UNDER GROUND DRAINAGE MONITORING SYSTEM USING IOT

[1]K.VISWANADH,[2]P.ROJITHA,[3]SK.KHADIJA,[4]S.M.S.P.C.VENKATARAJU,[5]P.NAGAMANI
[1,2,3,4]UG Student,[5]Assistant Professor, Department of Computer Science and Engineering,
Godavari Institute of Engineering & Technology, Rajahmundry, AP

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.

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. Most of the cities adopted the underground drainage system and it is the duty of managing station (Municipal Corporation) to maintain cleanliness of the cities. If the drainage maintenance is not proper the pure water gets contaminate with drainage water and infectious diseases may get spread. The drainage gets blocked during rainy season, it will create problem for routine life such as traffic may get jammed, the environment becomes dirty, and totally it upsets the public. Suppose if there should be a facility which would be there in Municipal Corporation (managing station) that the officials come to know immediately after blocking of drainage in which area and the exact place where it is blocked. Therefore, it is essential to develop a system which can handle underground 3 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. 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. 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. 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.

II. Existing system

Today's drainage monitoring system is not automated. 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.

IV.Block Diagram and Its Working

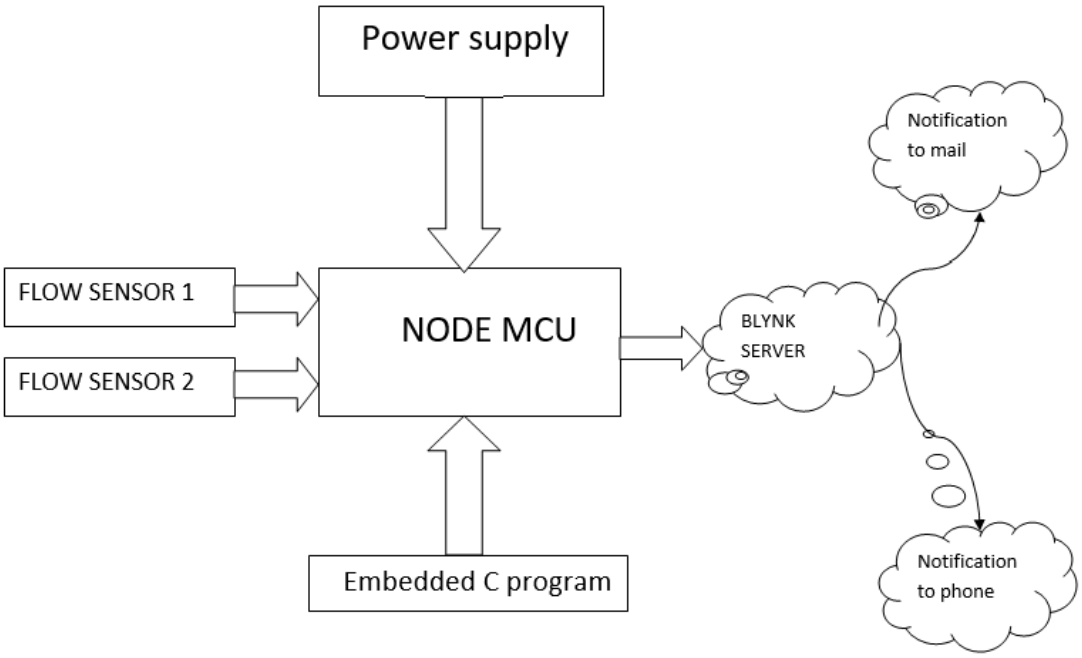


Fig 4.1: Block Diagram of Drainage monitoring system

The figure 4.1 explains that our project consists of two flow sensors, one for each drain, nodemcu and blynk application. The main theme is to identify any drainage clogs. Therefore, here we use the flow sensors to check the regular flow of the sewage fluid and if there are any abnormal flows then it will send the corresponding information to nodemcu. The nodemcu depends is connected to Wi-Fi and upon receiving the information from the flow sensor the data will be sent to blynk cloud through API. The flow of the fluid can be seen in the blynk application and when the clog occurs the notification is sent to the blynk application as well as the registered Email.

V.SYSTEM SPECIFICATION

NodeMCU

NodeMCU is an open source LUA based firmware developed for ESP8266 wifi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board.

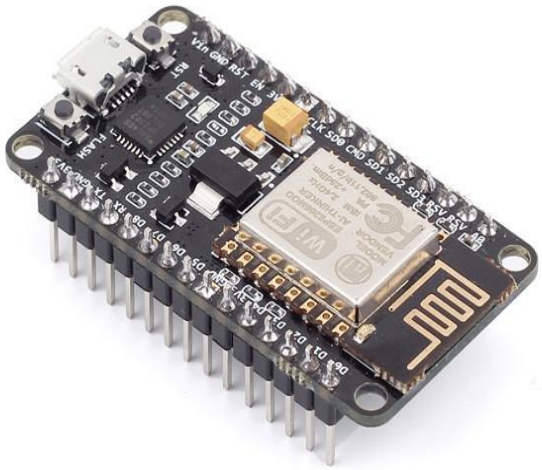


Fig 5.1: Node MCU

The figure 5.1 nodemcu is a board which is used to take the readings from the flow sensor when the power supply is given. Nodemcu here is connected to Wi-Fi which is used to send the notifications to the blynk cloud regarding the changes in the flow of sewage fluid.

Features

- Finally, programmable Wi-Fi module.
- Arduino-like (software defined) hardware IO.
- Can be programmed with the simple and powerful Lua programming language or Arduino IDE.
- USB-TTL included, plug & play.
- 10 GPIOs D0-D10, PWM functionality, IIC and SPI communication, 1-Wire and ADC A0 etc. all in one board.
- Wi-Fi networking (can be used as access point and/or station, host a web server), connect to internet to fetch or upload data.
- Event-driven API for network applications.
- PCB antenna.

Flow Sensor

A flow sensor is a device used to measure the instant flow rate or quantity of a gas or liquid passing through a pipeline. Flow meters are also known to by other names, such as flow gauge, flow indicator, liquid meter, etc. depending on the particular industry.

Fig 5.2: Flow Sensor

The figure 5.2 here is used to calculate the flow rate of the sewage fluid at all the time intervals and gives the information to nodemcu ranging between 1-31 LPM.

Working of Flow sensor

The Arduino flow meter works on the principle of the Hall effect. According to the Hall effect, a voltage difference is induced in a conductor transverse to the electric current and the magnetic field perpendicular to it. Here, the Hall Effect is utilized in the flow meter using a small fan/propeller-shaped rotor, which is placed in the path of the liquid flowing. The liquid pushes against the fins of the rotor, causing it to rotate. The shaft of the rotor is connected to a Hall Effect sensor. It is an arrangement of a current flowing coil and a magnet connected to the shaft of the rotor, thus a voltage/pulse is induced as this rotor rotates. In this flow meter, for every liter of liquid passing through it per minute, it outputs about 4.5 pulses. This is due to the changing magnetic field caused by the magnet attached to the rotor shaft as seen in the picture above. We measure the number of pulses and then calculate the flow rate in liters per hour (L/hr) using a simple conversion formula.

Blynk Application

Blynk was designed for the internet of things. It can control hardware remotely, it can display sensor data, and it can store data, visualize it and do many other cool things.
There are three major components in the platform:

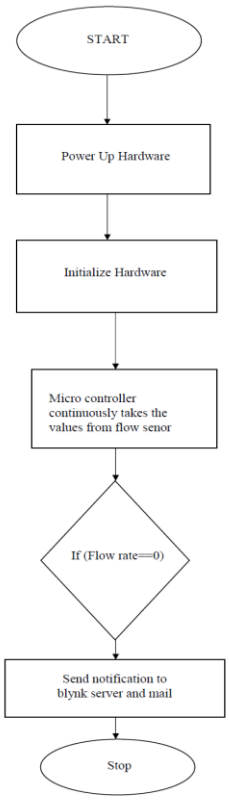
- **Blynk app** - allows to you create amazing interfaces for your projects using various widgets we provide.
- **Blynk server** - responsible for all the communications between the smartphone and hardware. You can use our blynk cloud or run your private blynk server locally. Its open-source, could easily handle thousands of devices and can even be launched on a raspberry pi.
- **Blynk libraries** - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

Features of Blynk Application

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

VI.FLOW CHART

The following diagram explains about the work flow of our project.



VII.Future work

Sensor networks are considered as the key enablers for the IoT paradigm. This paper addresses all about smart and real-time Drainage monitoring system through IoT applications. By using various sensors such as flow sensor, water level as well as blockage detection we can monitor the real time scenario of drainage system by detecting the problems in drainage system. By doing this we can able to take particular action on the problems as we will receive the early alerts of blockage as well as increase. This can be used to design the smart and real time drainage system for monitoring as well as troubleshooting purpose.

VIII.Conclusion

Underground drainage 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 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. By using this project, we can reduce the man power and time consumption to verify the manhole blocking and underground drainage pipe lines and also avoids the hazards. If the person in charge and doesn't have a smart phone to access the blynk application or he/she unable to check email regularly, we can send the notification through SMS alert, but we not added this SMS module to our project which is the limitation.

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