker.

It demonstrates various applications in real time, such as underground drainage and manhole detection. Various variables like concentration of fatal gases, water level, location of the sewer, heartbeat and the respiratory rate of the human scavenger are monitored using Internet of Things. IoT allows for remote control and notifications on theUBIDOTS platform.

As a consequence, the person in charge and the authorities are able to take the

necessary actions and unnecessary trips to the manhole location are saved and can only be conducted if necessary.

The IOT platform's real-time alerts via the internet assist in preserving drainage checkup regularity, thus preventing fatal accidents and hazards.

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