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Smart Drainage Monitoring and Clog Identification Using IOT

Shruthi Shri A. S.
Department of Electronics and Communication Engineering Kongu Engineering College Perundurai, Tamil Nadu, India

ABSTRACT

The Sewage Outlet System monitoring has been a difficult and tedious task. A clog in the sewage pipe will lead to overflow and stagnation of sewer water along the streets. The environmental issues and diseases that arise to sewage stagnation are disastrous. The irregular maintenance of sewage Outlet System has caused huge catastrophes in the state claiming many human lives. The project proposes a novel mechanism to monitor sewage outlet pipes. The clog in the pipe will be sent to the remote server by means of IOT. Another advantage of the project is that clogs in drainage pipes can be detected as soon as it is formed rather than detecting it after the sewage water starts overflowing into the roads causing serious inconvenience to the public and revenue loss to the government. The system, in addition, does not require any human labor to detect the clog. Thus the clogs can be detected easily without any human interference. Therefore, a variety of sensors and clog detecting modules are placed in various positions along the drainage network and the data is collected using IOT. Thus the project will provide an efficient means of monitoring the drainage or sewage outlet system providing a way for the smarter sewer system and detecting the clog formation at its very existence, and helps maintain a clean environment, avoiding deadly contagious diseases helping the entire human race lead a healthy peaceful life.

Keywords: Clog detection, float sensors, and IOT(Internet of Things)

I. INTRODUCTION

Regular maintenance of drainage system will ensure that it functions properly at all times. It should be ensured that the outlet ditches of the subsurface systems are free from blockages caused by sediment buildup and the debris does not seal the inlet covers. Drainage problems can cause significant damage to home, property, and the City of Shoreline storm drain system. Today's drainage system is not computerized. So whenever there is blockage it is difficult to figure out the exact location of the blockage. Also, we don't get early alerts of the blockage. Hence detection and repairing of the blockage become so 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. It is important to identify and correct drainage problems when they occur. If a tile of the drainage system breaks, it has to be replaced, otherwise, it can contaminate bodies of fresh water. A research conducted by the University of Illinois has shown drainage systems can also contribute to contamination problems, especially when a clog occurs and is left unnoticed. The sewage outlet system monitoring has been a difficult and tedious task. A clog in the sewage pipe will lead to overflow and stagnation of sewer water along the streets. The environmental issues and diseases that arise to sewage stagnation are disastrous. The irregular maintenance of sewage outlet system has caused huge catastrophes in the state claiming many human lives.

The project proposes a novel mechanism to monitor sewage outlet pipes. The clog in the pipe will be sent to the remote server by means of IOT. Another advantage of the project is that clogs in drainage pipes can be detected as soon as it is formed rather than detecting it after the sewage water starts overflowing into the roads causing serious inconvenience to the public and revenue loss to the government. The system, in addition, does not require any human labor as shown in Figure 1 to detect the clog. Thus the clogs can be detected easily without any human interference. Therefore, it leads to a major drawback since it affects the human health and is also time-consuming. Thus the project will provide an efficient means of monitoring the drainage or sewage outlet system providing a way for the smarter sewer system and detecting the clog formation at its very existence, and helps maintain a clean environment,

avoiding deadly contagious diseases helping the entire human race lead a healthy peaceful life.

Figure 1. Manual Clog Identification

Most of the cities adopted the underground drainage system and it is the duty of Municipal Corporation to maintain cleanliness, health, and safety of cities. If the drainage system is not properly managed, then pure water gets contaminated with drainage water and infectious diseases may get spread. The drainage gets blocked during the rainy season and it will create problems to routine life. The problems include traffic jams, dirty environment, and inconvenience to the public. In many cases, blocked drainage can cause sewage and wastewater to stagnate and potentially enter the public and private property. Suppose if there is a facility that officials or concerned persons can come to know immediately that there is a blockage or clog inside the drainage channels and the area and exact place where the block occurred. So the main focus is to monitor the manholes using sensors. If drainage gets blocked or water overflows, the sensor senses the activity and sends the information via the transmitter to the concerned person.

Manhole maintenance by a human is very difficult because the environment is very poor and it is difficult to go inside of manhole for inspecting the state of manholes all the time. It is not possible to confirm immediately if the person intrudes the manhole or an accident happens inside of the manhole. The drainage system is essential for the people who live in urban areas as this system reduces flood effect by carrying water away (a facility to dispose of liquid waste). Improper maintenance of existing drainage system leaves people to suffer.

Irregular monitoring of drainage system leads to contamination of water and leads to water-borne diseases. Stagnation of water on roads will cause roads to damage. More importantly, flooding of roads lead to traffic jams and causes loss of valuable human hours, loss of revenue and employment. Groundwater contamination is also possible if once it is contaminated it's very difficult to clean up. A good and efficient drainage system is badly required for the developing countries like India. In the creation of many smart cities, the architecture of drainage system plays an important role. To maintain a good and proper drainage system it takes more human resource. Even though investing crores of rupees in drainage department when it rains the scenario will be the same. To overcome all these problems, we need a remote monitoring system to monitor the state of drainage inside drainage channels.

Smart drainage system can contribute to sustainable development and improve the places and spaces where we live, work and play by balancing the different opportunities and challenges that influence the urban design and development of communities. The present existing drainage system has to integrate with technology to wipe out the problems of today. The smart drainage system has

1. Predictive drainage clogging system: The intelligence of sensors and predictive system identifies the drain clogged spot and gives us the details for further actions to take.
2. Drainage clogging alert system: If there is any clogging in any area sensors will give us the necessary details about the location.

3. Completely connected: The sensors are connected through communication modules to share information. Using the smart drainage system one can easily monitor, modify and rectify the problems in real time. No drainage system is effective without human interaction.

II. METHODOLOGY

This project proposes a novel system to automatically d etect the sewage clogs using float level sensors and IOT module as shown in Figure 2, in order to avoid unclean environment, save the government time and revenue bei

ng spent on clog identification and to avoid human labor in detecting the clog occurred area.

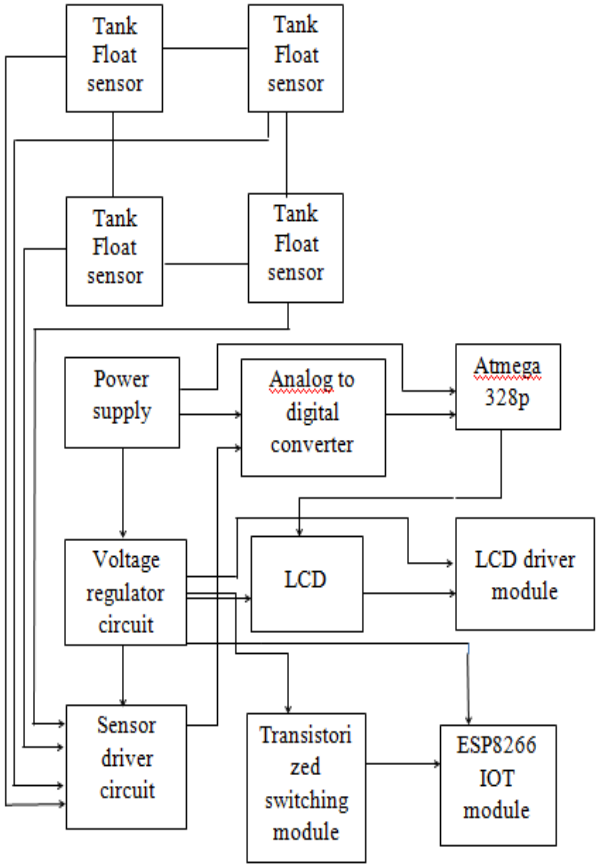

Figure 2. Block Diagram

The block consists of four float sensors, regulator circuit, LCD display, microcontroller, IOT module power supply and sensor driver circuits. The float sensors are located at regular intervals in the drainage system. For example, let us consider a drainage system for 2kms.The float sensors are placed at half kilometer distance. When the drainage water flows through the pipe, the float sensor detects the level of the water and the flow of water inside the pipe. If there occurs a blockage due to clog, then the water does not flow at a normal rate. The level and flow of water reduce and thus the clog is identified in the drainage system. The power supply used in the system has a range of 12V, but the only 5V is needed for the circuit. Therefore, the power supply circuit voltage is regulated using a voltage regulator to get 5V as input to the circuit. Once the clog is detected in the sensor, the data must be sent to the IOT module. The data from the float sensor is given to the ADC converter in the microcontroller circuit. The digitized data output is then sent to the IOT module and the data is updated in the system using an LCD display. The LCD display sows in which sensor the clog is detected. The status is updated at 30 minutes' interval and the continuous graph is obtained. Thus the clog is detected at an early stage and this avoids the overflow of sewage waste. Thus less human intervention takes place and the sewage system is monitored at regular intervals.

2.1 Our Solution

Required changes in the system –

1. Detect the location
2. Immediate information of the blockage Design of Smart Drainage System.

The system governing the flow of sewage from the pipes.

Use of flow sensors to detect the variations in the flow.

Collect the database.

Get the prior alerts of blockages and locate them using IOT.

2.2 Technology

IOT flow sensors at different locations will collect information of sewage flow through that node and send it to the central system which will generate alerts handful of time before complete blockage.

Database management system- It will contain the generalized data for different time instance with which the data received from the flow sensors will be compared to generate the alerts.

III. RESULTS AND DISCUSSION

The data from the sensor circuit is sent to the driver circuit and the programming for LCD is done in the Arduino. The sensors provide the data about the flow of sewage water in the drainage tanks. The LCD module provides a 16x2 output about whether there is a flow or no flow of sewage water inside the tank as shown in Figure 4. The flow of water is also indicated by the glowing of led light in the distribution network. This data is interfaced with the transistor driving circuit to send data to the Wi-Fi module. The output the value from the tank sensors are sent to the sensor driver circuit and the output is produced. The LCD provides the output determining all the four float level sensors as sewage 1 to sewage 4 and the flow or no flow of sewage water is shown determine the flow of sewage water inside the drainage pipes.

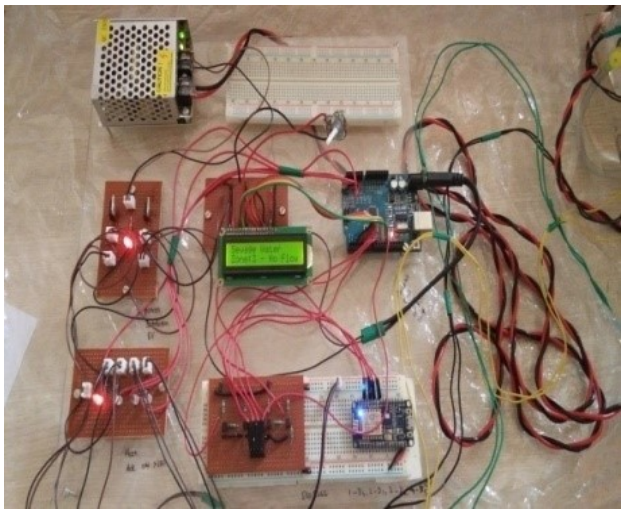

Figure 3. Hardware LCD Working

Figure 4. Thing speak Output

The data from the Wi-Fi module is cloud interacted with an open IOT server analytics called the "thingspeak". A channel is created in thingspeak inside which four field charts are created for the four float level sensors inside the tank. The field chart is indicated by the Matlab software used in thingspeak as shown in Figure 4 Each field chart provides the current value of the float level sensor. Each field chart corresponds to the value of each sensor. When the reading creates a low value it indicates the normal flow of the sewage water whereas a peak in the graph indicates the higher level of water in a tank.

This indicates a slow flow of water to the other tank which indicates a clog in the network. The data provides a continues value of the readings obtained at regular intervals of time. Here, the data from the tank networks is obtained at an interval of 15 to 30 minutes once.

Figure 5. Location of The Clog

One of the major objectives of this project is to locate the place where the clog has occurred. This is also done by using thingspeak. The location of the clog is identified by providing location access through thingspeak as shown in the Figure 5. This gives us prior information about the specific place where the clog is detected and it provides easier access to the clogged places. This system provides information as soon as the clog has occurred preventing the sewage water peeping into the roads.

IV. CONCLUSION

Thus this system provides a smart way of detecting the drainage clogs, which can be implemented in all the smart cities to reduce time, money and human intervention. This is one another initiative to maintain the city clean and safeguard the cleanliness that already prevails in the city. This one-time implementation will thus pave a way to forbid the repeated large process that is done every time the sewage water peeps out the roads causing deadly diseases. The proposed project identifies the flow of sewage water in the drainage system and provides immediate information about the appearance of a clog in the sewage network.

V. FUTURE SCOPE

After having implemented this sewage monitoring syste m, what remains is the scope for improvements. First, th e clog can be removed by increasing the pressure of the sewage water once the development of clog is identifie d .

In addition to this system, chemicals can be used inside the drainage pipes that release a strong effect on the clo g so that the clog is split into small particles and thus rel eases the blockage in that place.

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