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Underground Drainage Monitoring System Using IoT

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ABSTRACT

India has announced a project of making 100 smart cities. For making a smart city one needs to consider many parameters such as smart water, smart electricity, 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 drainage system with different approaches. It also gives a description of water wise system and detection method to detect leakage defects in sewer pipeline. Also, some part of condition rating model for underground Infrastructure Sustainable Water Mains and Intelligent system for underground pipeline assessment, rehabilitation and management are explained.

Keywords*: Drainage Monitoring System, IoT, Monitoring Smart City.*

1. INTRODUCTION

1.1 OVERVIEW OF THE SYSTEM

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 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 that sensor sends information via the transmitter which is located in that area to the corresponding managing station.

1.2 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.

So this system proposes:

- Detect the location
- The system governing the flow of sewage from the pipes.
- Use of flow sensors to detect the variations in the flow.
- Get the prior alerts of blockages and locate them using IOT. Trace location using GPS and send SMS through GSM.

1.3 OBJECTIVES

- Cleaner cities and intelligent management of drainage in the city.
- Detection of drainage water level and blockages in the drainage.
- 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.
- The main objective is to obtain an effective low-cost and flexible solution for condition monitoring and infrastructure management in the city.
- Sensing the temperature and leakage of gas and updating it in real time through IoT.

1.4 LITERATURE SURVEY

A. 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 consist 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.

B. Automated Internet of Things for Underground Drainage and Manhole Monitoring System for Metropolitan Cities.

Author: Muragesh S. K1 and Santhosha Rao

Description: The Internet of Things (IoT) consists of real life objects, communication devices attached to sensor networks in order to provide communication and automated actions between real world and information world. IoT came into existence because, without human interaction, computers were able to access data from objects and devices, but it was aimed at, to overcome the limiting factors of human entered data, and to achieve cost, accuracy and generality factors. Sensor Network is a key enabler for IoT paradigm. It represents the implementation and design function of an Underground Drainage and Manhole Monitoring System (UDMS) for IoT applications. The vital considerations of this design are low cost, low maintenance, fast deployment, and a high number of sensors, long life-time and high quality of service. The proposed model provides a system for monitoring the water level and atmospheric temperature and pressure inside a manhole and to check whether a manhole lid is open. It also monitors underground installed electric power lines. In real time, UDMS can remotely monitor current states of the manholes.

2. SYSTEM DESIGN

2.1 BLOCK DIAGRAM

Below diagram represents the major components of the Underground Drainage Monitoring system.

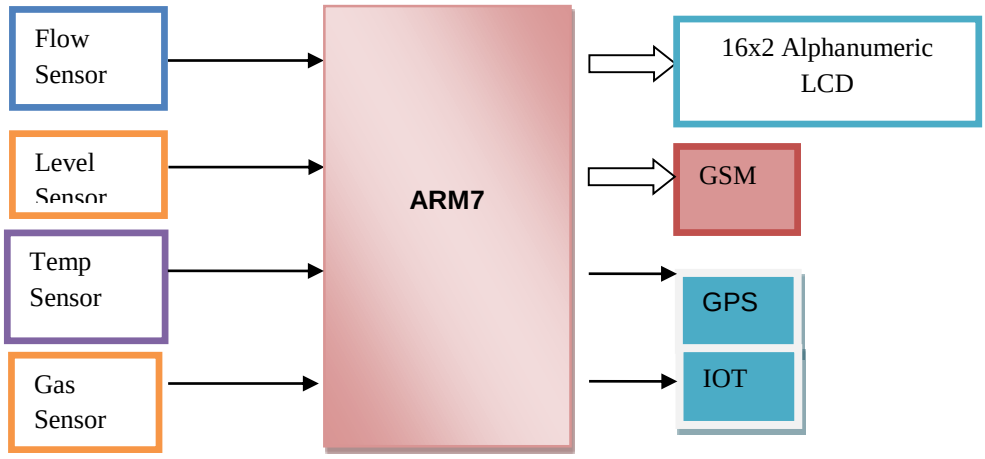

Fig1: Block Diagram of Underground Drainage Monitoring System

2.2 WORKING

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 (flow, level, temperature and gas sensors) are interfaced with microcontroller ARM7 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 microcontroller. Furthermore, ARM7 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, ARM7 updates the live values of all the sensors in the manholes falling under the respective area using IoT. A message will also be displayed on the 16*2 LCD.

3. System Specifications

3.1 ARM 7
ARM7 is widely used processor family in embedded system applications. It is manufactured by Philips and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as a high end application developer.

3.2 LM35 (TEMPERATURE SENSOR)
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.

3.3 LCD (LIQUID CRYSTAL DISPLAY)
LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.

3.4 CO2 SENSOR
This is a simple-to-use Carbon Monoxide (CO) sensor, suitable for sensing CO concentrations in the air. The MQ-7 can detect CO-gas concentrations anywhere from 20 to 2000ppm.
This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. It has good sensitivity to carbon monoxide in a wide range and has advantages such as long lifespan, low cost, and simple drive circuit &etc.

3.5 LEVEL SENSOR
Level sensors detect the level of liquids and other fluids and fluidized solids, including slurries, granular materials, and powder that exhibit an upper free surface. Substances that flow become essentially horizontal in their containers (or other physical boundaries) because of gravity whereas most bulk solids pile at an angle of repose to a peak.

3.6 GPS
The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

3.7 GSM

Fig 2: GSM

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.

3.8 FLOW SENSOR/METER

Water flow sensor consists 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. The hall-effect sensor outputs the corresponding pulse signal. This one is suitable to detect flow in water dispenser or coffee machine.

Features:

- Compact, Easy to Install
- High Sealing Performance
- High Quality Hall Effect Sensor
- RoHS Compliant

4. FUTURE WORK

Sensor networks are considered as the key enablers for the IoT paradigm. However, due to the widening variety of applications, it is increasingly difficult to define common requirements for the WSN nodes and platforms. This project addresses all automated Internet of Things for Underground Drainage phases of the practical development of an Underground Drainage Monitoring System (UDMS) through IoT applications for metropolitan cities. A real life, demanding application is selected as a reference to guide. Aspects of sensor network platform considered are: platform structure, flexibility and reusability, optimization of the sensor nodes, optimization of the communication, error recovery from communications and node operation, high availability of service at all levels, application server reliability and the interfacing with IoT applications. This project can be used to guide the specification, optimization, and development of sensor network Platforms for other IoT application domains.

5. ALGORITHM

- Power Up hardware.
- Initialize hardware Module.
- Display On LCD as "**DRAINAGE MONITORING SYSTEM**"
- Microcontroller sense Sensor value.
- Temperature sensor sense temperature display value on LCD
- CO2 sensor check for carbon dioxide level in environment.
- When level increases and flow decreases at that time.
- GPS trace location of that place.
- By using GSM location will be send.
- If any sensor exceeds than its set value. Then GSM through message will be sent.
- IOT used for sensor related data will be updated on the web server.
- All information will be display on LCD.
- STOP

5. FLOWCHART

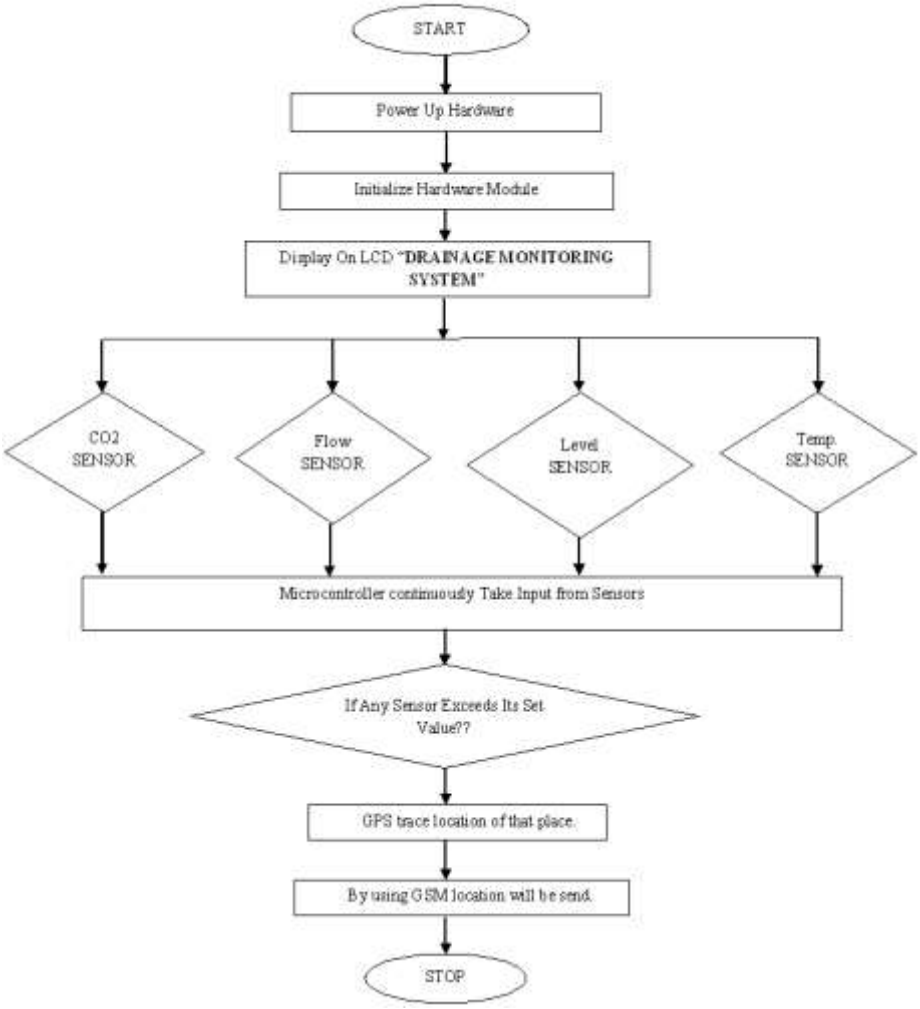

Fig 3: Flow Chart

7. 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, flow 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 avoiding the hazards.

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