ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 2, February 2018

Explosion Detection and Drainage Monitoring by Automation System

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ABSTRACT: The Internet Of Things(IoT)connects all the surrounding smart devices(things) to internet. These devices use sensors and actuators to communicate with each other across the internet. IoT helps to control andsense the object remotely over the existing network,so that it has direct integration of physical world to computer based world.

The traditional Drainage Monitoring System failed to acknowledge in the field of alerting the people about the gas explosion, increase in the water level and the opened lid. Therefore,wehaveused the IoT technologytomakeDrainage Monitoring System in a highly automative by using sensor for detecting and sending alert messages to the authorities , storing the data in the cloud and displaying the details in the web browser. Thus, the proposed system helps in predicting the dangerous situations in Drainage system.

KEYWORDS: Internet Of Things, Water levelsensor, accelerometer sensor , gas sensor , automative , cloud , web browser.

I.INTRODUCTION

The Internet Of Things(IoT) is currently considered as a basic communication infrastructure for smart cities, where machines communicate automatically between each other (Machine to Machine).The Biggest advantage is the cooperation of many different communication technologies and devices(machines)within one functional system, where big amount of information and data are shared and used in a secure and smart way.

Monitoring the Drainage system is one of the major crisis in today's world. Inorder to have a proper drainage system its function has to be monitored regularly.Drainage monitoring team is not present on all areas which leads to occurrence of mishaps.

The irregular monitoring has contribution on the clogging of the drainage that imply to the siltation which trigger the flooding in the drainage.Manual monitoring is also inefficient.It needs a lot of manpower who are only able to record limited report with low accuracy .So these weakness lead to the slow handling for problems in drainage.

This system not only detects these conditions it also alerts through audible alarms and glowing of LED light. With a help of IoT , it alerts the concerned authority about the condition by sending messages through Wi-Fi module.

To solve these conditions this paper proposes a system that uses an

1} Gas sensorwhich is capable of detecting gases such asiso-butane , propane , LNG, carbon monoxide, methane and hydrogen sulphide[15].

2} Water level sensor is used to detect the level of substances that can flow. Such substances include liquids, slurries, granular material and powders[14].

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3} Accelerometer sensor is used to measure an objects orientation, velocity etc .It is used to obtain the positions in space[16].

II.RELATED WORK

Maintaining the drainage is very important to keep the city clean. If it is not maintained properly, it leads to many environmental hazards such as erosion problem, health deterioration like air and water borne disease.
To overcome all these problems the drainage monitoring system must be in a automated way,so that the officials can be aware of all the problem in a drainage system.
It is very difficult to maintain the drainage manually.It is a tedious process to inspect the state of the water level and also gases present in the drainage.It is also very difficult to estimate whether the lid is opened or closed in the drainage.
To solve all these problems an automation system is required.This automation system helps in detecting the problems that occurs in the drainage by and sensing all the information to the officials through the Wi-Fi module and the data are displayed in the web browser.
A system capable of easily confirming current events of amanholearerevealed in previous work entitled “Manhole state monitoring system”.However the conventional system has problems that the wired PSTN, that is the dedicationcommunication network. But current states of the manholes cannot be remotely managed by wireless.
This work improved by a paper entitled “A manhole monitoring system based on IoT[9]”.
This invention has been made to solve the above mentioned conventional art, andit provides a system for monitoring manholes in which manhole information transmitted and received through collecting terminal andcollects the informationsensed by the sensors, a server and a relay terminal.This system introduces pluralityof collecting terminals each including terminal unit that has at least one of an opening or closing sensor, water level sensor and temperature sensor to sense the current states of the manholes.But, Now a days one more dangerous problem observed that ismanhole explosion.
Explosion can be a result of the release of chemical andelectrical energy inside a manhole. Manhole explosion events can be classified into three categories mainly smoking events, fires and explosion due to sudden raise in pressure .Previous work fails to solve these kinds of problems because it increasesthe number of sensors, it can’t provide scalability.
So the present invention entitled“Automated Internet of Things for Underground Drainage and Manhole monitoring System (UDMS) for Metropolitan Cities”[10] overcomes all these problems. This system adopts three way alert systems at the managing station, which include LCD display, route map and speaker.

III.COMPONENTS

Fig3 shows the circuit diagram of the prototype.
The components used in making of this system are as follows

1.ArduinoUNO(ATMEGA328P)

Arduino is a computer hardware and software company, projectand user community that designs and manufactures microcontroller kits for holding digital devices and interactive objects that can sense and control objects[4].
Arduino is open source hardware. It is a board that comes preprogrammed that allows uploading new code to it without the use of an external hardware programmer.Arduino programs may be written in any programming language with a compiler that produces binary machine code[4].The arduino can be programmed with arduino software IDE.The gas sensor,accelerometer sensor,water level sensor are connected to this board for processing the sensor readings according to the program.Arduinopowers the Wi-Fi module which is stacked upon it for connectivity to internet.It also powers the GSM module which is used for sending message.The buzzer is used as an audible alarm and a led will glow when there is increase in the water level.

2. ESP8266

The ESP8266 Wi-Fi module is a complete Wi-Fi network where you can easily connect as a serving Wi-Fi adapter,wireless internet access interface to any microcontroller.

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Based design on its simple connectivity through serial communication or UART interface.
It helps in uploading sensor values in the cloud.It works under 3.3V and works with high speed.

3.GSM MODULE

GSM is the popular standard for mobile phones in the world.Its promoter,the GSM association,estimates that 80% of the global market[10].This GSM module is connected to arduino board which helps in sending text messages when the sensor values crosses the threshold values.
The SIM900A delivers GSM/GPRS 90/800MHz performance for voice,SMS,data in a small form factor with low power consumption.

4.GAS SENSOR

MQ-4 gas sensor is used to detect the presence of a dangerous LPG leak in a car or in a service station,storage tank environment[15].
This unit can be easily incorporated into an alarm unit,to sound an alarm or give a visual indication of LPG concentration[15]. The sensor has excellent sensitivity combined with a quick response time .The sensor can also sense iso-butane,propane,LNG, carbon monoxide,methane and hydrogen sulphide.It has high response rate[2].

5.WATER LEVEL SENSOR

Water level sensor is used to detect the level of substance that can flow.Such substances include liquids,slurries,granular material and powders[14].Such measurements can be used to determine the amount of materials within a closed container or the flow of water in open channels.

6.BUZZER

A piezoelectric buzzer may be driven by an oscillating electronic circuit or other audio signal source driven with a piezo electric audio amplifier.Sounds commonly used to indicate that a button has been pressed are a clicka ring or a beep[1].

7.ACCCELEROMETER SENSOR

Accelerometer or gyroscope[16] is used to measure an object's orientation,velocity etc.Often additionalsensors(magnetic, temperature) are included to improve accuracy.It is used to obtain the positions in space.

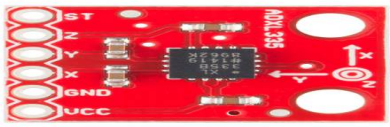

Fig2:Accelerometer sensor

8.LED

An LED is a small light (it stands for "light emitting diode") that works with relatively little power. The Arduinoboard has one built-in on digital pin.

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IV.SYSTEM DESIGN

ARCHITECTURAL DIAGRAM

Block diagram represents the major components of drainage monitoring system.

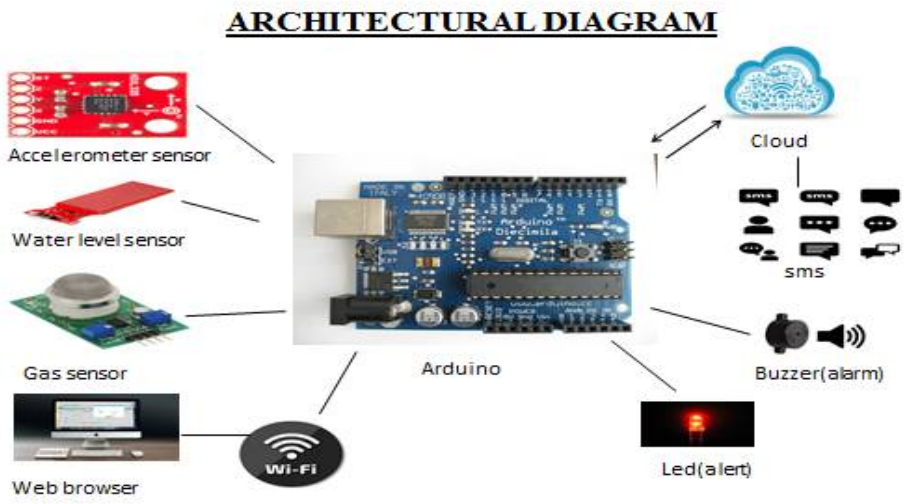

Fig2:Architectural diagram of drainage monitoring system

V.PROCESSING STEPS

Fig4 shows the flowchart depicting the workflow

1. Water level sensorconsists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with a different rate of flow[14]. The hall-effect sensor outputs the corresponding pulse signal. This one is suitable to detect flow in water in the drainage.
2. Accelerometer sensoruses the piezoelectric effect - they contain microscopic crystal structures that get stressed by accelerative forces, which cause a voltage to be generated[1]. Another way to do it is by sensing changes in capacitance.
3. Gas sensorsare available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors[15]. This Insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element[15]. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current.
4. **The** particular value is fixed as a threshold value.The threshold value is decided based on the behavior of the sensor.The value sensed by the sensor is checked against the threshold value.For accelerometer the angles are fixed .If there is any slight changes in the angle it ensures that the lid is open[16].
5. The readings from the sensor are collected and updated in the cloud.
6. If the sensor readings exceeds the threshold value the alert message are sent to the concerned authorities through GSM.
7. The buzzer is actuated when the readings exceeds the threshold value.
8. The led will glow when there is increase in the water level than the threshold value.
9. All this details are displayed in the web browser.

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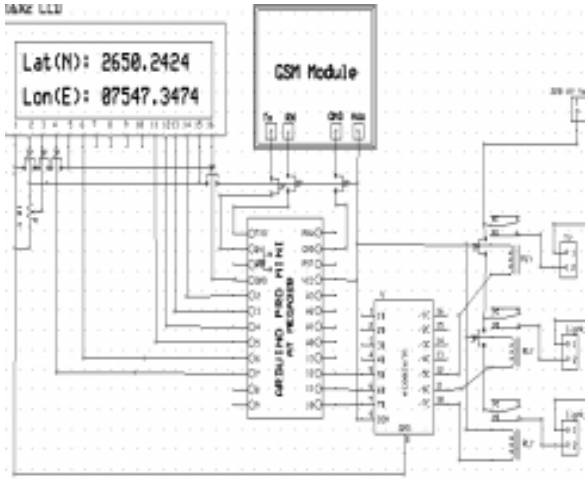

Fig3:circuit diagram

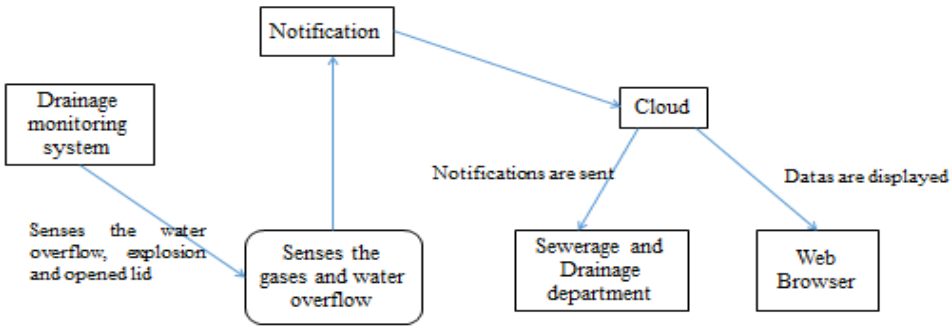

Fig4:Processing steps

VI.ACKNOWLEDGEMENT

We thank our Head of the Department (IT) **Dr.A.Joshi** for providing us all the necessary facilities.We express our sincere thankfulness to our Project Guide **Mrs.Dhanalakshmi.G** for her successful guidance to our project. Without the help it would be a tough job for us to accomplish this task. We thank our guide for her consistent guidance, encouragement and motivation throughout our period of work.

VII.CONCLUSION

Monitoring the drainage and detecting the explosion is the major problem. This project proposes different methods for monitoring an underground drainage system. Various parameters like gas explosion,opening and closing of lid,increase

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in water level are being monitored and updated on the internet using theInternet of Things[10][11]. All these details are displayed in the web browser.The buzzer produces alarm and led glows if any of these problems arise.
This enables the person in-charge to take the necessary actions regarding the defect. In this way the unnecessary trips on the manholes are saved .Also, real time update on the internet helps in maintaining the regularity in drainage check thus avoiding the hazards.

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