

AUTOMATIC DRAINAGE CLEANER

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Abstract - Now-a-days almost all the processes are being automatized but the drainage cleaning system in our country is still completely manual. The proposed concept in this paper is to automatize the existing manual drainage cleaning system that is existing in our country. The "Automatic Drainage Cleaning System" is intended to be used in the drains and sewer lines which are clogged by the plastic and floating debris. The solution proposed in this paper is to design a vehicle which is capable of collecting the plastic and floating wastes. This vehicle is based on concept of 'Mr. Trash Wheel'. The system consists of raspberry pi which acts as the brain by controls the entire process and wastes will be collected using a conveyor mechanism. Two motors will be used for the motion of system and for conveyor mechanism. The vehicle moves along drains in water collecting the wastes into a bin and this bin will be monitored continuously using an ultrasonic sensor.

Key Words: Drainage, Motor, Conveyor, Raspberry Pi, Plastic Debris.

1. INTRODUCTION

Hygienic surroundings are needed to maintain the health of a person. Now-a-days drainages are most important in keeping the surroundings clean. But the drains and sewers in most of the places are being left unsupervised. Plastic wastes have become a very big threat to society. Most people after the usage throws these plastic bags and other plastic wastes in drains instead of disposing them properly. Due to these plastic wastes the drains will be clogged and creates many health related problems. Once or twice in a month the sewage workers have to come and clean them manually. While cleaning such drains without proper equipment many are losing their lives. So, a proper automated system is need for the cleaning of these drains.

Most systems in the world today are automated. Almost 1.2 million workers are involved in sanitation works. The working conditions of these sanitary workers have remained unchanged over years. Apart from the social atrocities that these workers face, they are exposed to many health problems by virtue of their occupation. This can be prevented through engineering, medical and legislative measures. While the engineering measures will help in protecting against exposures, the medical measures will help in early detection of the effects of these exposures. This can be partly achieved by developing an effective occupational health service for this group of workers. So, the engineering solution to this problem is discussed in this paper.

2. LITERATURE REVIEW

Ganesh U L, et.al. showed the usage of mechanical drainage cleaner to replace the manual work required for drainage cleaning system. Drainage pipes are very dirty. Sometimes it is harmful for human life while it is need for cleaning drainage system. To overcome this problem, they implemented mechanical semi-automatic drainage water cleaner To overcome this issue, the mechanical semi automatically operated drainage waste cleaner is made which makes water to flow effectively due to regular filtration of wastages.[1]

Ndubusi C. Daniels, et.al. showed the drainage system cleaner machine used to remove garbage and sewage automatically which helped to protect the environment from different kinds of environmental hazards. The drainage system cleaner has three major parts which are the propeller, the cleaner and the pan all makes up for its effective functioning [2].

Elangovan K., et.al. reviewed about drainage cleaning to replace manual work to automated system because manually cleaning system it is harmful for human life and cleaning time, is more so to overcome this problem they implemented a design "Automatic drainage water pump monitoring and control system using PLC and SCADA". PLC and SCADA were designed [3].

Dr. K. Kumaresan explained manual work converted to automated system. Drainage pipe using for disposal and it may be loss for human life while cleaning the blockage in the drainage pipes. To overcome this problem they implemented "Automatic Sewage Cleaning System". They designed their project different way clearance of gaseous substance are treated separately so the flow of water efficiently. This project may be developed with the full utilization of men, machines, and materials and money. They made their project economical and efficient with the available resources. They used automation technology concerned with his application of mechanical, electronics, computer based systems to operate and control production [4].

Nitin Sall, et.al. explained flow of used water from homes, business industries, commercial activities is called waste water. 200 and 500 litres wastage water are generated each person every day. So using waste water technology that removes, rather than destroys, a pollutant in a drainage system [5].

3. EXISTING SYSTEMS

3.1 Manual Cleaning:

This is the most commonly followed method in cleaning of drainages. This involves a person who has to clean the drains using shovel. It also means that a person uses a mesh or net to pick up the wastes in the water of drains. This method becomes useless where the drains are closed and in such situations the person has to actually go into the drains and clean these wastes.

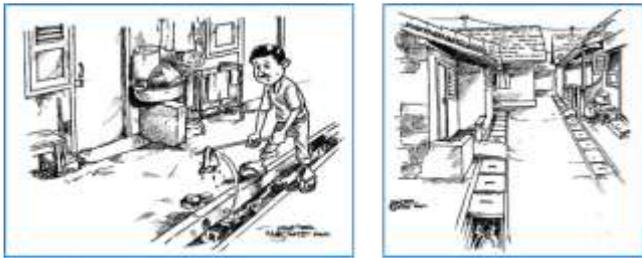


Fig-1 : Manual Cleaning of drainages

3.2 Hydro Jetting:

It is the mostly followed method of cleaning drains in foreign countries. In this method a group of three or four professionals uses a high pressured water pump and a special nozzle at valve of hose to unblock the clog. A flexible hose connects through an adjustable nozzle that emits water to remove plastic wastes, clogged sewer lines and ordinary household objects. Even tree roots that are growing on pipes will get flushed away to the municipal sewer system. By using this mode of leaning the drains will be cleaned instantly and will be ready to use. The water flow is adjustable based on requirement. The only problem is this method is that it requires a large amount of water and huge trucks to carry the water and all other equipment.



Fig-2 : Hydro Jetting Method

3.3 Drain Augers:

These devices are effective in cleaning major clogs from drains without using any harmful chemicals. They contain a long flexible pipe with wires attached to a motorised equipment. A coil of wires goes down the drain until it reaches the obstruction. Then, the motor runs and the end of the wires driving down slowly into the clog. Then a person can pull out this clog and dump it. Some augers are hand-

driven which means instead of motor a hand driven bolt is provided. These are also known as “drain snakes”.

4. PROPOSED SYSTEM

The main purpose of the entire system is to provide a more radical solution to the manual cleaning of drains. So this system is a vehicle which operates with help of raspberry pi as the brain and it controls the motion motors using the motor driver IC L293D. The raspberry is pre-programmed with a python code about the controls of motors. While the motor for the control of wheels is running another motor which controls the motion of conveyor system also rotates. This conveyor is the heart of the system it alone controls the lifting up of the floating waste from the water and storing them in a bin. An ultra sonic sensor is placed on top of the bin for its monitoring.

When the bin gets filled upto a predetermined threshold level the ultra sonic sensor senses it and with the python code in raspberry pi if the level is reached the motors will be stopped and a mail will be delivered to the selected recipient indicating the status of the bin in form of a text message using SMTP protocol. The central idea of vehicle was taken from the Mr. Trash Wheel concept.



Fig-3 : Mr. Trash Wheel in Baltimore

5. COMPONENTS USED

5.1 Raspberry Pi:

In this project raspberry pi is used to control the motors and also send the message whenever the garbage in bin reaches the predetermined threshold level using a python script which is stored in it.



Fig-4 : Raspberry Pi 3 model B

5.2 L293D IC

As the maximum voltage from the raspberry pi is 5V only and it is not enough to drive the 12V motors we need a motor drive to run the motors. For this purpose we use the L293D IC which will be connected to raspberry, two motors and a power supply.



Fig-5 : L293D IC

5.3 Motors

Here two motors are used in the project. One is used to run the aerator modelled wheels to drive the entire system on the water. Other is connected to the conveyor system with help of gears which is the lifting system of debris.



Fig -6 : 12V DC Motor

5.4 Ultra sonic sensor [HC-SR04]

The purpose of the ultra sonic sensor is to monitor the status of the bin. It is connected to the raspberry pi and using the python code in raspberry it continuously measures the distance from the filled level of bin to the sensor. Whenever this distance reaches the pre-determined threshold level the motors will be stopped and an alert mail will be send to the selected recipient.

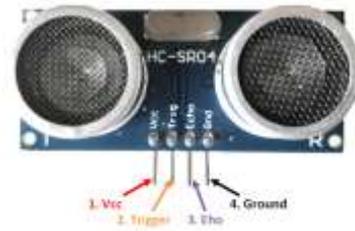


Fig-7: Ultra sonic sensor

6 WORKING

The entire system consists of three subsystems. They are

- Conveyor System
- Warning System
- Vehicle motion system



Fig-8 : Experimental Circuit setup

6.1 Conveyor System

It is the main subsystem which controls the lifting of the wastes. It is operated with the help of motor which is controlled by raspberry pi. Due rotation of motor conveyor rotated. As the conveyor rotates, it collects wastes and when waste debris reaches the upper extreme position it will get dropped in the bin. Hence this will result in cleaning of water surfaces and safe collection of waste debris from water. The motor will be connected to the shaft if the conveyor system with the help of plastic gears. The motor is fitted with a plastic gear which when rotated rotates another plastic gear which is connected to the rotating shaft of the conveyor system.

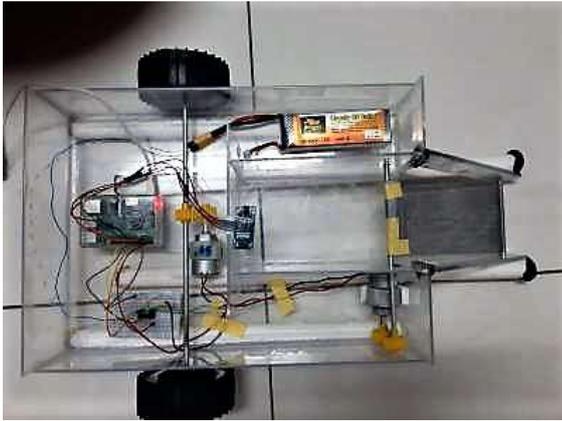


Fig-9 : Designed system

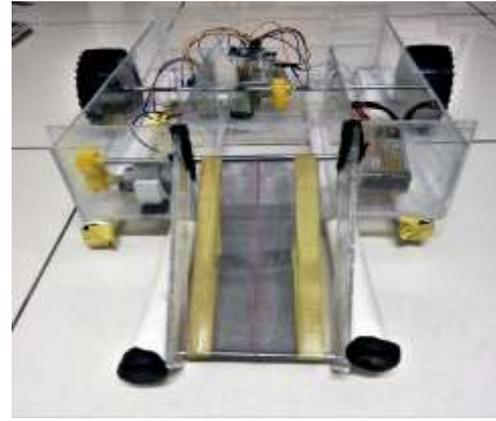


Fig-10 : Designed system front view

6.2 Warning System

The warning system is used for the monitoring of the status of the dump collector bin. This system is also controlled by the raspberry pi. It consists of an ultra sonic sensor. The sensor is attached to the raspberry pi and is placed on the top of the bin. Using python code the sensor will measure the level of filling of bin continuously. A particular level is decided as threshold level. When the dump reaches this level the sensor automatically detects this and as the motors are controlled by raspberry pi through L293D raspberry stops the running of motors and an alert message will be send to the pre-described recipient using the SMTP protocol. Then this bin has to be cleared and system will resume its operation by running the program again.

6.3 Vehicle Motion System

The motion of this system is carried out by two wheels which are situated at the rear end of the vehicle. The wheels are connected to a shaft which is already fitted with a plastic gear. Then this plastic gear will be connected to another plastic gear which is mounted to the motor itself. So, when the motor is powered it rotates and the wheels run in opposite direction of the motor with help of plastic gears. When the wheels rotate the water will be pushed back moving the vehicle forward since the wheels are designed based on the "Water wheel aerator" model. This helps the movement of the system and collecting the wastes that are in its way.

7. CONCLUSION

The project provides a proper solution to an underlying problem of drainage cleaning. This has is far better than the existing systems and reduces the risks involved in the drainage cleaning. The operation of this system is simple and it also provides flexibility. Cost of the system changes based on the extent of the operation of vehicle. So the project "Automatic drainage Cleaner" is designed to provide a system that is economical and helpful to remove water impurities like plastics, trashes, water debris which is floating on drain water surface. Use of this machine will reduce the man power considerably. It can also be used in fisheries in collection of dead fishes.

8. FUTURE SCOPE

In future this project can be improved to sort more categories of waste. Instead of conveyor system using a crane based robotic arm mechanism will improve the efficiency of system and can also collect submerged wastes. The modification in the size of system can also be done based on the amount of the waste that is to be collected. This project is made only for small drainages by doing some modification in its size and capacity it can be used in big lakes and rivers. Use of solar panels and automating the clearance of bin can be done to decrease the human intervention.

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