

# DESIGN OF AUTOMATED MONITORING ROBOT FOR DRAINAGE SYSTEMS USING IOT PLATFORM

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**Abstract:** In India most of the cities has underground system and also the facility is maintained by Municipal Corporation to form the environment clean and healthy. Sometimes because of poor maintenance of the system, the water within the system gets mixed up with the pure water and infectious diseases may spread on the environment. In an existing system the PH level of drainage water, humidity and temperature is measured manually. It needs a lots of dedicated persons who are only able to record limited report with low accuracy. These weaknesses causes the slow handling of drainage systems and increases the death rates of sewage workers. The proposed system aims at monitoring the drainage systems using the Robot with various sensors that are meet its entire region. These sensors will monitor the PH water level, gas level, temperature and humidity level within the sewage environment. The minimum and maximum levels are set and uploaded within the controller and also the sensor keeps on monitoring the extent of varied parameters within the sewage. As the level reaches the atmost point, the buzzer sounds. And the information are send to the user through Ai thinker module using IoT. If any obstacles are detected the robot can move away automatically using the ultrasonic sensors. The robot are often applied to varied fields of monitoring. It also can be accustomed to detect the leakage or fault within the unmanned service positions.

**Keywords** – Controlller; Ai Thinker Module; IC chip; Sensors; Buzzer;

## 1.INTRODUCTION

Sewage or household wastewater could also be a form of waste water which is produced by a bunch of individuals. It consists of mostly grey water from sinks, tubs, showers and black water which is used to flush toilets, combined with the human waste. In cities where drainage and sanitation are poor, water runs over the bottom during rainstorms and contaminates water sources. This contributes much to the spread of diseases like typhoid and cholera. This stagnant water contains many chemicals and dangerous bacteria that make to much air born diseases. So protecting the environment from such situation has become one of the difficult challenges of twenty first century[1].

And it was mandatory to monitor the drainage system conditions to ensure its proper functioning[1].Also people functioning in glutters and below under ground systems usually have respiratory disorders due to poisonous gases such as Carbon monoxide(CO),Carbon dioxide(CO<sub>2</sub>),Nitrogen dioxide(NO<sub>2</sub>) or inflammable gases like Hydrogen(H),Methane(CH<sub>4</sub>),Liquid Petroleum Gas may be present[2].Therefore Manual monitoring is also ineffective and dangerous. But Smart cities needs smart solutions which would reduces the man effort and also needs to gave quick check over of the problem. So it needs an Automated Robot to keep up proper sewage systems and to shield sewage workers from death[3].

## 2. INTERNET OF THINGS

Internet of things could be a structure that which is employed to interconnect computing devices, machines, objects, animals or peoples that are supplied with unique identifiers and their capability to transmit data over a network without human- to-human interaction or maybe human -to- computer interaction. The internet service is the fundamental system linked to the local user, router/hub and the cloud. The signal is transferred to the IoT module where the local user and the router interact and pass on the message to the first fed inputs.

## 3. SYSTEM DESIGN

Sewage monitoring system consists of three sections namely Robotic section, Sensing section and the Networking section. The robotic section includes Controller, IC chip, DC motor, Ultrasonic sensors. The Networking section includes Ai Thinker Module, Cloud. The Sensing section includes all the sensors such as PH level sensor, Gas sensor, DHT sensor, Buzzer. The Block diagram of the complete system is shown in Fig: 1. When the supply is given to the Controller, the motor starts rotating which makes the robot to start moving and the sensors senses various parameters present in the sewage environment according to actions which is already programmed and uploaded in the Controller. When these parameters exceeds the threshold value, Alert sound is created by using the Buzzer. These informations are then stored in the cloud through Ai Thinker Module in Thinkspeak cloud platform and can be viewed by the client at any time. A camera can also be fixed at the front side of the robot to check for leakages and faults inside the sewage system. The detailed

functioning of the above sections will be discussed below. This paper is based especially on closed drains and can also be used for open drains[4].

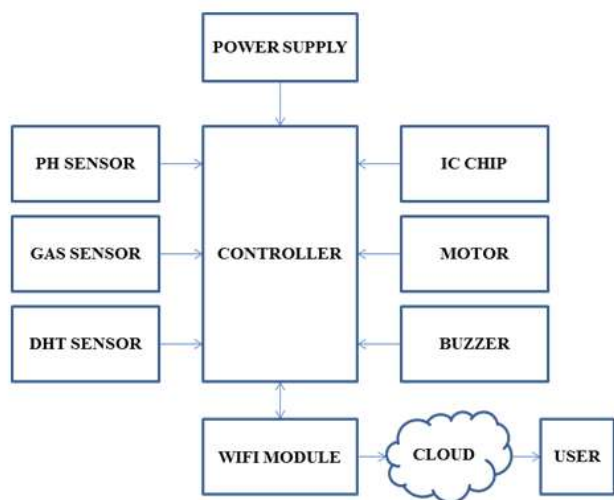


Fig: 1 Block diagram of proposed system

#### 4. ROBOTIC SECTION

In this section, the Controller is already programmed with the actions to be performed by Motor and Ultrasonic sensors. When supply is given to the Controller and the IC chip, the DC motor rotates which makes robot to start moving and the Ultrasonic sensors placed in front, left and right side of the robot detects the obstacles, which helps the robot to avoid crashing the obstacles. The Block diagram of Robotic section is shown in Fig.2

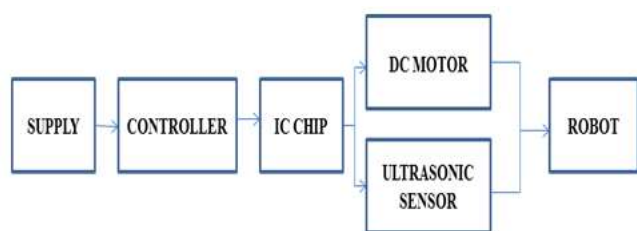


Fig: 2 Block Diagram of Robotic Section

##### 4.1 Controller

The controller used here is Arudino Uno. The Arduino Uno can be a micro controller board supported the ATmega328.It has 14 digital input/output pins (of which 6 could also be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, an influence jack, an ICSP header, and a button. It contains everything needed to support the micro controller. To get started, simply connect it to a computer with a USB cable.



Fig: 3 Controller

##### 4.2 IC chip

An Integrated Circuit used here is LM2390, which is an electronic device that gathers a number of electronic components on a small semiconductor chip. IC's can be digital or analog. It consists of 14 pins which is used to give input and ground connections.



Fig: 4 IC chip

##### 4.3 DC motor

A simple DC motor is a machine that transforms electric energy into mechanical energy in the form of rotation. Its movement is produced by the physical behavior of Electromagnetism. DC motors have inductors inside, which produce the magnetic field used to generate movement. It runs on power or ac line voltage with a rectifier. Its operating speed is of 100 rpm. It has the efficiency of 60%-75%.



Fig: 5 DC Motor

##### 4.4 Ultrasonic Sensor

Ultrasonic Sensor is used to sense the Obstacles in drainage channel. It consists of 4 pins namely VCC, GND, Trigger pin and Echo pin. They typically operate by generating a high-frequency pulse of sound, and then receiving and evaluating the properties of the echo pulse. If the input signal is Low there is no Obstacle in drainage channel and if the input signal is High there is an Obstacle in drainage[4].



Fig: 6 Ultrasonic Sensor

#### 5. SENSING SECTION

In this section, all the sensors which is connected to the robot senses the various parameters such as PH level, Poisonous gases, Temperature and Humidity. If the parameters exceed certain threshold value then the signal is send to the buzzer which gives a alert sound. The Block diagram of Sensing section is shown in the Fig.7.

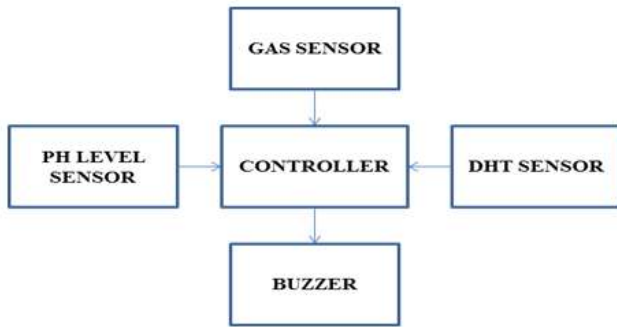


Fig: 7 Block diagram of Sensing Section.

The detection range of various sensors used here are given in the table: 1 based on sensor used, detection will be varied.

Table: 1 Detection Range of sensors

SENSOR NAME	DETECTION RANGE
PH sensor	0 - 14
Gas sensor	100 - 10000 ppm
DHT sensor	Temp: 0 - 50°C
	Hum: 20% - 90%
Ultrasonic sensor	20 metres

### 5.1 PH Sensor

A pH sensor is employed to live the hydrogen-ion activity in water based solutions, indicating its acidity or alkalinity expressed as pH[5]. The difference in electrical potential relates to the acidity or pH of the solution[6]. It consists of seven pins which incorporates VCC, GND, Digital pins, TX, RX. pH meters are used for soil measurements in agriculture, water quality for municipal water supplies and plenty of other applications.



Fig: 8 PH Sensor

### 5.2 Gas Sensor

The Gas sensor used here is MQ6 sensor. It consists of 4 pins includes VCC, GND, Digital and Analog pin. It may be connected with Arduino or other popular microcontrollers to detect the presence of Liquid Petroleum Gas which will produce various harmful gases

like Carbon monoxide and Methane under certain conditions. If the gases are beyond threshold limit, workers may have death.



Fig: 9 Gas Sensor

### 5.3 DHT Sensor

The DHT sensors are fabricated from two parts, a capacitive humidity sensor and a thermistor which is employed to live the Humidity and Temperature of the sewage environment. It consists of three pins which incorporates VCC, GND, and DATA.



Fig: 10 DHT Sensor

The threshold limit of various parameters are shown in table: 2 based on levels low, medium, high. The maximum value such as high level is said to be an threshold limit.

Table: 2 Threshold limit for gases

NAME OF PARAMETER	THRESHOLD LIMIT
PH level	7.35 - 7.45
Temperature	42.22°C
Humidity	30% - 60%
Carbon monoxide	70 ppm
Methane	1000ppm

### 5.3 Buzzer

It is used to give alert sound. It consists of information and GND pins. It has two state namely Normal/Abnormal. If it reaches to abnormal state, buzzer sound will produced. During this process beep sound are going to be measure within the variety of voltage variation. Its voltage varies from (1 to 5v).



Fig: 11 Buzzer

## 6. NETWORKING SECTION

In this section, the parameters which is measured using the sensors are stored in the Thinkspeak cloud platform using the Ai Thinker module through Wifi. Then the stored informations can be viewed by the client at any time. The Block diagram of Networking section is shown in the Fig.3



Fig: 12 Block diagram of Networking section.

### 6.1 Ai Thinker Module

This could be the primary series of modules made with the ESP8266 by the third-party manufacturer Ai-Thinker and remains the foremost widely available[7].To create a workable development system they require additional components, especially a USB adapter and an external 3.3 volt power supply. When project development is complete, those components aren't needed and these cheaper ESP-xx modules are a lower power, smaller footprint option for production runs.



Fig: 13 Ai Thinker Module

### 6.2 Thinkspeak cloud platform

In step with the developers the thinkspeak is an open source IoT application and API to store and retrieve data from things using the HTTP and MQTT protocol over the online via local area network.

## 7. CONCLUSION

The proposed system could be a low cost, and energy efficient prototype of an automatic monitoring system. The prototype system consists of the robot interfaced with sensors and controller. It's been designed using wireless transmission capable application processor modules because wireless transmissions are more flexible and that we can avoid the working problem. Also it helps in improving the efficiency of transmitting the signal and performance of the system and also reduces the value of extending the system. Drainage Detection system is meant and implemented for continuous monitoring and alerting to the drainage cleaning people.

To drag the robot forward high torque dc motors may be utilized. For parallel operation of the robot it may be integrated with GPS technology to seek out the pathway just in case of any emergency. This method may also be modified and used for detecting fire accidents or leakages within the system.

## REFERENCES

1. Sifat Rezwan, Taoseef Ishtiak, Rummana Rahman, Hafiz Abdur Rahman, "A Minimalist Model of IoT based Sensor System for Sewage Treatment Plant Monitoring", (2019) Eng. Struct., vol.48, pp.176-192.
2. R. Rajalakshmi, J. Vidhya, "Toxic environment monitoring using sensors based on arduino", (2019) in Proc. IEEE Environment. Eng Soc., pp.98-102.
3. Arulananth T.S, Ramya laxmi. G, Renuka. K, Karthick. K, "Smart Sensor and Arm based Drainage Monitoring System" (2019) International Journal of Innovative Technology and Exploring Engineering, vol 8 Issue 11.
4. R. Vijayalashmi, Dr. D. Sengeni, "IOT Based Smart Detection System for Harmful gases in Underground Sewages", (2017) International Journal For Research in Applied Science and Engineering Technology, vol 5 Issue 11.
5. Sugato Ghosh, Indranil Das, Deepajana Adak, Nillohit Mukherjee, Raghunath Bhattacharria, Hiranmay Saha, "Development of Selective and sensitive Gas Sensor for Manhole Gas Detection" (2016).
6. Sindhoor. S, "IoT Based Garbage Gas Detection System", (2016) International Journal of Computer Science and Mobile Computing, vol 5 Issues 9.
7. K. Krishnakumari, B. Suganthi, M. Yuganthi, P.S. Pooja, "Review of Natural Gas Leakage through gas Pipelines and Various Methods to Detect the Leakage", (2016) International Conference on Explorations and Innovations in Engineering and technology".
8. Chandler E. Kemp, Aravind P. Ravikumar and Adam R. Brandt, "Comparing natural gas leakage detection technologies using an open-souce virtual gas field simulator", (2016) Environmental science and technology, vol.4, Issues 12.
9. T. Leppanen, Harjula .E, Ylianttila .M, Ojala T and Yang .L, "Cloud things: A common architecture for integrating the internet of things with cloud computing", (2013) IEEE 17<sup>th</sup> International Conference on Computer Supported Cooperative Work in Design, 651-657.
10. Ramos .P.M, Pereira .J.M.D, Ribeiro .A.L, "A Four terminal water quality monitoring conductivity sensor", (2008) IEEE Transactions on instrumentation and Measurement, 577-583.