SEWAGE MONITORING SYSTEM

A Project Report Submitted

in Partial Fulfilment of the Requirements

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Bachelor of Technology

in

COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

by

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to

DEPARTEMENT OF COMPUTER SCIENCE

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DECLARATION

I, **Gondu Shivakrishna** (**Roll No: 2017BCS0021**), hereby declare that, this report entitled **"Sewage Monitoring System"** submitted to Indian Institute of Information Technology Kottayam towards partial requirement of **Bachelor of Technology** in **Computer Science And Engineering Department** is an original work carried out by me under the supervision of **Dr. S.Kala** and has not formed the basis for the award of any degree or diploma, in this or any other institution or university. I have sincerely tried to uphold the academic ethics and honesty. Whenever an external information or statement or result is used then, that have been duly acknowledged and cited.

Kottayam-686635 **Gondu Shivakrishna**

November 2020 **(2017BCS0021)**

CERTIFICATE

This is to certify that the work contained in this project report entitled **"Sewage Monitoring System"** submitted by **Gondu Shivakrishna** (**Roll No: 2017BCS0021**) to Indian Institute of Information Technology Kottayam towards partial requirement of **Bachelor of Technology** in **Computer Science And Engineering Department** has been carried out by Gondu Shivakrishna under my supervision and that it has not been submitted elsewhere for the award of any degree.

Kottayam-686635 (Dr. S.Kala)

November 2020 Project Supervisor

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I would like to express my special appreciation and thanks to my guide Dr. S.Kala, you have been a tremendous mentor for me. I would like to thank you for encouraging my research and for helping me in this project. Your advice on this project and research have been invaluable.

ABSTRACT

This project is based on a Sewage Monitoring System essentially means a system that is used to maintain the sewage properly and efficiently using Internet of things. Sewage system monitoring plays an important role to keep city clean. But, it is very difficult to monitor all the area manually where a human cannot reach. Improper maintenance results in the blockage of underground pipes, overflow of water and contamination of pure water resulting in the spread of infectious diseases. So, we propose a system which will keep a track of the water level and also it will sense the raise in amount of various gases which are harmful for human beings.

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Chapter 1

Introduction

Sewage monitoring plays a vital role in keeping our surroundings clean and hygiene. But, it is highly impossible to keep track of entire drain area where a human cannot reach. If drains are not maintained properly, it results in the overflow of sewage ultimately resulting in spread of various contagious diseases.Cleaning a sewer manually is the most difficult and riskiest job, but many scavengers are forced to get employed in this field just for feeding their family. Sewage cleaning used to be performed manually by entering workers into the drains till 2013. Supreme Court of India in 2013 gave an order that all such functions are to be performed by machines or with proper equipment to reduce the problems that occur due to manual scavenging. Recent official government statistics show that one manual scavenger has died every five days since the beginning of 2017 while cleaning sewers. This is due to the inhalation of harmful methane present in drains. If proper monitoring is not done, it might result into blockages of the underground sewage pipes and pollution of drinking water. All these problems have forced for the develop-

ment of a system which checks various factors like level of poisonous gases, sewage overflow and blockages in the pipes. For this purpose, wireless sensor networks and wireless protocols are made use of. Being remotely deployed and battery powered, energy minimisation is to be made of for maximising the network lifetime. So, a clear comparison of energy consumption between various topologies is needed to find out the better one for the deployment of various sensor nodes. On a whole, this project deals with the real-time sewage monitoring system with enhanced lifetime which communicates with the nearby municipal control office regarding the conditions inside the drain. Also WSN systems have more precision than wired networks in terms of cost and flexibility.

1.1 Objective of the Project

The main aim of this project is to provide central control system (municipal office) with the real time data about the conditions of the sewage and help keeping underground drainage monitored regularly. It includes sending data about the overflow of the drains, giving alert when the amount of poisonous gases in the sewers crosses the threshold value and giving information about the blockages in the underground pipes. Various approaches are used for collection and sending of data. Here, Wireless Sensor Networks are used. Also to Replace the manual work of drainage monitoring by modern technology to save manpower and time. The system should be capable of getting prior information of the blockage and location of blockage using IOT. Also if blockage occurs providing with vital information like level of poisonous gases,

depth of sewer etc.is important which can help workers taking safety measures. Collecting database using sensors and predicting the drainage clogging in particular spots for future action. Also our design should be cost effective, easy maintenance, fast deployment, long life-time and efficient.

1.2 Technical Concepts

1.2.1 Wireless Sensor Networks (WSNs)

Network of spatially dispersed and deployed sensors that monitor and collect information about various physical parameters of the environment is called a Wireless Sensor Network. They include data regarding humidity, temperature, sound, pollution levels etc. WSN is also responsible for processing the data and transmission of that data to the central location. WSN consists of several nodes each of which are connected to sensors and an access point. There are radio transceivers attached to nodes that provide communication. Applications of Wireless Sensor Networks include environmental sensing, physical sensing, monitoring of volcanic and mining areas, detection of poisonous gases, automated drip irrigation and pulse oximetry.

1.2.2 Sensor Node

A sensor node in Wireless Sensor Network performs processing, collects information from various sensors and communicates with other nodes located in the network. Its components include controller, memory, transceiver, power supply and some sensors as per the requirement of the application.

1.2.3 Wireless Protocols

There are various Wireless protocols. Few of them are Wi-fi, Bluetooth, Zigbee and RF. Wi-fi is a wireless protocol which allows to access the internet. It refers to IEEE 802.11 communication standard. It forms a Local Area Network (LAN). Development of its embedded system is cheaper and this protocol is secure. But, it has a drawback of low network range and high power consumption. Bluetooth is an open standard which develops a Personal Area Network (PAN). It supports IEEE 802.15.4 standard and functions at 2.4GHz frequency range. It is cheap and easy to install. But, it works only for short ranges typically less than 10 meters

1.2.4 Firebase

Firebase is an application by google that helps in analyzing the real time data. Firebase uses backend as a service. It stores its data on cloud and hence does not face any problem with storage. Data is stored as JSON and synchronization is done from time to time for every user. It mainly develops the backend features like storing of data, user authentication and hosting. Firebase is user friendly and can be configured easily. It can be accessed from the client side securely thereby increasing the scope of development. Users accessing this database can receive the updates real time data on their devices. Even if the user is offline, the data is stored in the database and user can view it when online.

1.3 Methodology

The methodology followed to develop our model is defined in the flow chart given below:

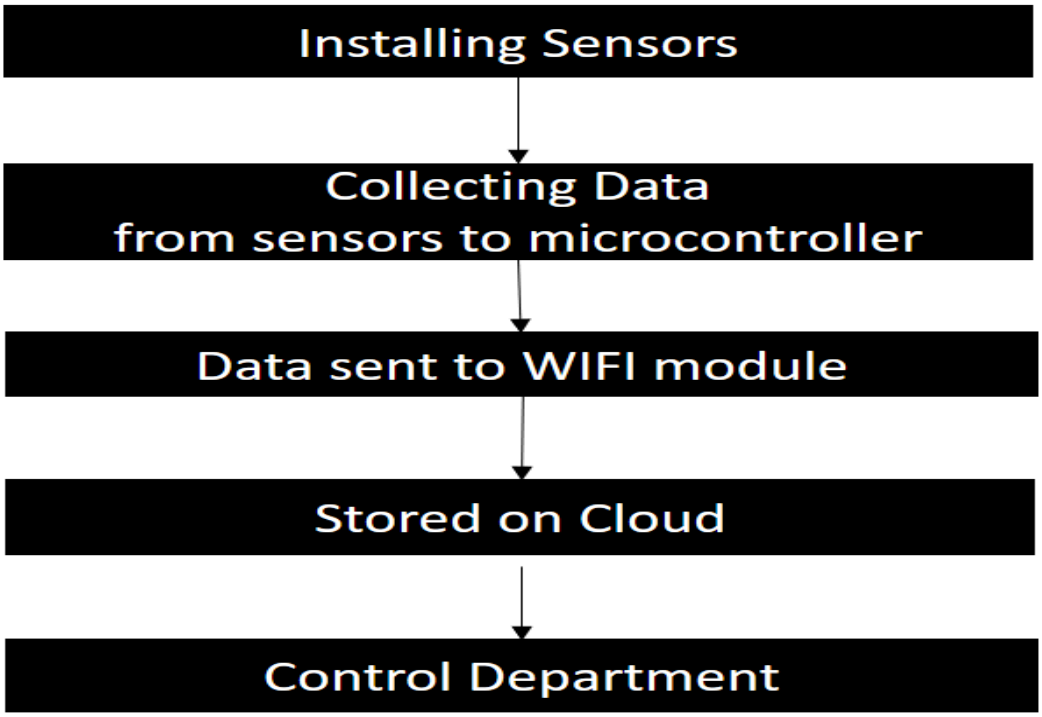

Figure 1.1: Flow diagram of Sewage Monitoring System

Chapter 2

Literature Survey

A sewage quality monitoring system based on wireless sensor network using Xibee [1]":- In this paper, Geng Chang proposed a sewer monitoring system that using Xibee as an communication module.

"Develops technology that can control sewage monitoring [2]":- In this Fujitsu have developed a Technology for Low-Cost Identification of Potential Sewer System Overflows by making a distinguishing structure to recognize social establishment possibility. He has made development that utilizes ICT for insignificant exertion revelation of early science sewer system in order to direct hurt in metropolitan regions starting from weighty storms, for model, Japan. They have arranged sewer vents in which sensors can measures water levels to exactly distinguish early signs of flood. This advancement can moreover choose the territory and number of sewer vents where sensors are presented, considering an examination of the time required for water to pour out of upstream lines to downstream territory according to land geography and the shape and length of sewer pipes, which makes it possible to follow

and predict the flood through a sewer structure using only a solitary fifth a similar number of sensors. This advancement decreased force usage by generally 70

"Smart real-time drainage monitoring system using iot [4]":- In paper presented the Smart water observing framework utilizing remote sensor. The framework comprises of a reasonable detecting unit that recognizes and controls the home electrical apparatuses utilized for every day exercises by following very surprising rates.

"Modeling sewage overflow in an urban residential area usingstorm water management mode [5]":- In this paper they have talked about Late examinations exhibited that tempest water coagulates into sewer framework and causes sewer flood issues. Sewage Water Management Model (SWMM) is analyzed by Hussein for reenacting precipitation driven stream in a sewer structure that could cause flood in sewer frameworks. The reenactment was done in a nearby area where storm water network was less made. The report calls regard for that genuine precipitation causes sewer flood and surface drenching in the zone.

Under ground drainage maintaninance using iot [6]:- In this research paper Muragesh S. K and Santhosh Rao [6] proposed a model that gives a framework to observing the water level, environmental temperature and pressure inside a sewer vent and to check whether a sewer vent top is open. It additionally screens underground introduced electrical cable. Progressively, UDMS can distantly screen present statuses of the sewer vents

"Implementing smart city concept with various application using iot based technique[7]" :- This paper work A.Shaikh, Suvarna A. Sonawane proposed

the framework for the Smart urban areas in the city to improve great administration and quicker advancement of the sewage management. Diverse sort of information is gathered from the sensors and moved to Raspberry Pi3 Controller in the framework. The obtained data from the regulator is shipped off the control room through the E-mail and furthermore show on the PC.

Yash Narale [8] has proposed Underground Drainage Monitoring System Using IoT by utilizing stream sensor, level sensor, temperature sensor and gas sensor to recognize stream pace of water regarding speed, the degree of fluids and different liquids, temperature in Celsius, and to detect CO focus in air separately. It follows area using GPS and send SMS through GSM. To beat the limiting parts of human entered data, and to achieve cost, exactness and rearrangements factors, IoT showed up because, without human association.

Chapter 3

Problem Statement

"We intend to take care of the issue identified with blockage happening because of expansion in waste level and furthermore screen the degree of harmful gases inside the sewage. Poor Maintenance of manholes and underground drainage is dangerous for workers to go inside the manholes for inspection of its current state and many lives are lost due to it."

Lack of computerized and automated drainage monitoring leads to delay in knowing the blockage alerts and exact location of blockage.

Additionally because of which we don't get early cautions of the blockage or ascend in measure of those gases or the expansion in water level.

Inconvenient ways of communication between the municipal offices and people.

Overflow of drainage causing contamination of clean groundwater, traffic jams and other infectious diseases.

Chapter 4

Proposed Work

Proposed system contains following features:

1. Information about the specific drain where the blockage occurred.
2. Immediate information of the blockage location.
3. The system regularly checks the level of sewage.
4. Use of gas sensors to detect the various poisonous gas.
5. Get real time alerts of blockages .

So the main aim of this project is to provide central control system (municipal office) with the real time data about the conditions of the sewage. It includes sending data about the overflow of the drains, giving alert when the amount of poisonous gases in the sewers crosses the threshold value and giving information about the blockages in the underground pipes.

4.1 Hardware Requirements

In the current project, things that are going to be implemented are checking the overflow of sewers, concentration of poisonous gases (methane) and blockages in the underground pipes. The data regarding these parameters is to be sensed and processed. So for this we are using following:

4.1.1 ESP32

In our project will use ESP module for transfer of data and communication between the cloud and the model system.The ESP8266 Wi-Fi module is self-compartment SOC with in focused TCP/IP convention stack that can give any microcontroller admittance to your Wi-Fi network. Each ESP8266 module comes pre-programmed with an AT commands set firmware. The ESP8266 module is an extremely cost effective bold with a hug and ever growing, community. So we will be using ESP 32 which is a 40 pin micro controller that works at low voltage. It has a dual core processor. This module has dual-mode bluetooth and wifi embedded on it. SP32 is made and created by Espressif Systems, a Shanghai-based Chinese organization, and is produced by TSMC utilizing their 40 nm process.It is a replacement to the ESP8266 microcontroller. ESP32 can aslo be used as a microcontroller and develop a design. It is very efficient and easy to use. It can be used both for commercial purpose and also for industrial purpose.

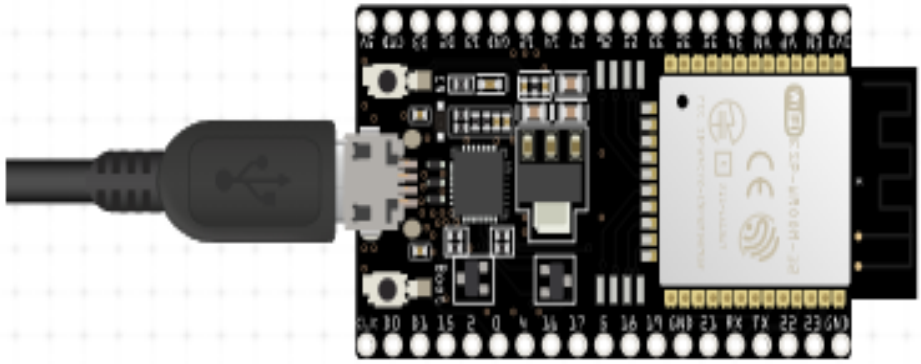

Figure 4.1: ESP32 Wifi Module

4.1.2 Arduino UNO

Arduino Uno is a microcontroller used to running all the sensors. It is the board that contains sets of digital and analog input output pins that helps in connecting many other sensors and modules.

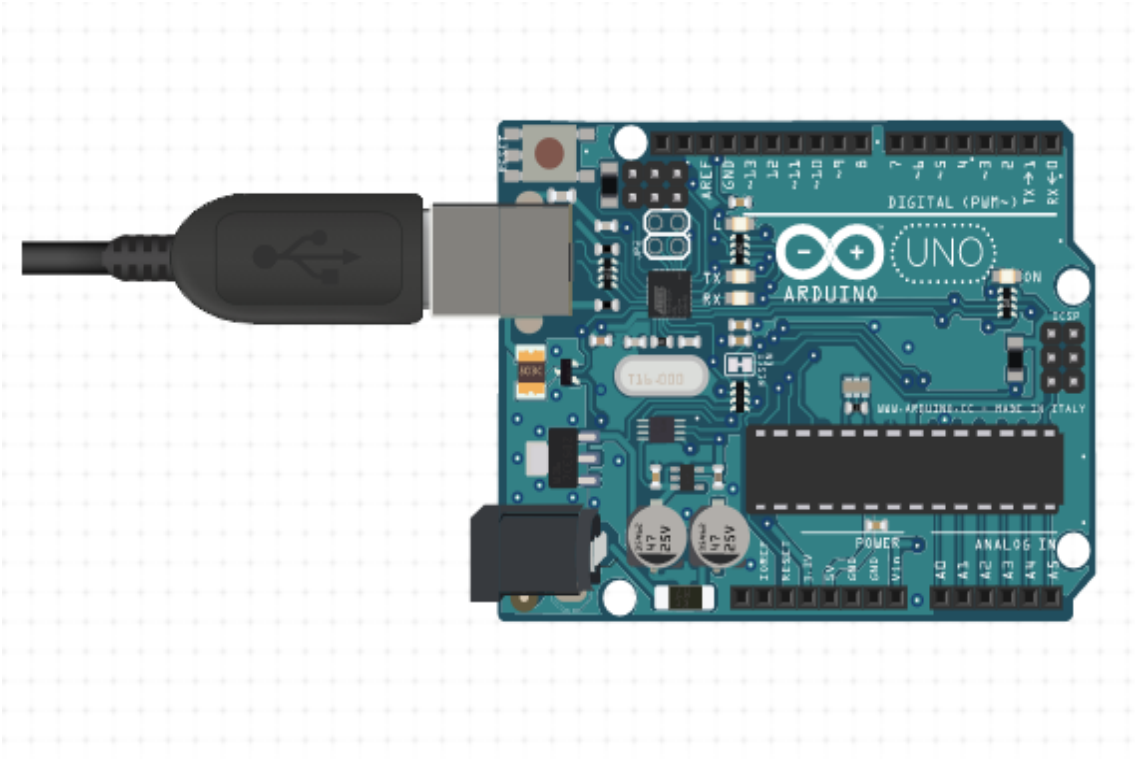

Figure 4.2: Arduino UNO

4.1.3 Ultrasonic Sensor

An ultrasonic sound sensor is a device that measures distance of the target. This sensor converts the electric signals into ultrasonic sound waves and the transmitter present in the sensor transmits them. When they hit the target,

waves reflect back and reach the receiver. Based on the time of reception of ultrasonic signals, distance of the target from the sensor is found out.An ultrasonic sound sensor is a device that measures distance of the target. HCSR04 ultrasonic sensor consists of a transmitter, a receiver and a control unit. In this module HCSR04, trigger pulse for 10sis provided to the TRIG pin, so that the transmitter generates ultrasonic sound waves of frequency 40 kHz.

Pin Description:

VCC: The supply of 5V is given to this pin.

TRIGGER: This is an input pin where 10s pulse is given to this pin.

ECHO: This pin is output pin which remains high until the echo sound wave is received.

GROUND: This is connected to 0V.

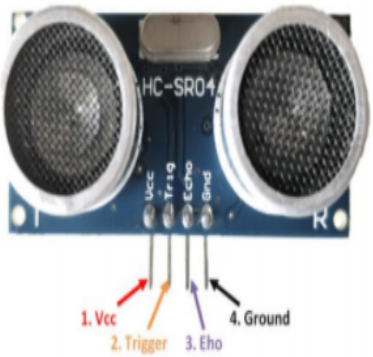

Figure 4.3: UltraSonic Sensor

4.1.4 MQ-135 Gas Sensor

MQ-135 gas sensor is used to detect the concentration levels of methane and natural gas in ppm. This sensor has a layer of SnO2. SnO2 is sensitive to methane gas. It increases its conductivity when it comes in contact with these harmful gases. So, the output voltage also increases. Thus this value is used to calibrate the methane level.

Pin Description:

VCC: A supply of 5V is given through this pin

AOUT: This is an ouput pin. This gives output analog voltage level depending on the concentration of methane

DOUT: This is a digital output pin.

GND: It is connected to ground

Figure 4.4: MQ 135 Gas Sensor

4.2 Architecture

This is the proposed architecture which contains two sensors connected to a Arduino microcontroller. Further the microcontroller sends the data obtained from sensors to the cloud using wifi module.

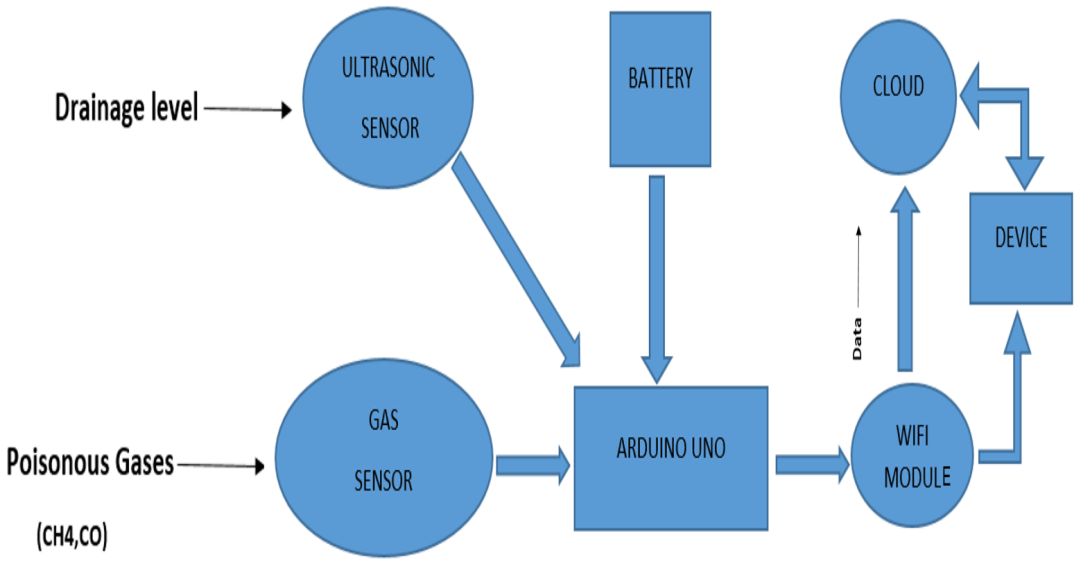

Figure 4.5: Architecture of Proposed Model

Chapter 5

Implementation and Run time Analysis

The implementation of our design is based on several steps. Initially we have developed the circuit diagram for the model.Then we have used Arduino IDE for the coding purpose of the micro controller and other sensors.

In fig.5.1 demonstrates the circuit diagram of the design.

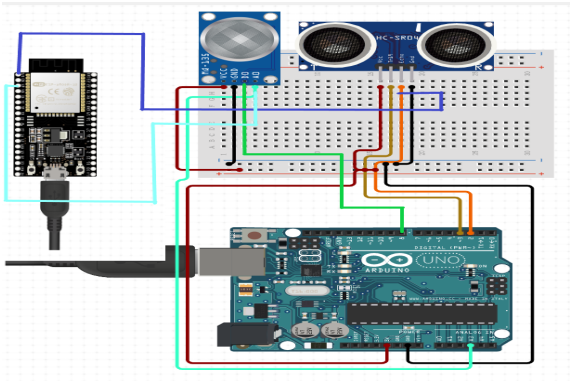

Figure 5.1: Circuit Diagram

Once the circuit diagram is made then we use the hardware and connect them according to our circuit diagram.And after making the model we need to code for our model. In the given lines of code in fig 5.2 demonstrates the code implemented to import the necessary libraries for the working of the model.

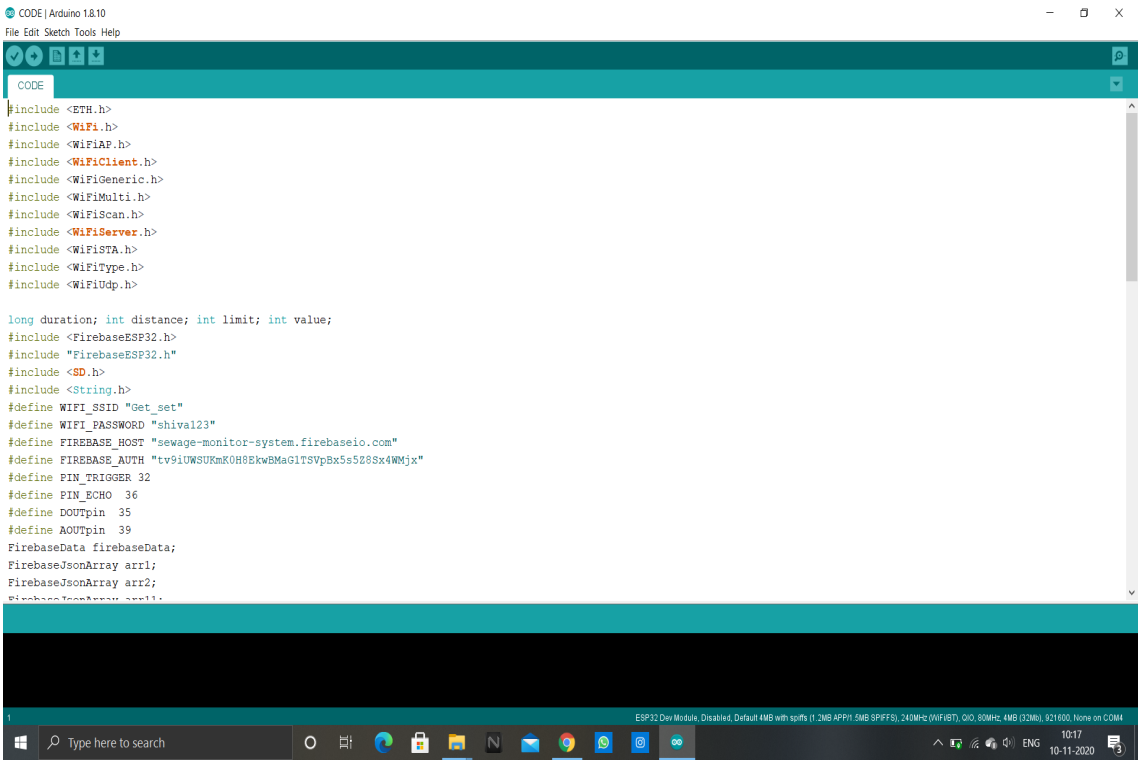

Figure 5.2: Code importing libraries

The below given lines of code in fig 5.3 deals with assigning the input pins of both the sensors with the micro controller. After that we have coded for the wifi module which connects our model to the firebase.Also we have authenticated the firebase with our esp32 for the data storage.

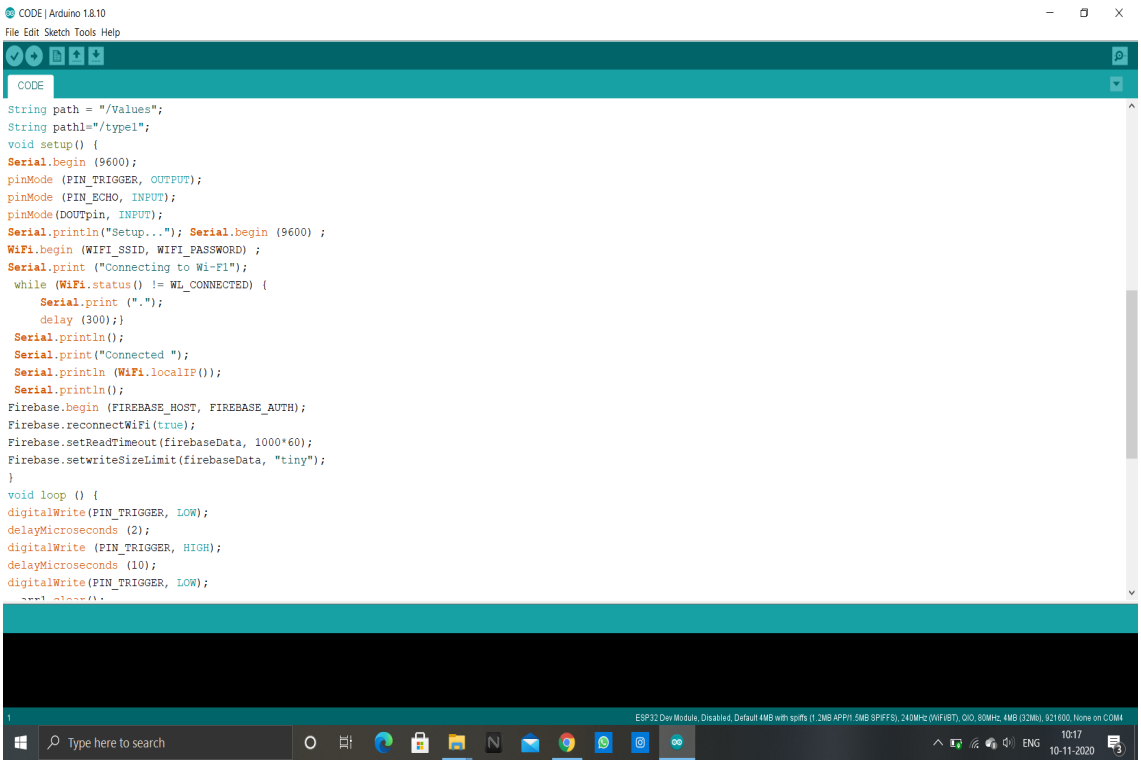

Figure 5.3: code for firebase authentication

The given lines of code in the fig5.4 defines the loop function which triggers both the sensors repeatedly and collects the readings.Also transfers the data to the firebase immediately.

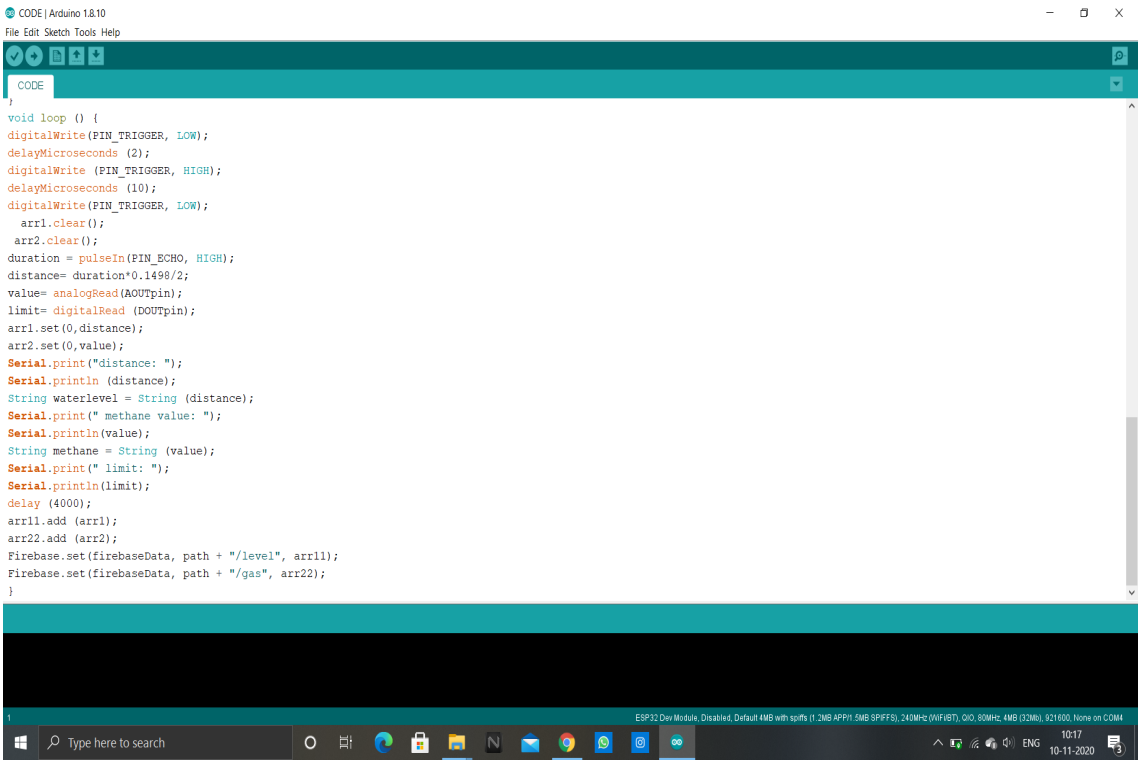

Figure 5.4: Code for triggering the sensors

In fig5.5 we are displaying the screen shot of IDE once the code is uploaded to microtroller and also connected to firebase using wifi module.

In fig5.6 and fig 5.7 we are getting the result when we run our model by giving power supply of 3V. The picture shows us the real time data that we get on firebase.

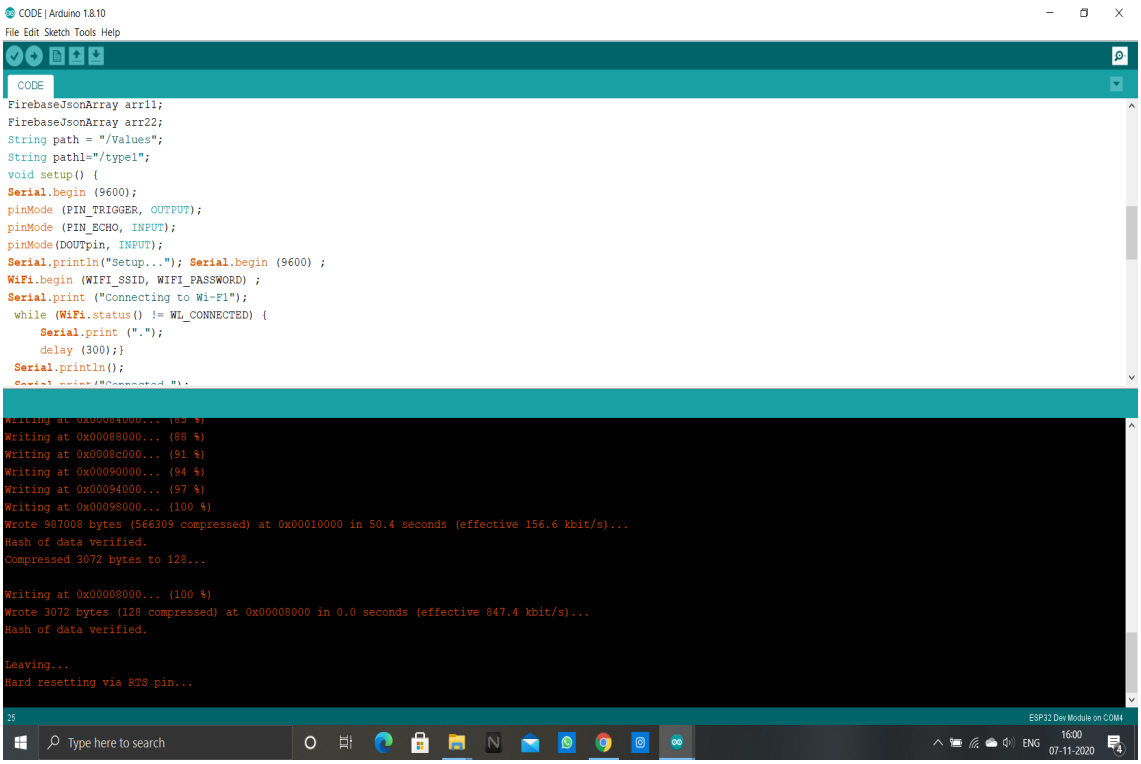

Figure 5.5: Uploaded code and connected to wifi

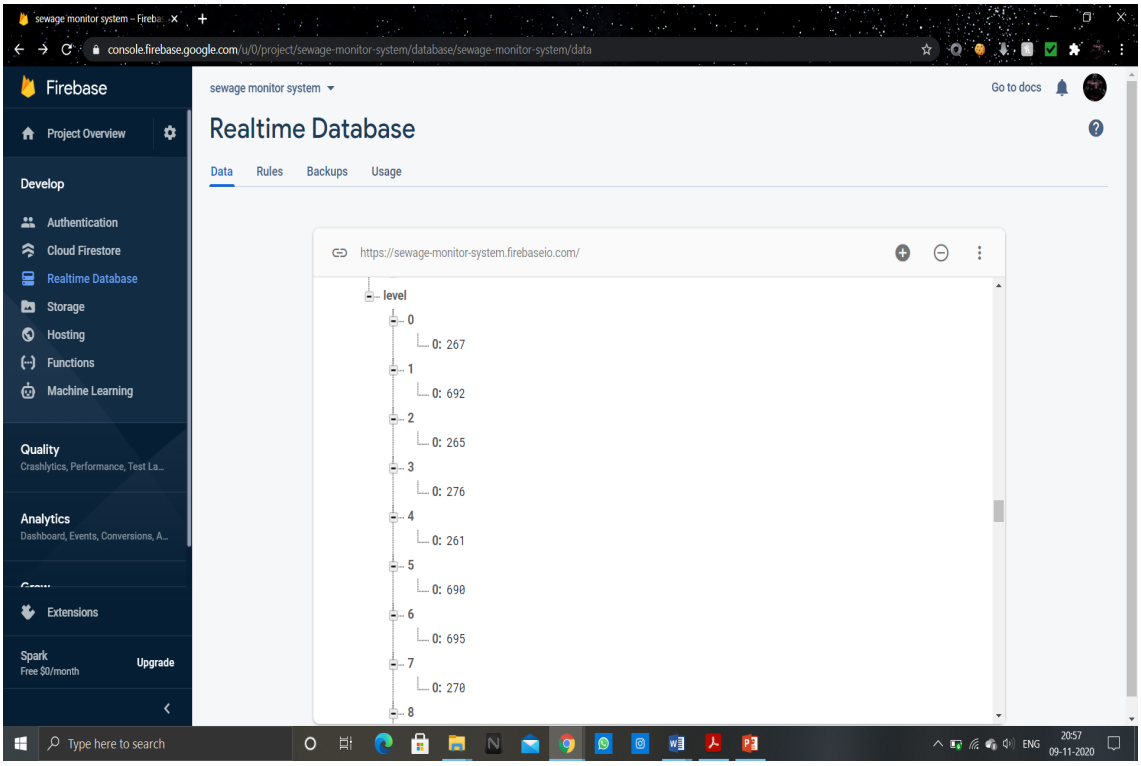

Figure 5.6: Real-time Reading of height on firebase

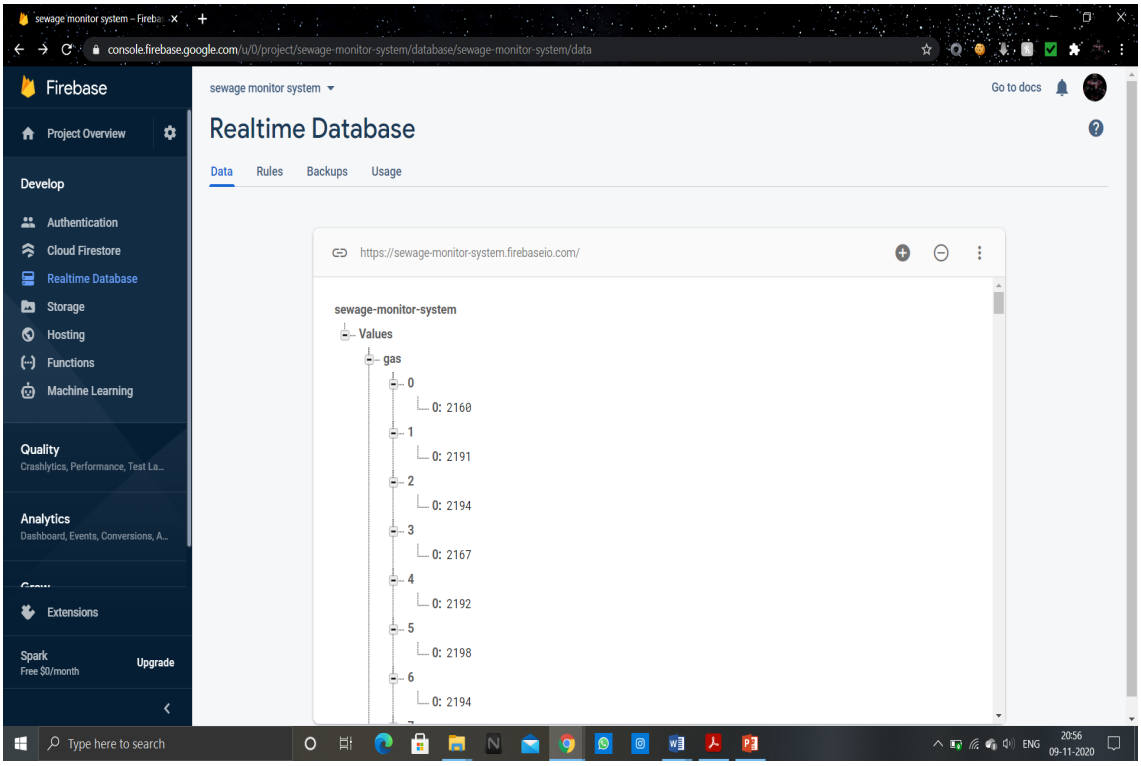

Figure 5.7: Real-time Reading of Gas on firebase

5.1 Results of the Project

The given table displays the reading that are obtained by our model under different artificial environmental condition.The methane gas readings are in ppm and the height reading are in cm.

Table 5.1: Table representing the readings

LEVEL READING(in cm)	GAS READING(ppm)
203	396
18	398
62	395
195	386
167	465
943	483
38	461
34	418
45	422
1040	620
1041	611-613
1043	608
137	606

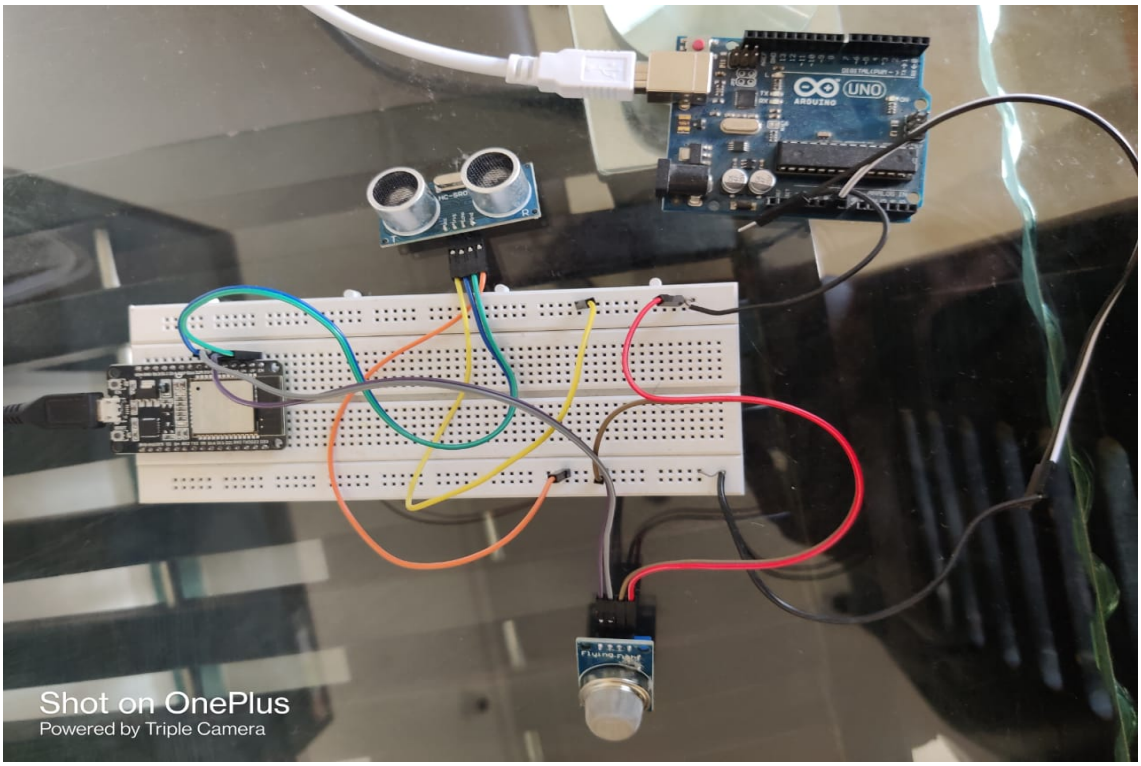

Figure 5.8: Picure of model

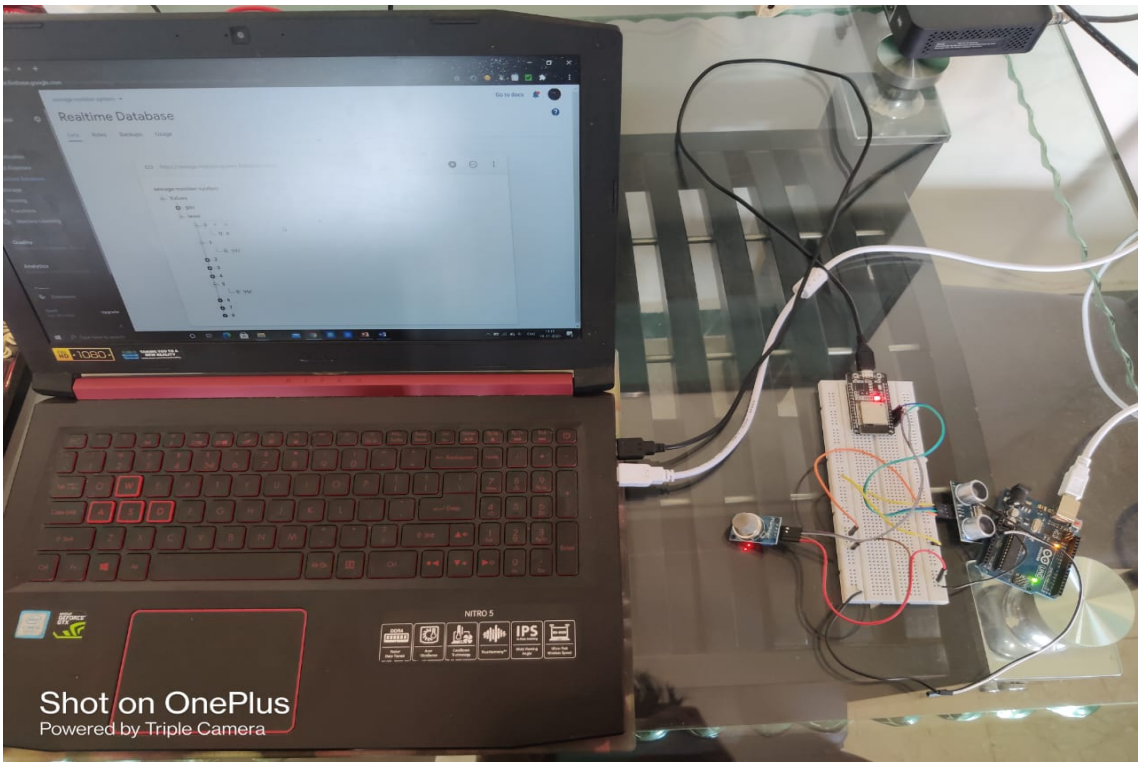

Figure 5.9: Picure of working model with firebase

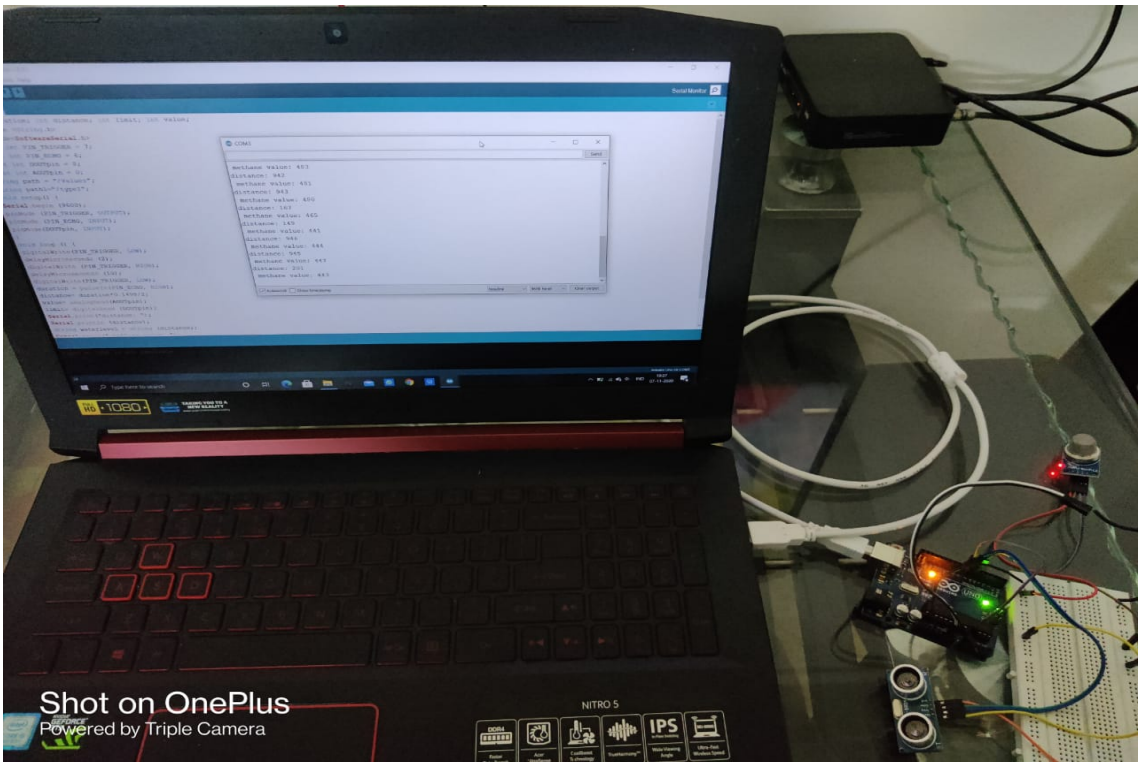

Figure 5.10: Picure of working model with IDE

Chapter 6

Conclusions and Future Work

As through this project we have achieved the our basic system that is able get the data using the sensors and work under real time. Our product is able to get the methane gas level keep record of them. It is able to get information about the height also using ultrasonic sensor. It is also able to all the real time data on firebase cloud. There is enormous scope of development in Sewage monitoring system. Also this project has got many more features to be implemented in it. There is future scope of development like we can implement other sensors in the model. We can also implement pressure detecting feature for safety purpose of manhole workers. There is a scope of future development in our model by using the data gathered. Later we will to implement it on more smaller micro controller to optimise the model design. This will help and impact environment a lot by very easy means. It avoids spreading of infection due to mosquitoes and gives clean and healthy environment as well as controls the diseases such as malaria, dengue, diarrhea, etc. Our model will cost effective as it will monitor the drainage pipe con-

gestion, from municipal location. It also reduces the accident caused by an exposed manhole. It will be helpful to solve the problem of blocked drainage; manhole overflows and maintains hygiene particularly in rainy season. This system has a direct impact on the health issues of citizens and workers who clean the underground drainage system. So in the future work of this project will be focusing more on achieving the more better version of our system to make it more user friendly and efficient.

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