SMART SEWAGE SYSTEM USING IoT

AN INTERNSHIP REPORT SUBMITTED

IN PARTIAL FULFILMENT FOR THE AWARD OF

THE DEGREE OF

BACHELOR OF TECHNOLOGY
IN
ELECTRONICS & INSTRUMENTATION ENGINEERING

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2021-22

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CERTIFICATE

This is to certify that the report of Internship titled **"SMART SEWAGE SYSTEM USING IoT"**is being submitted, by **P.Vinay kumar(19071A1094)**, **D.Nikhil (19071A1067)**, and **K.Satyanarayana(19071A1075)**, and **K.Sandeep(19071A1076)** in partial fulfilment of the requirement for the award of degree of **Bachelor of Technology in Electronics and Instrumentation Engineering**, to the Department of Electronics & Instrumentation Engineering at the **VNR Vignana Jyothi Institute of Engineering and Technology** is a record of *bonafide* work carried out by them under my guidance and supervision. The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree.

Internal Examiner

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ACKNOWLEDGEMENTS

This is an acknowledgement of the intense drive and technical competence of many individuals who contributed to the success of our project.

We express our sincere thanks to **Dr. R. Manjula Sri,** Professor & Head of the Department of Electronics & Instrumentation Engineering, VNRVJIET,and to other faculty members in the Department for guiding us through our education at the Institute and for encouraging us all through. We particularly thank our mentors, **Ms. S .Vandana** for helping us through our journey at VNRVJIET. We also extend our gratitude to the internship Coordinators ,**Ms. Jyothirmai Joshi,** Assistant Professor and **Ms. P . Sampurna Lakshmi,** Assistant Professor with the Department of EIE, for their valuable guidance and for streamlining the review process for our project work. Our thanks are also due to the other members of the Review Panel and All other Faculty members.

We express our thanks to **Dr.C.D. Naidu**,Principal-VNRVJIET, for enabling us to use the Institute facilities and resources for the successful completion of our project work.

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DECLARATION

We hereby declare that the work done during Internship titled **"SMART SEWAGE SYSTEM USING IoT"** submitted, towards partial fulfilment of requirements for the degree of Bachelor of Technology in Electronics and Instrumentation Engineering, to the Department of Electronics & Instrumentation Engineering at the VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad, is an authentic work and had not been submitted to any other University or Institute for any award of degree or diploma.

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ABSTRACT

IoT came into existence because without human interaction computers were able to access data from objects and devices, but it was aimed to complement the human entered data as a limiting factor, and to achieve cost, accuracy and generality factors. The sewerage system is a primary element of a city and is responsible for the congestion of both rain and gray water from homes and industries. It is essential to have a monitoring system and a plan to perform prior expansion in the sewerage management system, to avoid massive disruption. However, there is no monitoring system in several overpopulated cities in the world, and the expansion process faces myriad difficulties and takes much time. Our project helps people or the respected authorities to get intimated about the situation of overflow of water from sewerages and if there is any blockage in the sewerage which would affect the flow of sewage water and results into overflow of water into the low lying areas.

LITERATURE SURVEY

Before initiating the project we went through man published journals and papers from different websites such as IEEE, ReasearchGate and etc., This literature survey helped us in knowing how the problems caused by sewerages at the time of heavy rains can be addressed through IoT and what kind of new features that can be included in existing ideologies to make best out of it. We referred around 15 to 20 papers from different websites published from different parts of Asia and we got to know about different components that can be used for wireless communication between users.This survey helped us to know about the problems faced due to bad conditioned sewerages like Level of gas monitoring and others as mentioned in below table:

TITLE	PUBLISHED YEAR	AUTHORS	METHODOLOGY
IoT for harm full sewage gas detection	2019	N. Asthana and R. BahL	". The main aspect behind this paper is alerting the sewage workers from coming in contact with harm full gases like methane(CH4),traces of carbon dioxide(CO2),Hydrogen Sulphide (H2S),Nitrogen dioxide, Carbon Monoxide are some harm full gases produced due to industrial sewage and residential sewage. To detect these level of gases i.e., (The level which is hazardous to the workers who work for sanitation purposes in sewerages). To avoid these circumstances we need to develop a smart system that can process sensor data and assure a wireless communication to the server and achieve the result. To avoid these circumstances we need to develop a smart system that can process sensor data and assure a wireless communication to the server. It's a very good idea to use IoT in alerting the workers about the information about harm full gases

			level in the sewerage before cleaning sewerages about the level of ppm of harm full gases present, such that they would save their lives from contracting diseases like hepatitis, thyroid and other harm full diseases which would lead to costing their lives.
Smart Drainage and Health Monitoring System of Manual Scavenger using IoT	2021	S.P.K Ramadhin,S.Anand and R.Aishwarya	The basic idea behind the project "Smart Drainage and Health Monitoring System of Manual Scavenger using IoT " is alerting workers before clogging or cleaning out the manholes by intimating them about the level of harm full gases(in ppm) which may be very dangerous so, they don't go to work before the level of gases decreases and also the module consists of pulse sensor, heartbeat sensor, buzzer, fan, and arduino. When it crosses the threshold value, the buzzer will be alerted and its data will be displayed on the IoT webpage.
Smart Real-Time Drainage Monitoring System Using Internet of Things	2018	GAURANG SONAWANE, CHETAN MAHAJAN, ANUJA NIKALE and YOGITA DALVI	The irregular monitoring of drainage system leads to blockage of sewerages. In this case manual monitoring is not possible because it's difficult to have a professional everywhere and accuracy would be very less in case of manual monitoring.The basic idea behind the project is to send the data about the level of sewage gases to respected authorities.
Smart sewage system in urban by feedback use of smart sensors	2017	Y. A. Rjeily, M. Sadek, F. H. Chehade, O. Abbas and I. Shahrour	The paper is about the "smart sewage system in urban by feedback use of smart sensors" ,which is performed at a university in North France. They have made an arrangement of sensors, pipes so that in case of any storm or floods the water can flow easily out from the University. They made total network of pipelines in campus and two pipelines as collectors of flood water. It also had multiple pumping station, flow regulators and check valves.
IoT based sewage monitoring system.	2020	Pendharkar, Anushka and Chillapalli, Jyothi and Dhakate,	The title of the page is "IoT based sewage monitoring system", in which it deals with the safety of municipality workers. As we know

		Kanksha and Gogoi, Subhalaxmi and Jadhav, Yogesh	many harmful poisonous gases are released and effecting the workers. Due to it workers are facing respiratory diseases and being exposed to the green house gas emissions which leads to their death. For overcoming this situation, they have made an monitoring system in sewage system. The MQ4,MQ7 sensors are used for identifying of harmful gases like carbon and methane
Sewage Level Maintenance Using IoT	2019	Ronak and Tanwar, Rohit	The paper is about "Sewage Level Maintenance Using IoT",which is dealing with same situation as of the other projects. This particular project is about maintaining of sewage water level in case od floods or other natural calamities. A alaram system is developed in that drainage system,which allows the signal to transfer information to the concerned community and alaram will be start rings if the level of sewage is reached beyond the threshold level.
Smart sensors and arm based drainage monitoring system	2019	-	This paper is about the "smart sensors and arm based drainage monitoring system", which describes that monitoring of drainage system is done with other types of sensors and IoT. It also has a same motive of monitoring the drainage system through detecting the gases, blockage of water and other problems in drainage system. And a new sensor ARM7 is used to overcome this problem. And LCD screen is displayed for showing the output of gases and any blockage is occurred in drainage system.
Drainage monitoring system using IoT	2018	-	The title of the paper is “Drainage monitoring system using IoT” This article focusses on the issues like Harm full gases, Water leakage, Sewage waste, Drainage

			blockage. Actually any team work can't be introduced to avoid these issues because the work would be not accurate and of less precision and it is not even possible to allocate number of teams for each and every locality. So we can make the better use of technologies like IoT to overcome these sort of issues.
" IoT based smart drainage monitoring and cleaning system for solid waste materials	2021	M. Omamageswari, A. Mohanraj, S. Carolin Jeeva, A. Kishore Reddy, K. Thilagam, Usthulamuri Penchalaiah	The paper-" IoT based smart drainage monitoring and cleaning system for solid waste materials" is all about how could IoT play a role in helping us in drainage monitoring and cleaning the solid waste. The project basically focusses on the issue in India water plays the important role while cooking, washing and etc., but solid waste contaminated issue is one of the modern day issue so to overcome these issues a system is developed that is the system will automatically clean the water in the drainage system with the help of drive system controlled by Arduino and the mechanical setup which runs with the help servo motor to collect the solid waste and dispose it in waste bins and avoid drainage blockage. It reduces the cost of manual labour as well as reduces the threat to human life.
Waste Management System Using IoT-Based Machine Learning in University	2020	Tran Anh Khoa, Cao Hoang Phuc, Pham Duc Lam, Le Mai Bao Nhu, Nguyen Minh Trong, Nguyen Thi Hoang Phuong, Nguyen Van Dung, Nguyen Tan-Y, Hoang Nam Nguyen, Dang Ngoc Minh Duc	The project is "Waste Management System Using IoT-Based Machine Learning in University". The issues are focused mainly in urban areas the paper states that the waste management had become a serious issue and has become a daily task leading to lot of expenses spent on it. Many approaches have been practiced to control the issue but all the techniques are now of no use. In the paper they have proposed a

			method that efficiently achieves waste management by predicting the probability of the waste level in trash bins. By using IoT based machine learning and graph theory,The machinery they've used to buit the project is The system under consideration consists of smart trash bins with a real-time monitoring system which integrates multichoices, such as ultrasound distance, along with a LoRa E32 TTL-100 433 MHz transmission module.

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CHAPTER 1

INTRODUCTION

1.1 Objective

IoT is most trending and growing technology which could help us to communicate with the outer world using wireless communication. The basic objective of the project is to intimate or to know about the level of water in the sewerage using IoT through ThingSpeak IoT platform i.e, is the level of water ok or will it flow over within some time such that respected authorities can take required action over the issue and intimate people in the that locality.We can also know whether the any blockage in the water flow.

1.2 Introduction

Human health denotes the mental, social, and physical state of a lifestyle, not only a disease-free condition. To lead a healthy life and secured/safe life, it is essential to live in a healthy environment; so this is the basic reason to select this issue as our project. In a city like Hyderabad where the estimated population is 10.2 Million it is a complicated and difficult task to maintain the sewerage system. We can consider the same issue with the other major cities in our country. So, our model helps in addressing the some of the drainage issues faced in the city at the time of heavy rains.

The basic idea to select this as our project is, in 2019 around the month of September/October there was a very bad situation in the low lying areas of Hyderabad due to heavy rains continuously

For 3 days and situations were more than worse in the areas like OldCity , Gowliguda etc.,

Here are some pictures published in news articles at those times this is all due to the poor maintenance of sewerage system in our country and also the negligence of the officials caused great damage to the people like collapsing of houses and etc.,

Fig 1.1(a)- Over flow of sewerage water due to blocked drainage lines.

Fig 1.1(b)- Over flow of sewerage water due to blocked drainage lines.

1.3 Motivation

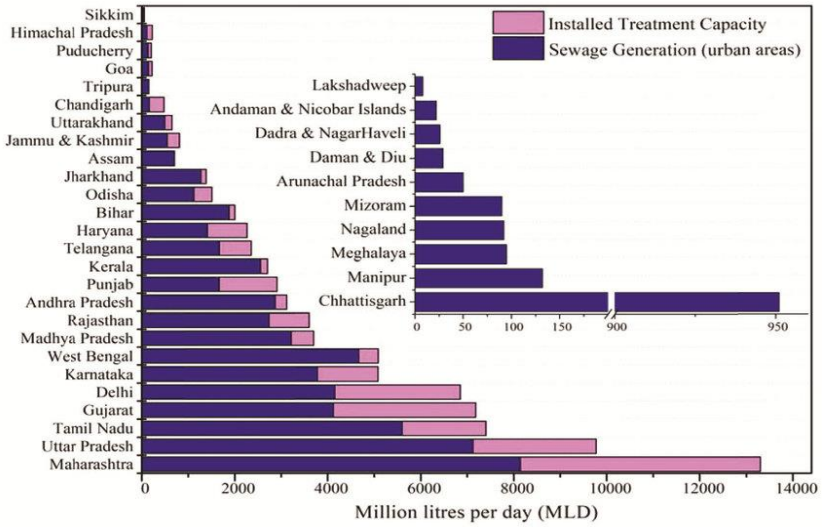

Fig 1.2- State wise treatment generation and treatment capacity.

This is the statistical representation of state wise sewage generation and it's treatment in different parts of our country. This is very poor when compared to other developed countries due to poor maintenance of sewerage system in our country. This is a major problem faced across our country and our project is a very small scaled one and it's just a small step initiated by me and our team to control overflow of sewerage water.

1.4 Scope for the Work

There is good scope for the project in changing the maintenance of the sewerage system in our country. The work done by us helps us in getting the information about the flow of water to indicate any sort of over flow of water due to blockages or poor condition of the sewerage lines. We have reached our goal in implementing our idea as of now but we would definitely like to extend the scope of our project by including new features in to it like :

- Tilt detection(Open Man holes/broken Man holes) due to heavy rains people couldn’t see the man hole and many of them have lost their lives due to this problem and we feel that this one of the major issues that government authorities to take in to consideration.
- Using flow electrodes we can generate a signal when flow reaches a prescribed level.
- We would like to build our own web server for communication with the devices.

CHAPTER 2

PROJECT OVERVIEW

SECTION 2.1

This section consists of Block diagram, Flow chart, Components used and etc,. We use the below mentioned block diagram for initiating our project. Not only the block diagram we have also included the circuit diagram built in a digital platform and the total overview .

2.1.1-Block diagram

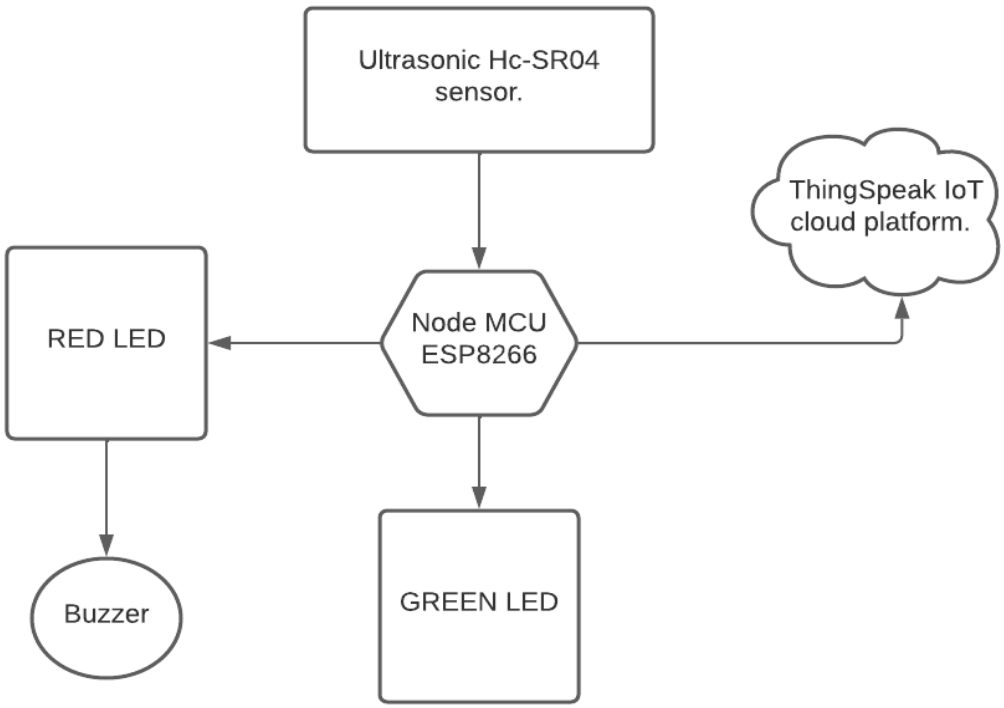

Fig 2.1- Block diagram

The information from the ultrasonic sensor is been transferred to NODE MCU ESP 8266 and we then upload our code certainly to send back information to the ThingSpeak IoT platform and we can use led's externally through the pins of ESP-8266 for the indication of over flow and presence of any blockage. We can also use buzzer when the prescribed level of water exceeds and we can use ThingSpeak Premium for E-Mail alerts, Field charts, Buttons.

2.1.2- Circuit Diagram

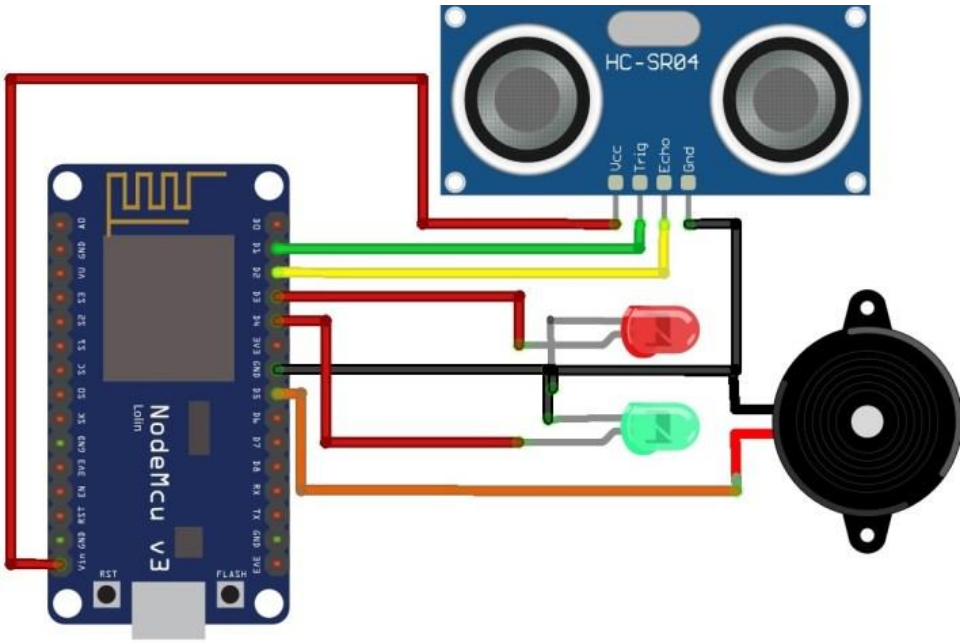

Fig 2.2 – Digitalized block diagram

This the basic digital circuit diagram of the circuit we use to build this project.

SECTION 2.2

2.2.1 Components used to build the project

- Node MCU- ESP 8266 WIFI module

- Bread board
- Jumper Wires
- Buzzer
- Red led
- Green led
- Ultrasonic sensor

2.2.2 Components description

1. **Node MCU ESP 8266 :** NodeMCU is an open source firmware for which open source prototyping board designs are available. ... The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS.

2. **Bread board :** A breadboard, or protoboard, is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used when slicing bread. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.

3. **Jumpers :** A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or

sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally.

4. **Buzzer :** A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

5. **Ultrasonic sensor :** An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity

CHAPTER 3

METHODOLOGY

Moving on to the research we've done through the literature survey and also searching what sort of problems people face due to the poor maintenance of sewerage system in respected localities of India. The literature survey we've conducted helped us to gain definite knowledge about the problems which are faced by the people.

Here are some problems briefly discussed that are at most addressed in every paper we've gone through

SECTION 3.1

As mentioned above this section includes the types of problem we mostly came through our survey are as follows:

3.1.1-Issues being focussed in various papers

1) Gas Detection

In a sewage system management we can include another feature called Gas Detection. It is also an major aspect which will gives the information about the nature of sewage water like is it containing the gas effluents. Gas effluents like CH4, Cl2, O2, SO2, NH3, O3, ClO2 and CO2. To detect these kind of harmful gases some of the wired and wireless detectors are

used. Each gas has its unique properties. So according to it's property different detectors and controllers are available. For CH4 gas sensmart 5300ir is used or wireless sensor 7300ir is used. For Gases like, O2, SO2, NH3, O3, ClO2 sensors like sensmart 5100EC and wireless like sensmart 7100EC can be used. Other gases like CO2 sensmart 5400IR and sensmart 7400IR are used. So, it would be a major feature to develop the smart sewage system.

2) **Filtration**

For future development of smart sewage system we introduce a feature called filtration. Filtration process includes cleaning the sewage water in both solid wastes and chemical wastes. For these kind of filtration process different techniques and systems are used. For solid waste filtration: Sand Filters – Dual Media or Sand / Anthracite Filters – Activated Carbon Filters – Birm Filters. Depending upon mode of operation, filters like Manual IF Filters and Automatic IF Filters are used. Brim filters and adsorption are the mostly used techniques in filtration of sewage water.

3) **Cleaning solid waste**

The project basically focusses on the issue in India water plays the important role while cooking, washing and etc., but solid waste contaminated issue is one of the modern day issue so to overcome these issues a system is developed that is the system will automatically clean the water in the drainage system with the help of drive system controlled by Arduino and the mechanical setup which runs with the help servo motor to collect the solid waste and dispose it in waste bins and avoid drainage blockage.

4) **Odor control**

One of the major thing to handle in smart sewage system is odor control. Due to the odor control the environment around the waste water won't be effected and will not be much harmful to the living organisms nearby. For ejecting the odor from water some of the solutions are used . Such as Bry-air eco scrubber solution is widely used to neutralize the chemical property in waste water and reduces the odor. Some of the smart sensors are also used. As the odor is detected in sewage water a sprinkler will allows the solution to mix with sewage water and neutralize to reduce the odor.

Finally, we can conclude that odor control is also an aspect which should be a major thing in developing a smart sewage system.

So by going through different problems addressed we team have decided to consider the task of overflow of water due to heavy rains which was always the basic idea behind selecting this problem statement we are also focussing on the issue of drainage blockages.

The method we've used in analysing the result is ThingSpeak-IoT and Arduino

3.2

This section is to discuss about the methods/platforms we've particularly used to achieve our results.

Here is the information about the pins for interfacing Ultrasonic sensor and Node MCU

Ultrasonic HC-SR04	ESP8266
Vcc Pin	Vin Pin
Trig Pin	D1 (GPIO 5)
Echo Pin	D2 (GPIO 4)
GND Pin	GND

Table 3.1

3.2.1-ThingSpeak-IoT

ThingSpeak IoT is a platform where we can interface our projects and we can visualize the functions performed by the circuit which is programmed using arduino language to perform specific functions.ThingSpeak is a open-source software written in Ruby which allows users to communicate with internet enabled devices. It facilitates data access, retrieval and logging of data by providing an API to both the devices and social network websites.

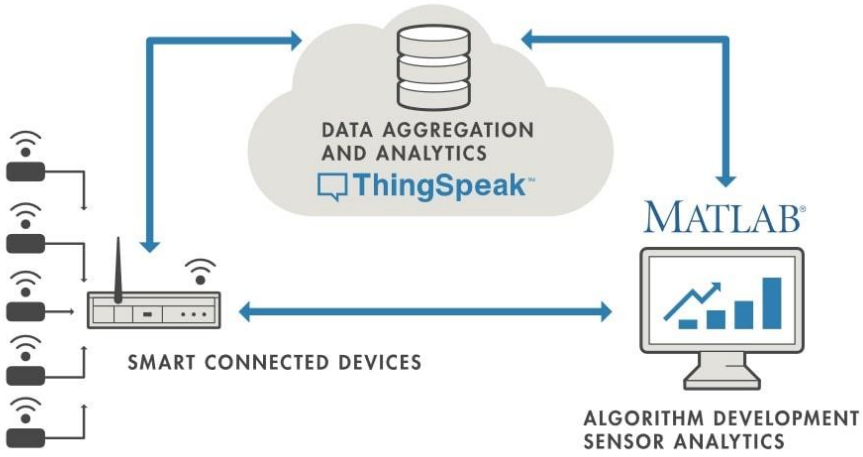

Fig 3.1-ThingSpeak IoT

3.2.2-Arduino Programming

Arduino IDE(Integrated Development Environment) is the software for Arduino. It is a text editor like a notepad with different features. It is used for writing code, compiling the code to check if any errors are there and uploading the code to the Arduino. It is based on C++ programming language it supports many devices such as Arduino UNO board, Esp 32, ESP 8266 etc.,

It also supports many IoT platforms such as ThingSpeak IoT, Blynk IoT, Arduino IoT etc., Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux.

Fig 3.2 Arduino IDE

CHAPTER 4

RESULTS AND DISCUSSIONS

Once we are ready with the code and the required circuit connected we can move on to the ThingSpeak platform and perform following steps:

- Open thingspeak platform using an E-mail
- Then create a channel using 2 field values
- Then move on to the generation of API keys

After the creation of channel we need to apply the code on to our Node MCU

and weight for required results. In this way we can record the results.In the process of uploading the code first we need to change required settings in the software.

- Open the Arduino IDE, then go to File> Preferences> Settings.
- Insert the URL:https://arduino.esp8266.com/stable/package_esp8266com_index.json in the 'Additional Board Manager URL' field and click 'Ok'.
- Now go to In the Boards Manager window, type ESP8266 in the search Bar and select the new version of the board and click Install.
- After successful installation, go Tools>Board and select ESP Node MCU 12E Module Now you can program NodeMCU with Ardino IDE.
- After the above setup for programming NodeMCU. You can upload the complete code to ESP8266 NodeMCU.

These are the basic steps we need to complete before writing or uploading our code.We should also select the correct COM port before uploading our code on to the Node MCU.

Section 4.1

4.1.1 Button Alert!

The output we have obtained during the process of execution is as follows shown in the figure :

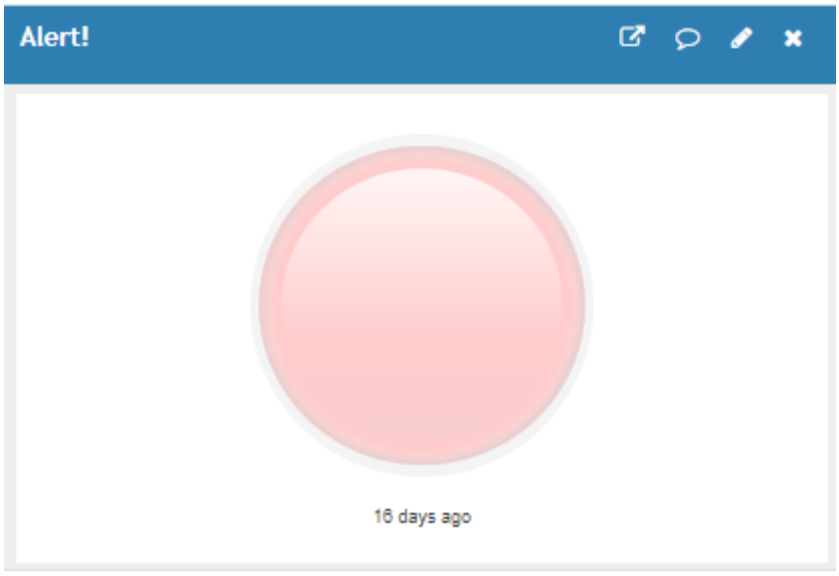

Fig-4.1 Button Alert

This is the button to indicate is there any blockage at a certain level in the sewerage which could effect the flow of water then it would turn into red colour which can also be visualized on the circuit by the use of LED'S.

The other feature we gonna go through is finding the level of water using a field value chart where the field value is the level of water.

4.1.2- Field value display

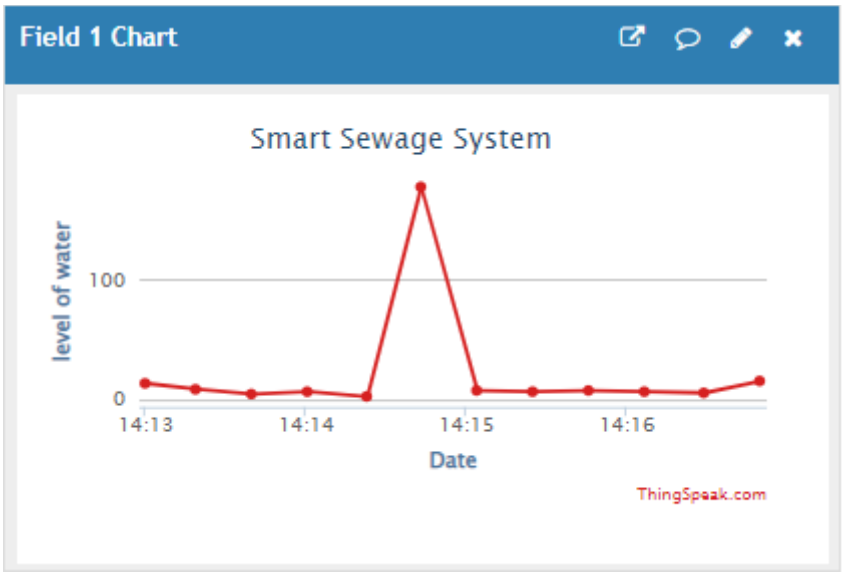

Fig-4.2 Field Value Chart

This is the field value display which indicates the level of water in the container we use and in case if we find the sewerage water to be above a certain prescribed level we can then intimate the people or respected authorities to get alerted about the situation we are going to face. The above picture displays the recording of the values of water in an container.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

SECTION 5.1

We have come to an end in implementing our project it's been a great experience to know insights from our mentor and we also completed a course for implementing our project before initiation of the project. This being a very small scale project could also be extended in future and we think that this type of model would definitely change the things around. People can know about near conditions and what precautions they can take for the upcoming circumstances at the time of heavy rains. The proposed model could also help us to intimate the respected authorities about the current situation in the particular area.In short span we have a definite plan to include many more features into our project such that it could be a valued more in terms of it's use.

The features we like include are as follows:

- Tilt detection(Open Man holes/broken Man holes) due to heavy rains people couldn't see the man hole and many of them have lost their lives due to this problem and we feel that this one of the major issues that government authorities to take in to consideration.

- Using flow electrodes we can generate a signal when flow reches a prescribed level.
- We would like to build our own web server for communication with the devices.
- We can also include harm full gas detection like CO, CO2, SO2 etc.,
- We can also add on features like release of gases that would kill Rats which would cause serious damage to the drainage lines in case of any detection we would intimate the internal gas tankers to release the gas at threshold level at which the health of sewage workers is not affected.

We believe that there is a definite future scope for the project in the future with number of features.

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APPENDIX A

Input Block and Output Block

```
#include "ThingSpeak.h"

#include <ESP8266WiFi.h>

const int trigPin1 = D1;

const int echoPin1 = D2;

#define redled D3

#define grnled D4



unsigned long ch_no = 1645298;

const char * write_api = "S0Y4TRUGLG3E0JNG";

char auth[] = " mwa0000019231363";

char ssid[] = "AndroidAP669E";

char pass[] = "cdtm6154";

unsigned long startMillis;
```

```
unsigned long currentMillis;

const unsigned long period = 10000;

WiFiClient  client;

long duration1;

int distance1;

void setup()

{

  pinMode(trigPin1, OUTPUT);

  pinMode(echoPin1, INPUT);

  pinMode(redled, OUTPUT);

  pinMode(grnled, OUTPUT);

  digitalWrite(redled, LOW);

  digitalWrite(grnled, LOW);

  Serial.begin(115200);

  WiFi.begin(ssid, pass);

  while (WiFi.status() != WL_CONNECTED)
```

```
  {
    delay(500);
    Serial.print(".");
  }
  Serial.println("WiFi connected");
  Serial.println(WiFi.localIP());
  ThingSpeak.begin(client);
  startMillis = millis();  //initial start time
}
void loop()
{
  digitalWrite(trigPin1, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin1, HIGH);
  delayMicroseconds(10);
 digitalWrite(trigPin1, LOW);
```

```
duration1 = pulseIn(echoPin1, HIGH);

distance1 = duration1 * 0.034 / 2;

Serial.println(distance1);

if (distance1 <= 6)

{

  digitalWrite(D3, HIGH);



  digitalWrite(D4, LOW);

  delay(1500);



}

else

{

  digitalWrite(D4, HIGH);

  digitalWrite(D3, LOW);

}
```

```
  currentMillis = millis();

  if (currentMillis - startMillis >= period)

  {

    ThingSpeak.setField(1, distance1);

    ThingSpeak.writeFields(ch_no, write_api);

    startMillis = currentMillis;

  }

}
```