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Cloud Based Smart System for Monitoring and Managing Drainage using IoT

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ABSTRACT
In India the main concern is the drainage system. Sewage waste is overflowing due to less drainage system maintenance and even sewage waste also releases harmful gases that damage people's health status to fix this problem that we are implementing system that automatically monitors the drainage system using Internet of Things Technology. This device tracks the level of water flow, and recognizes hazardous gases. When the sensors exceed the threshold value, set of values will be stored, then evaluated in the cloud storage. The drainage status will be sent to near the corporate office as SMS via the Blynk server, and buzzer also starts making sound, then the corporation people will take appropriate action.

Key words: Blynk Server, Drainage system, GPS, Internet of Things, Node MCU.

1. INTRODUCTION

The world is rapidly growing into smart cities but the issues encountered are still primitive ones[14]. In its planning systems the modern world has a great need for modern advances and sophistication [12]. Smart cities need innovative technology, where the infrastructure of the city is survived by installing sensors to address the age-old issues [7].The one major issue detecting the blockage in the underground drainage system. Drainage system plays a critical function in major cities where millions of people live. Drainage system from the surplus and unused precipitation, Rain water and waste water is known as the basis for land dryness. To keep its proper work, the drainage conditions should be controlled. Not every area actually has a drainage management group. [10] It leads to intermittent monitoring of drainage condition. Irregular monitoring contributes to blocking drainage. Manual control is often ineffective. It needs a lot of committed individuals who can record only limited report with low accuracy.

In such drainage lines the issue emerges may bring serious problems to the city's daily routine. Issues such as waste material blockage, sudden rise in water level as well as potentially toxic gases may be created if the regular cleaning steps are not taken from time to time. If this issue is not understood it will have some severe repercussions. The drainage system of today is not computerized, so it is difficult to know whether blockage happens in a specific area. The waste in these drainage lines can also often contain different gases such as methane (CH4), carbon monoxide (CO), etc. that are dangerous and can cause serious problems if humans inhaled these gases in large quantities and due to this issue the drainage workers are usually threatened with death. Also manual monitoring system doesn't get early warnings about the blockage or the increase in the volume of such gases or the rise in the water level. Therefore blockage identification and repair becomes time-consuming and hectic [8]. The presented system is installed to a variety of strategic sewer system for initial evaluation. Smart drainage system makes use of microprocessor properties. This decreases man-effort and gives fast check on the issue as well. The system should be able to incorporate into standard monitoring / alarm systems to scrutinize the variations in the sewer [9].

2. RELATED WORK

Arulananth et.al. [1] have designed the system to regulate water level, water flow, and gases. If the drainage system is blocked and water overflows, the blockage will be detected instantly by the sensor. Different sensors that surpass the minimum threshold will indicate the problem and display the warning on the 16x2 LCD and will communicate this data to the nearby local municipality for more corrective action via GSM. A smart drainage management scheme will mainly help protect the protection of people living in surrounding areas during the rainy season and guarantee people are protected. This monitoring also ensures instinctive action on the part of government employees. At times, when the sky isn't clear, the sensors don't give precise values, there will be network problem in GSM.
Gaurang sonawane et.al.[2] Represents the smart and real-time Drainage and Manhole Monitoring System

technology and design functionality with the help of Internet of Things. Drainage manhole covers will have a module which will interface microcontroller with gas sensor, level indicator, NRF. If the blockage happens between two manholes, the system will detect and it will also sense the rise in the amount of various gases that are dangerous to humans, as well as a water level control device, so it will raise an alert and provide information to the health authorities from which appropriate measures can be taken.

Yash Narale et.al.[3] proposed the implementation and construction functions of various methods for controlling and maintaining underground drainage systems. It also includes an overview of the water wise device and method for detecting leakage faults in wastewater pipelines. Also some parts of the condition rating system for underground infrastructure are also clarified as Efficient Water Mains and Intelligent framework for sustainable drainage evaluation, restoration and management.

Dr. Gunasekaran at.el.[4] have proposed a System for the control and maintenance of groundwater drainage. It describes complex applications such as real time underground maintenance and tracking. On the Internet of Things, Arduino, Water flow sensor, and Global Mobile System (GSM) have been tracked and updated. This allows the in change individual to demand the actions of the same site mistreatments. Often update on the network in real time that helps to keep and verify that will minimize and avoid the dangers. The water quality metering system was introduced and tested at low price, reliable, and time span. This system gives the immediate message to officers via GSM. And the municipal officer's will keep track of the levels of contamination that occur within the drainage.

R. Girisrinivaas at.el.[5] have proposed a Drainage Overflow Management System (DOMS) model. This proposed system would track the level of water and gas in the drainage system, and the calculated values will be stored in the cloud storage, then analysed, and the state of the drainage system will be sent as SMS to nearest corporate office using GSM. A GSM WSN is proposed and built using ultrasonic sensors for surface drainage detection. Under the rainfall scenario it is applied as an application for the rainfall control and flood prediction. Based on the testing of the experiment, it detects and records right water level.

Dr S Ravichandran at.el.[6] describes a smart drainage management system. Good system for handling drainages. The drainage system explains the nature and process by which the blockage is found and the same is removed in the drainage system using internet of things. The manholes in the drainage have a module that interfaces microcontroller with gas sensor, level indicator, RFID. Whenever the level detector detects any blockage between two manholes, it will activate an alert and warn the user about the exact position by pointing out different colours depending on the distance from the blockage.

3. SYSTEM DESIGN

3.1 Block diagram

Figure 1 shows the system block diagram which consists of GPS sensor nodes, network controller, and cloud storage. In addition, a remote graphical user interface is developed to interpret the effects of the information and application. [11] The sensor nodes react to the observed voltage level by using the corresponding sensor to calculate the physical parameter, based on the proposed system design. The Blynk server will then be used via a wireless link to transmit these collected data to the organizers. The coordinator focuses on the management of the cluster, data collection and the transmission of cloud storage information via mobile internet through Wi-Fi [13]. Open Blynk cloud data storage platform custom- WSN in this work. The Blynk platform provides a wide range of data.

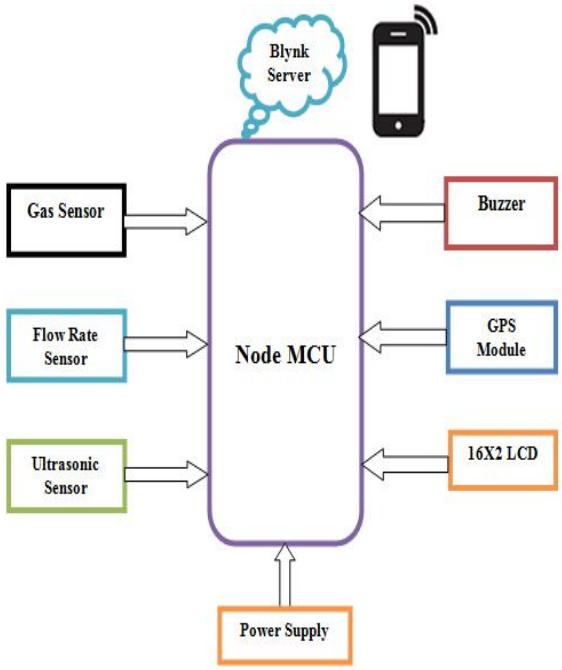

Figure 1: System block diagram

Figure 2 shows the flowchart of the drainage system. The hardware devices are connected to the power supply. The LCD initially displays the flow rate and the environmental condition of the device, with or without dangerous chemicals. If the ultrasonic sensor is activated, the buzzer is switched on and the sound and GPS location is switched on and the warning is sent to the registry phone. When the system starts taking power supply externally all the sensors will start to work. The gas sensor detects the noxious gases and reports to node MCU. The water flow rate sensor monitors water flow

and also checks water level and sends the values to the node MCU. Node MCU that has the built-in wifi module will process the sensor-sent information / values and display them in the blink server app. The observed values are shown in 16X2 LCD, and if the sensed values reach the threshold levels then the buzzer begins to make sound.

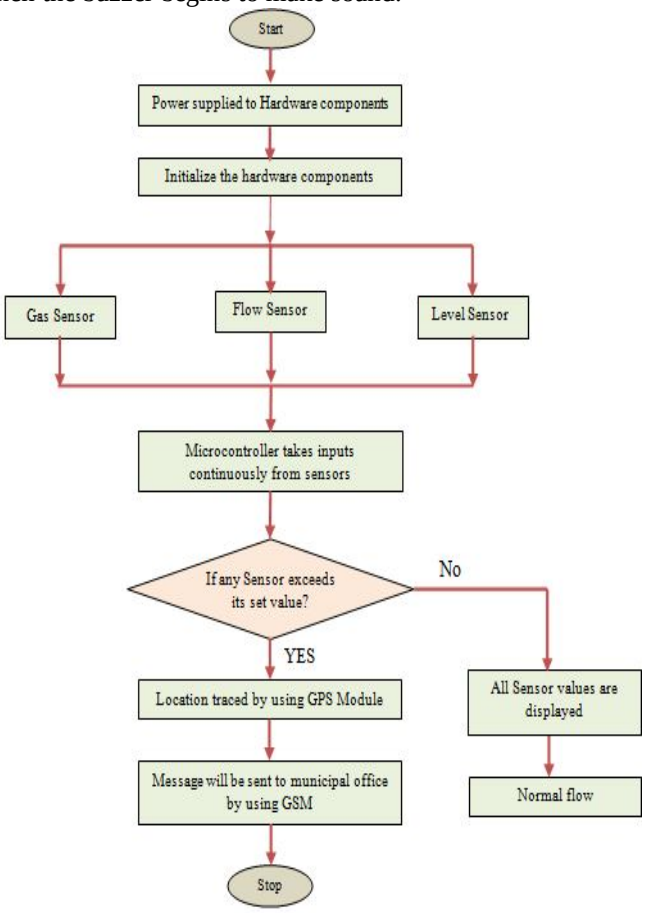

Figure 2: System Flowchart

Following steps explains how the smart drainage system works:

Step1: Start
Step 2: Power supplied to hardware components.
Step 3: Hardware Module initialized.
Step 4: Node MCU Microcontroller receives the sensed value from gas Sensor, Flow sensor and Level Sensor
Step 5: Node MCU Checks the sensed value with threshold value.
Step 6: If the sensed value exceeds the threshold value location will be identified and using GPS and message will be sent to municipal office using GSM.
If the sensed value not exceeds threshold value normal flow will be continued.
Step 7: All sensed values are displayed on LCD screen.
Step 8: Stop.

4. EXPERIMENTAL RESULTS

Figure 3 shows the prototype of smart drainage system. All the sensors in the system will start working when power supplied from externally [15]. All the sensors sense the information and report that information to Node MCU. The gas sensor senses the harmful gases; water flow rate sensor will check the flow of water and also check the level of water and sends the values to the node MCU. Node MCU designed with inbuilt wifi module will process the information sent by the all the sensors and store that information in the cloud. Also that value will be displayed in blink server app installed in smart phone as shown in Figure 4. The recorded values will be displayed in 16X2 LCD as shown in Figure 5 and 6.If sensed values exceed the threshold values then buzzer starts making sound and also sends information to local municipal officer via SMS .The concern Officer can check the status of Drainage system in their smart phone using blynk server app and they can take further action based on the status and also they can identify the location.

Figure 3: System Prototype

Code to identify the location of drainage

```
gps.f_get_position(&flat, &flon);
smartdelay(1000);
float flat, flon;
gps.f_get_position(&flat, &flon);
Blynk.virtualWrite(V0,flat);
Blynk.virtualWrite(V1,flon);
Serial.println(flat);
Serial.println(flon);
```

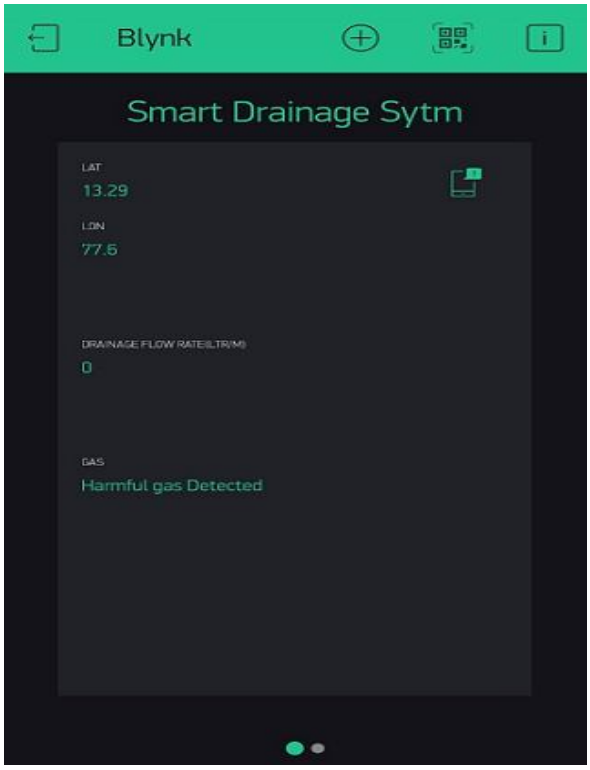

Figure 4: Blynk app display

Figure 5: Water flow level displayed on LCD Screen

Code to detect the dangerous gas

```
gasvalue=digitalRead(gas);
if(gasvalue==0)
{
  lcd.setCursor(0,1);
  lcd.print("Gas Detected");
  Blynk.virtualWrite(V3,"Harmful gas Detected");
}
else if(gasvalue==1)
{
  lcd.setCursor(0,1);
  lcd.print("Gas not Detected");
  Blynk.virtualWrite(V3,"Harmful gas not Detected");
}
```

Figure 6: LCD Displays when harmful gas detected

5. CONCLUSION

Underground drainage control is nowadays a big issue. This paper offers a cloud-based Smart drainage monitoring framework that prevents the issues faced by local people stay near drainage. With the assistance of sensors such as ultrasonic, gas and water flow level sensors, this device eliminates drainage system problems. This system helps to alert the registered municipal number when the harmful gases are detected by a gas sensor and the level of water flow is detected by an ultrasonic sensor using Wi-Fi module such as NODE MCU connected to the blink server. All of the information is processed and accessed from and to the cloud. Future improvement may require what kind of dangerous gases are present in drainage systems.

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