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Smart Drainage Monitoring and Controlling System Using IOT

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ABSTRACT:
India is constantly moving towards automation and aiming to build every city a smart city. For making a smart city we need to consider many parameters such as smart water management, smart electricity management, smart transportation etc. There will be a need of smart underground infrastructure which includes underground water pipelines, communication cables, gas pipelines, electric flow, etc. As most of the cities in India have adopted underground drainage system, it is very important that this system should work in a proper manner to keep the city clean, safe and healthy. If they fail to maintain the drainage system, the pure water may get contaminated with drainage water and can spread infectious diseases. So different kind of work has been done to detect, maintain and manage these underground systems. Also, leaks and bursts are unavoidable aspects of water distribution system management and can account for significant water loss within a distribution network if left undetected for long period. This project represents the implementation and design functions for monitoring and managing underground/road-sided drainage system with different approaches. It also gives a detail regarding the safety issues like gases which adversely affects to the workers, temperature details weather it is suitable for the workers or not and also blocking parts are present or not.
Keyword: *Blynk, IoT, GSM, GPS, Arduino, Node MCU Wi-Fi Module, Alarm, Sensors, LED.*

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I. INTRODUCTION

The underground drainage system is an important component of urban infrastructure. It is considered to be city's lifeline. Most management on underground drainage is manual therefore it is not efficient to have clean and working underground system also in such big cities, it is difficult for the government personnel to locate the exact manhole which is facing the problem. Therefore, it is essential to develop a system which can handle underground drainage without human intervention. Underground Drainage involves sewerage system, gas pipeline network, water pipeline, and manholes. This project describes various functions used for maintenance and monitoring of underground and road-sided drainage system. It provides a system which is able to monitor the water level, atmospheric temperature, water flow and toxic gasses. If drainage system gets blocked and water overflows it can be identified by the sensor system. And machine starts moving in the forward direction and clean all the blocking part of the drainage.

II. PROBLEM STATEMENT

Today's drainage system is not high-tech. So, whenever there is blockage, it is difficult to figure out the exact location of the blockage. Also, early alerts of the blockage are not received. Hence detection and repairing of the blockage become time consuming. It becomes very inconvenient to handle the situation when pipes are blocked completely. Due to such failure of drainage line people face a lot of problems.

III. PROPOSED SYSTEM

Our proposed system proposes the following features.

1. Detects the specific drain where the blockage occurs.
2. Immediate information of the blockage.
3. The system governs the flow of sewage from the pipes.
4. Use of flow sensors to detect the variations in the flow.
5. Get the prior alerts of blockages and locate them using IOT.
6. Trace location using GPS and send SMS through GSM.

IV. OBJECTIVES

1. Cleaner cities and intelligent management of drainage in the city.
2. Detection of drainage water level and blockages in the drainage.
3. Checking water flow rate continuously, as well as sending automatic mail, display on the monitor if the water level is outside of an expected normal range.
4. The main objective is to obtain an effective low-cost and flexible solution for condition monitoring and infrastructure management in the city.
5. Sensing the temperature and leakage of gas and updating it in real time through IoT.

V. LITERATURE REVIEW

4.1 The design space of wireless sensor networks, Wireless Communications

Author: Romer, K. Mattern,

Description: In the recent past, wireless sensor networks have found their way into a wide variety of applications and systems with vastly varying requirements and characteristics. As a consequence, it is becoming increasingly difficult to discuss typical requirements regarding hardware issues and software support. This is particularly problematic in a multidisciplinary research area such as wireless sensor networks, where close collaboration between users, application domain experts, hardware designers, and software developers is needed to implement efficient systems. In this paper we discuss the consequences of this fact with regard to the design space of wireless sensor networks by considering its various dimensions. We justify our view by demonstrating that specific existing applications occupy different points in the design space.

4.2 Towards the Implementation of IoT for Environmental Condition Monitoring in Homes

Author: Kelly S.D.T, Suryadevara, N.K, Mukhopadhyay S.C

Description: In this paper, we have reported an effective implementation for Internet of Things used for monitoring regular domestic conditions by means of low-cost ubiquitous sensing system. The description about the integrated network architecture and the interconnecting mechanisms for reliable measurement of parameters by smart sensors and transmission of data via internet is being presented. The longitudinal learning system was able to provide self-control mechanism for better operations of the devices in monitoring stage. The framework of the monitoring system is based on combination of pervasive distributed sensing units, information system for data aggregation, reasoning and context awareness. Results are encouraging as the reliability of sensing information transmission through the proposed integrated network architecture is 97%. The prototype was tested to generate real-time graphical information rather than a test bed scenario.

4.3. Monitoring Smart City Applications using Raspberry PI Based on IOT

Authors: Prof. S A.Shaikh 1, Suvarna A. Sonawane.

Description: The Smart city is the development goal to monitor the quality of resource in the city to improve good management and faster development of the city required necessity is to upgrade healthy and safe cities that delivering real time services and latest facility to implement the concept of smart city use IoT concept by which easy wireless communication is possible. The system consists of sensors, collect different types of data from sensors and transfer to the Raspberry Pi3 controller. The acquired output from the controller is sent to the control room through the E- mail and also display on the personal computer.

VI. SYSTEM SPECIFICATION

1`. Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the microchip ATmega328P microcontroller. the board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards(shields) and other circuits .it can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

Fig 1 Arduino Uno

2. Node MCU

Node MCU is an IoT framework that is open source. A micro-controller device is a compact machine operating on an integrated circuit board with single MOS. A micro-controller has one or more central processing units, with memory peripherals for input / output.

Fig 2 Node MCU

3. Temperature Sensor LM35

The LM35 series are a precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade-scaling.

Fig 3 Temperature Sensor

4. Gas Sensor MQ135

A gas detector is a device that usually as part of a security system detects gas occurrence in a region. This type of equipment is used to notice gas leakage or other emissions, and can interface with a control system to automatically shut down a method. A gas detector may sound an alarm associated with operators in the region where leak occurs, allowing them to leave.

Fig 4 Gas Sensor

5. Ultrasonic Sensor

An ultrasonic detector is a device that tests the distance to an object by taking sound waves. This detects distance by allowing a sound wave to return at a specific frequency and by waiting for that sound wave.

Fig 5 Ultrasonic Sensor

6. Liquid Crystal Display LCD

Liquid crystal Display LCD is a blend of two solid and liquid states of matter. It is an electronic display module with a 16x2 LCD screen which says that it has 16 characters with respect to 2 rows. LCD uses a crystal liquid to produce a visible image. Such technique has been used to show an picture on a laptop or some other computer tool.

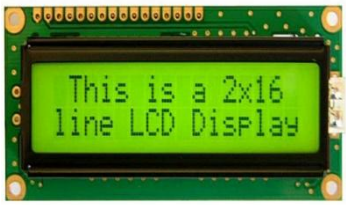


Fig 6 Liquid Crystal Display

7. GPS MODULE:

GPS utilizes satellites to detect the location of any GPS monitoring chip item, including cars, humans and pets. This functions independently of atmospheric factors and offers spatial details in real time.

8.GSM MODULE

SIM900 GSM Module is the module that supports communication in 900MHz band. We are from India and most of the mobile network providers in this country operate in the 900 MHz band. If you are from another country, you have to check the mobile network band in your area. A majority of United States mobile networks operate in 850 MHz bands (the band is either 850 MHz or 1900 MHz). Canada operates primarily in 1900 MHz band.

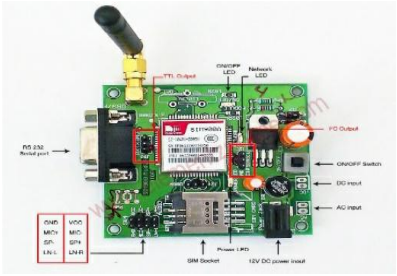


Fig7 GSM

8. Blynk application for android

Blynk was set up for the IOT. It can remotely track devices, display sensor data, store data, simulate and do a lot of other cool things. There are three major components on the platform

1. Blynk App - Lets you to create stunning interfaces for your projects using the various widgets that we provide.

2. Blynk Server - Responsible for all interactions between smartphones and equipment. You may either use our Blynk Platform or operate your own Blynk server locally. It's open-source, can accommodate thousands of devices quickly, and can even be installed on a Raspberry Pi.

3. Blynk Libraries - All common hardware platforms enable contact with the server and process both incoming and outcoming commands.

Features of Blynk Application:

1. Similar API & UI for all supported hardware & devices.
2. Connection to the cloud using Wi-Fi
3. Bluetooth and BLE
4. Ethernet
5. USB (Serial)
6. GSM
7. Set of easy-to-use Widgets
8. Direct pin manipulation with no code writing
9. Easy to integrate and add new functionality using virtual pins.
10. History data monitoring via Super Chart widget
11. Device-to-Device communication using Bridge Widget
12. Sending emails, tweets, push notifications, etc.

VII. METHODOLOGY

1. PROPOSED SYSTEM

Fig.9 shows the system block diagram of the proposed system, the network consists of GPS sensors nodes, network coordinator, and Cloud storage. A remote graphical user interface is further developed to examine the information and analysis results. Based on the proposed system architecture, sensor nodes response to sample

the physical parameter to measurable voltage level through corresponding sensors; The Blynk server is then used to transfer these acquired data to the organizer via a wireless connection. Coordinator is focusing to constellation maintenance, collect data and transfer the reassemble information to the cloud storage using the Wi-Fi through mobile internet. Open WSN Cloud data storage platform Blynk custom-made in this work. The Blynk platform offers versatile data assortment and visual image; therefore, ease the support of enormous number of sensor data and GPS locations are streams and viewed. An underground drainage monitoring system will not only help in maintaining the proper health and safety of the city but also in reducing the work of government personnel. Various types of sensors (Ultrasonic, temperature and gas sensors) are interfaced with Arduino uno in order to make the system smart. When the respective sensors reach the threshold level, the indication of that respective value and sensor is being sent to the controller. Furthermore, Arduino uno then sends the signal and location of the manhole to the municipal corporation through GSM and GPS and the officials could easily locate which manhole is having the problem and could take appropriate steps. Also, Arduino Uno updates the live values of all the sensors in the manholes falling under the respective area using IoT. message will also be displayed on the LCD.

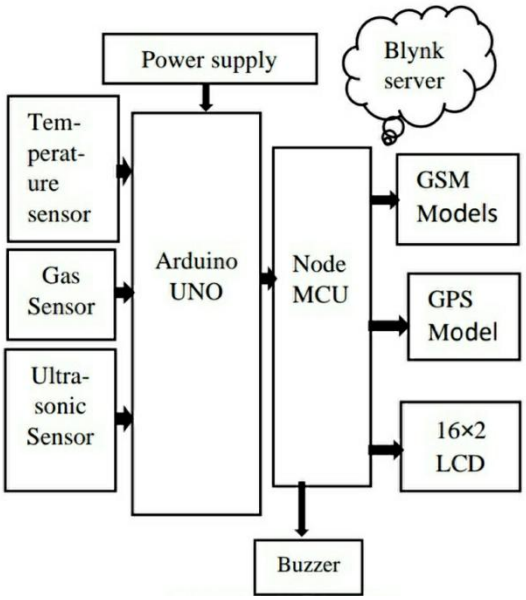


Fig 8 Block Diagram

2. ALGORITHM

1. Power Up hardware.
2. Initialize hardware Module
3. Arduino sense Sensor value.
4. Temperature sensor sense temperature display value on LCD.
5. Gas sensor check for gas level in environment.
6. GPS trace location of that place.
7. By using GSM location will be sent.
8. If any sensor exceeds than its set value. Then GSM through message will be sent.
9. IOT used for sensor related data will be updated on the web server.
10. All information will be display on LCD.
11. STOP

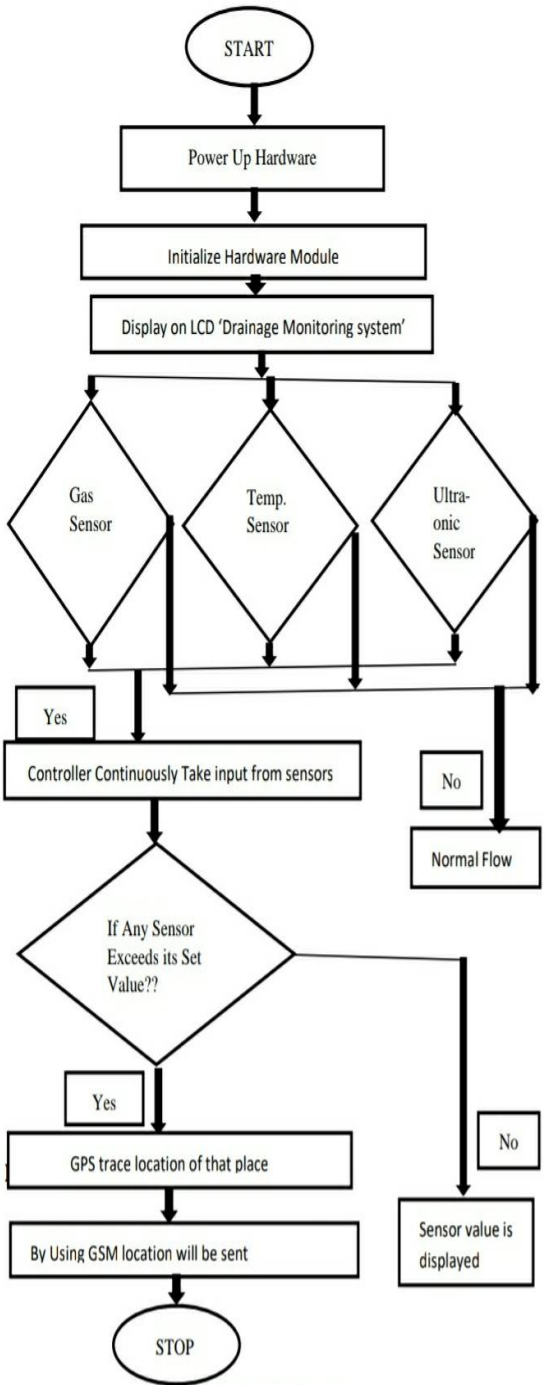
3. FLOW CHART

As Shown in Fig.10 Link the device (Hardware) to the power supply. Initially, the LCD shows the flow rate and the system's environmental state, with or without dangerous gases. If the ultrasonic sensor is triggered, the buzzer will be activated and the sound and GPS position and the notification will be transmitted to the registry phone. If there is a wave, the wave sensor is sensed and the flow rate is reflected on the LCD.
Figure 9 Flowchart of the project

VIII. ADVANTAGES

1. Increment in safety precautions for manual cleaning.

2. Real time monitoring and analysis of whole drainage system



3. Detecting the pollutants, we can determine the level of risk in deploying the workers in particular manhole
4. Battery monitoring for easy maintenance
5. Easy interpretable GUI for every type of users
6. Automation and alerting in case for emergency and potential hazardous situations.

IX. RESULTS

When the system gets started by taking power supply externally all the sensors will start working. The gas sensor senses the harmful gases and reports to node MCU. The Ultrasonic sensor will check the level of water and sends the values to the node MCU. Node MCU which is having the in-built Wi-Fi module will

process the information/values sent by the sensors and will be displayed in blink server app. The recorded values will be displayed in 16X2 LCD and if sensed values exceed the threshold values, then buzzer starts making sound, and led blink.

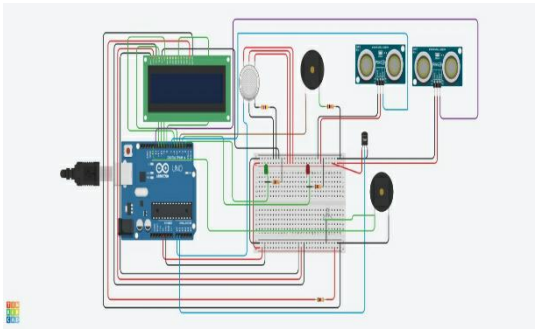


Fig 10 Prototyping of working model

X. CONCLUSION

Underground monitoring is challenging problem. This project proposes different methods for monitoring and managing underground drainage system. It explains various applications like underground drainage and manhole identification in real time. Various parameters like temperature, toxic gases, and level of water are being monitored and updated on the internet using the Internet of Things. This enables the person in-charge to take the necessary actions regarding the same. In this way the unnecessary trips on the manholes are saved and can only be conducted as and when required. Also, real time update on the internet helps in maintaining the regularity in drainage check thus avoid the hazards**.** Our project helps to reduce the problems of drainage system with the help of sensors like ultrasonic, gas and Temperature sensors. Our mechanism helps to notify the registered number, when the harmful gases are detected to gas sensor and level is detected by ultrasonic sensor, with help Wi-Fi module like NODE_MCU Arduino which is connected with the blink server. By this project the underground drainage system can be easily organized.

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