

Garbage Accumulation Monitoring and Cleaning System in Sewage Lines

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Abstract—The recycling of sewage water is one of the methods to reduce the scarcity of water. It is calculated that more than 100 gallons of sewage water is generated. But, only 40% of sewage water is been recycled. The cause for this is the loss of water in the drainage lines, which is due to overflow caused by blockages. The existing methods that are used to remove the garbage blockages are power rodding, bucket machine, flushing. One of the common disadvantages in all the above systems is that it waste's a lot of water to remove the garbage accumulated. The method discussed here uses simple circuitry to remove the garbage from the sewer lines without leading them to deposition, causing blockages. The garbage is pushed into bins and the bin levels are constantly monitored and the authorities are informed about the status using Zigbee, leading to a periodic cleaning system.

keywords—Gallons, power rodding, flushing, debris, silt, Zigbee.

I. INTRODUCTION

The major problems we face in cities today is increased traffic. It's estimated that people in huge cities, in India, spend about quarter of their day in traffic. If vehicular density is one reason contributing towards congestion on roads, while poor roads are the other. And this contributes to accidents as well. The roads have a reduced life span due to the water accumulation on roads. Though the sewer lines are provided on either side of the roads, there is often overflowing and results in water logging. Due the moisture content that the accumulated water causes potholes are formed, which are further developed into gutters and leads to more water accumulation and hence total devastation of roads. The garbage like dry leaves, plastics, paper etc... which gets accumulated in the sewer lines reducing their capacity of water flow and also causing blockages are contributing towards accumulation of water on roads.

All the recent advancements are based on water recycling and are done at sewage treatment plant level. A recent survey shows that only 48% of the total sewage water is been recycled, which clearly is an indication of water wastage. This project aims at getting the maximum quantity of water in to

the sewage treatment plants, with slight modifications in the current concrete sewage lines.

Hence this helps in reducing water wastage, wear and tear of roads by which accidents, traffic congestion and high maintenance of vehicular parts can be reduced. It also aims at providing a central sewage management scheme leading to cleanliness and a hygienic ambience.

The garbage blocks stagnates the water flowing in the sewer lines providing habitat to various insects that cause dreadful diseases to mankind and animals as well.

The poor roads are to be subjected under regular and frequent repair process, causing huge economical loss.

The sewage blockages also contaminate the air causing foul smell, and releasing some hazardous combinations of gases during decaying process, at the blockage which affects the environment.

Most of the times the sewer infrastructure is found near the water bodies. Hence, the overflow might result in contamination of water. This is harmful for the aquatic plants and animals and also for mankind which uses it for consumption, hence affects the ecological balance. This project can be implemented without much constructional modification in the current system as it involves only placing of bins and circuitry at regular intervals.

II. EXISTING SYSTEMS FOR GARBAGE REMOVAL IN SEWAGE LINES

1. Flushing

Sewer systems need regular cleaning especially during the rainy season. The sewer flushing is a process which is performed by professionals who are trained to properly operate the machines and deal with any issues that may arise.

Flushing is of two types

1.1 Jetting

Jetting releases water and high pressure to dislodge dirt and debris and flush it into containment vessels. High pressure

water jetting is an efficiently economical and environmentally safe way to clean drainage and sewer pipes.

A special nozzle mounted on the end of a heavy-duty hose has an array of forward and reverse water jets, which directs extremely powerful concentrated streams of water all the way to the pipe walls.

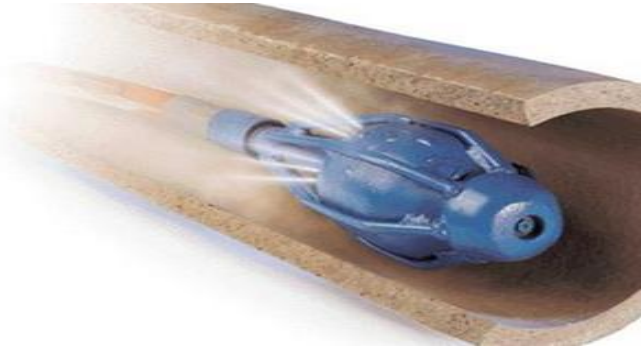


Fig. 1.1. Jetting method using to clean the drainage pipes

1.2 Vacuum sewer system

A vacuum sewer system is a method of transporting sewage from its source to a sewage treatment plant. Vacuum flushing uses a system of air based pressure to suck at dirt and collect it for disposal. Vacuum sewage systems consists of a vacuum station, where the vacuum is generated, the vacuum pipeline system, collection chamber with collection tanks and interface valve units.

In Contrast to conventional gravity Sewage system, with immediate pumping station. The permanent pressure within the vacuum system is maintained below atmospheric pressure.

2. Bucket machine

These are also known as power bucket machine .



Fig.2. Power bucket machine

These are the very effective way of cleaning pipes, especially the large one's.

Power bucket machines can open heavily blocked sewers, even if clogged with large masses of roots, sands and grit. The power bucket machine system involves using two trailer mounted with units-pulling unit and a truck loader unit each equipped with sufficient steel cable and are setup between the two manholes. The truck loader pulls the bucket through the pipe, with the bucket scooping up the materials its dragged along the pipe, pulls the bucket out and then loads it on the loader unit, depositing it in to a dump trunk

III. OBJECTIVES

- i. Designing a system to remove the accumulated garbage easily from the sewage pipes in to bins.
- ii. Monitoring the state of the bin.
- iii. Determining the location of the filled up bins with of the help of Xbee.
- iv. generating an automated message using GSM to alert the concerned authorities.

IV. PROPOSED SYSTEM FOR GARBAGE ACCUMULATION MONITORING AND CLEANING SYSTEM IN SEWAGE LINES

A. Proposed System

The Fig.1 shown below is the proposed system of Garbage Accumulation Monitoring and Cleaning System. It is illustration of how we have implemented this project and the various parts involved in it. The system is divided in to two sections i.e. Garbage Monitoring and Garbage cleaning.

Garbage Monitoring: The solid waste's that are flowing in the sewage water are blocked by using a steel cage, which is placed vertical to the flow of sewage water in sewage lines. As the sewage water starts to flow, the solid waste's will be blocked by the steel cage and only sewage water will be allowed to flow. As the solid waste's accumulation goes on increasing ,the quantity of sewage water that is allowed to flow through the steel cage goes on decreasing.

By placing ultrasonic sensors on either side of the steel cage, we can determine the amount of garbage accumulated near the steel cage ,by Comparing the level of sewage water on either side of the steel cage using a controller ATmega328p. If there is no difference in the levels on either side of the steel cage , than it indicates that the Garbage Accumulation level is Low and if the difference level is HIGH, than it indicates that the Accumulation Level is HIGH.

When the Solid waste's accumulation level reaches HIGH the Micro controller activates the 12v linear actuator using relays. The linear actuator which is attached to the steel cage, pulls the steel cage towards the bin, which are placed beside the sewage line at every 500m.

When the steel cage is pulled towards the bin, the waste's that is accumulated near the steel cage is dumped in to the bin.

After dumping the waste's into the bin, the steel cage goes back to its initial position and performs the same function again.

When the amount of waste's dumped into the bin reaches above 90%, it will be detected by ultrasonic sensor by measuring the depth of bin. Then the microcontroller will activate the linear actuator for one last time. Then the microcontroller will send a message to the server end using zigbee[2].

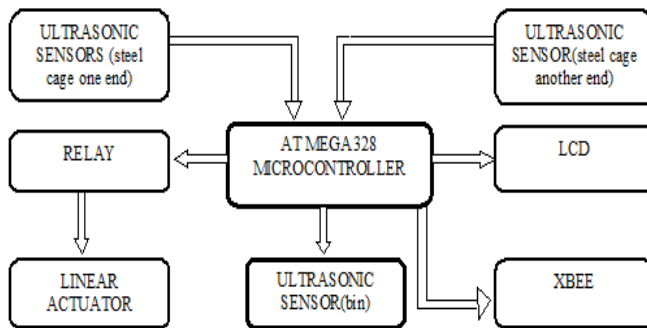


Fig. 3.1. Block diagram of Garbage Accumulation Monitoring unit

The zigbee that are interfaced with each microcontroller at every bin are configured as routers using XCTU software, so each bin status is transmitted to the next bin, the zigbee at that bin will send the received message plus its own bin status. Like this all the bins status will be combined and transmitted to the server end, where the zigbee is configured as coordinator.

Garbage Cleaning: All the bin status will be monitored and when the particular bin is filled, the person who is monitoring the system can send a message to the concerned authority using GSM.

The received bin status values are uploaded in to the webpage, which are further useful in preparing systematic reports and provide access to every common people.

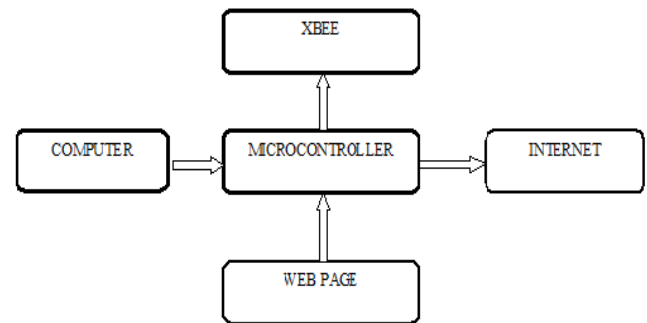


Fig. 1.2. Block diagram of Garbage Cleaning unit

V. RESULTS AND DISCUSSIONS



Fig. 4. Prototype of underground garbage accumulation monitoring and cleaning system.

In the above figure the sewer lines are represented by the wooden cases on either sides. To one edge of each case the ultrasonic sensors are fitted in, the entire circuitry is mounted onto a board above the middle case.

The middle case here contains the steel cage and it is also fitted with a linear actuator. The ultrasonic sensor sends the pulses, and receives the echoes, which are sent to the microcontroller and if the blockage is sensed, it activates the linear actuator. It pushes the middle case and dumps the garbage into the bin and goes back to its initial position.

The bins are also attached with the ultrasonic sensor, through which the levels are monitored. The result is transmitted through Xbee to the base station.

The person who is monitoring all these bins, can call the appropriate person to clean the bins, when a certain number of bins are filled.

VI. CONCLUSION

This project aims at monitoring the garbage accumulation in the sewage pipes, which causes the water logging on roads. As a result of water logging the increased traffic had turned to a dreaded issue. Apart from that the wear and tear of road is also a major problem in India. The stagnant water also results in unhygienic conditions causing pollution and various diseases, which can be limited by implementing this project. The altering system used helps to maintain a hygienic scenario by periodic cleaning procedure.

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