

AUTOMATIC SEPTIC TANK CLEANING SYSTEM

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Abstract - India is the first Asian nation to reach the Mars orbit the technological advancements in the field of science and economy make it one of the fastest growing nations in the world still we cannot fathom a technology that eliminates the deadly practice of manual scavenging. The existing manhole cleaning process practice requires the worker to manually position the sewer jetting machine or sewer rods which are fed inside the manhole for sewer line cleaning but these machines meant to unblock the sewer lines are not effective in cleaning manholes. The project proposed here is used solve this problem and design an automated machine that will eliminate manual scavenging completely and carry out the sewage work more effectively with 95 to 98% cleaning efficiency. Thereby this project deals with the conversion of manholes into machine holes.

Key Words: Manual scavenging, Septic tank, Manholes, Sludge, Machine holes

1. INTRODUCTION

80% of sewer worker are dying before the age of 50. The casualty on manual scavenging even more than the casualty on the border. Despite a recent prohibition of manual scavenging act passed in 2013, the practice of manual scavenging continues illegally. In the proposed system instead of man entering into the manhole the sewage cutter pump interfaced with the Arduino microcontroller is used to remove the sludge and is monitored through an LCD display.

1.1 OVERVIEW OF SEPTIC TANK

Septic tanks allow a safe disposal of wastewater and hence are widely popular in areas that have a poor drainage system or are off the mains sewage network. They work by collecting the excreta and wastewater in one big underground tank, they are predominantly used in rural areas. A septic system has a simple design. It is an underground watertight container made of fiberglass, plastic or concrete. The tank is connected with two pipes (for inlet and outlet). The inlet pipe collects the water waste in the septic tank, long enough that the solid and liquid waste is separated from each other. The outlet pipe also called the drain field, moves out the preprocessed wastewater from the septic tank and connects to the sewage line. In the septic tank the wastewater separates in 3 layers. The top layer is oils and grease and floats above all the waste. This is called

scum. The middle layer is the wastewater along with waste particles. The bottom layer consists of heavier particles that are heavier than water and form a layer of sludge which is difficult to remove. Inside the tank bacteria from the wastewater breaks down the solid waste. These bacteria decompose the solid waste rapidly allowing the liquids to separate and drain away more easily. But this technique takes a long time and is not suitable for larger septic tanks. The project proposed here deals with the removal of the bottom sediment layer of sludge effectively using chemical and mechanical methods rather than conventional manual methods and to aggravate the conventional bacterial degrading process.

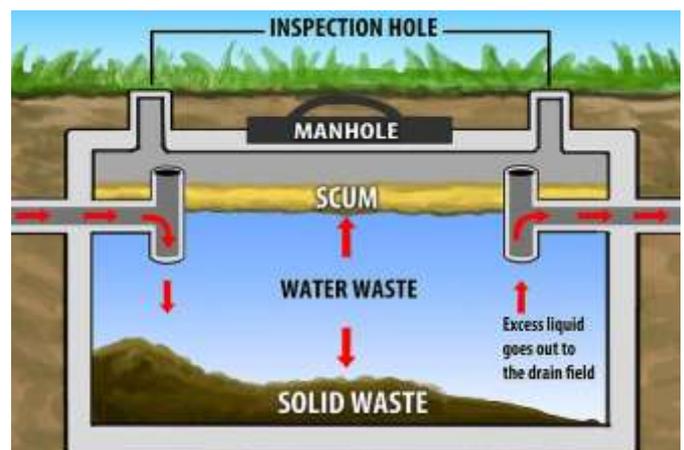


FIG.1: CONVENTIONAL SEPTIC TANK SYSTEM

1.2 PUMPING PROCESS

Septic tank pumping and haul contractors can pump your septic tank. To extract all the material from the tank, the scum layer must be broken up and the sludge layer mixed with the liquid portion of the tank. This is usually done by alternately pumping liquid from the tank and re-injecting it into the bottom of the tank. The septic tank must be pumped through the two large central access ports (manholes), not the small inlet or outlet inspection ports located above each baffle. Pumping a tank through the baffle inspection ports can damage the baffles and yield incomplete removal of sludge and scum. The existing manhole cleaning procedure requires a worker to manually position the sewer jetting machine or sewer rods which are fed inside the manhole for sewer line cleaning but these machines meant to unblock the sewer lines are not effective in cleaning

manholes and nobody has thought of making new one for humans to clean. yes the existing methods of manhole cleaning are not perfect that's why these workers need to enter manholes despite stern prohibition by the governing bodies they are forced to completely submerged into the manhole filled with toxic gases and infected liquid waste to remove these solid wastes to open blockage its no surprise that hundreds of scavengers are dying each day after being affected by various kinds of diseases like amnesia and nausea. The solid waste removal is done only upto 60-70%.The suction pump need high power supply and exhibits average performance. Large quantity of pure water is required for flushing out the sludge layer from the septic tank. Sometimes human entry into the manhole is required for the cleaning process which can be life threatening.

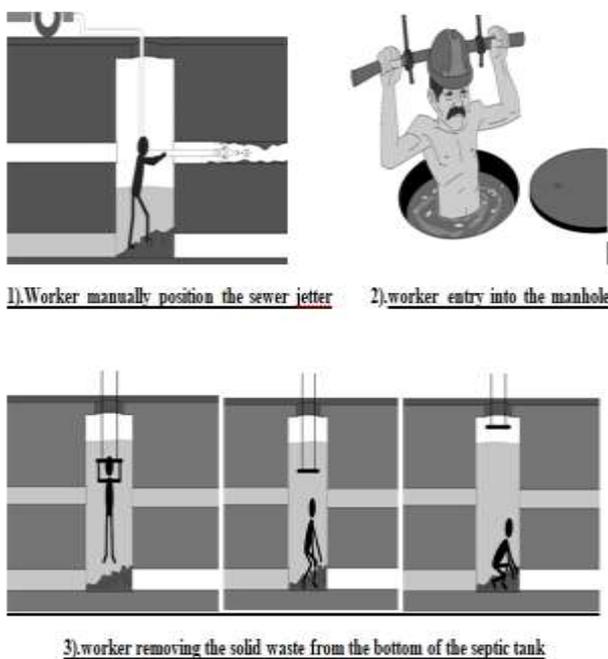


FIG.2: PROCEDURE OF PUMPING PROCESS

2. PROPOSED SYSTEM

2.1 BLOCK DIAGRAM

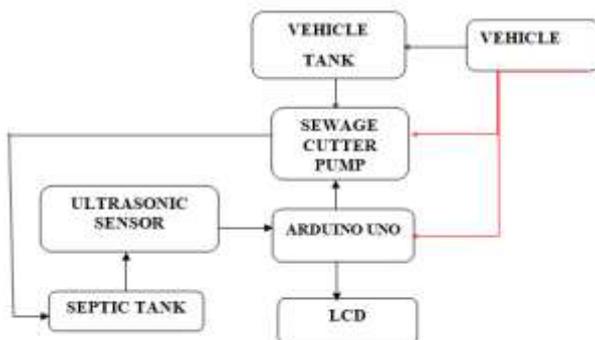


FIG.3: BLOCK DIAGRAM OF PROPOSED SYSTEM

2.2 MECHANICAL MESH STRUCTURE

A stainless steel non corrosive epoxy coated mesh structure to the size of the septic tank is fixed at the bottom with a pulley system. When there is over collection of sediment in the bottom the mesh can be pulled up breaking the solid waste particles and allowing them to loosen up to increase surface area for more good bacteria to feed upon.

2.3 METHODOLOGY

Bio clean is a unique blend of all natural bacteria (pseudomonas, E-Coli) and enzymes with conc. HCL solution used to eliminate waste build up in plumbing and septic systems. It is the most powerful on the market and is delivered in powder form to retain potency and maximize effectiveness. Bio clean will allows to treat the 4 types of waste containing (protein, grease, carbohydrates, fibre) It creates no heat, no fumes, no boiling. It does not attack live tissue nor inorganic materials but only the organic wastes like grease, hair, food particles, paper, cotton & sewage. This makes Bio clean safe for people, plumbing and the environment. Bio clean changes the waste particles into water, carbon dioxide and mineral ash which run harmlessly out of your waste system. These elements are then available for plant life as manure. Within an hour after pouring the bio clean solution with water into the drain, the bacteria begin to eat their way into the waste that has accumulated on the sides and top of the drain pipe. As this is their natural food. They digest the waste and spread throughout your system, cleaning it completely. Thus providing a cleaned tank with a substantial decrease in waste sediment settling and formation. Therefore a mechanical and chemical method for treatment of solid waste sediment in septic tanks has been proposed here keeping in mind a cleaner and greener environment.



FIG.4: ACTION OF BIO CLEAN POWDER IN THE PIPE

2.4 PROCEDURE

A high pressure **sewage cutter pump**(fig.5.1) which requires low power supply is used to extract the sludge out of the septic tank. The **Arduino microcontroller** (fig.5.2) is interfaced to the pump to control its operations. An **ultrasonic sensor**(fig.5.3) is fitted to the mechanical mesh structure which indicates the amount of sludge remaining in

the septic tank which can be monitor through an **LCD display(fig.5.4)**. After the liquid layer is flushed out the bio clean powder is sprayed into the septic tank which converts the solid waste into liquid waste through chemical reaction. This can be easily pumped out from the tank. Once the entire septic tank is drained the motor is switched off automatically.



FIG.5.1:SEWAGE CUTTER PUMP



FIG.5.2:ARDUINO UNO



FIG.5.3:ULTRASONIC SENSOR



FIG.5.4:LCD DISPLAY

3. HARDWARE DESCRIPTION:

3.1ARDUINO UNO:

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion board and other circuits. The board has 14 Digital pins, 6 analog pins, and programmable with the Arduino IDE(Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts.

3.2ULTRASONIC SENSOR:

This is the HC-SR04 ultrasonic distance sensor. This economical sensor provides upto 70 feet of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit. There are only four pins that you need to worry about on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground).Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.

3.3.SEWAGE CUTTER PUMP:

A sewage cutter pump is a centrifugal pump which is equipped with a cutting system to facilitate chopping or

maceration of solids that are present in the pumped liquid. The main advantage of this type of pump is that it prevents clogging of the pump itself and of the adjacent piping, as all the solids and stringy materials are macerated by the chopping system. These pumps are typically equipped with an electric motor to run the impeller and to provide torque for the chopping system. Due to its high solids handling capabilities, the cutter pump is often used for pumping sewage, sludge, manure slurries, and other liquids that contain large or tough solids. A cutter pump is operated by a drive unit (e.g. electric motor, hydraulic motor), which turns the impeller and the cutting system. A system of mechanical seals are used to prevent the pumped liquid from entering the motor. The pump can either be connected to a pipe, flexible hose or lowered down a guide rail so that the pump sits on a coupling foot (aka base elbow), thereby connecting it to the discharge pipe.

3.4.LCD DISPLAY:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome, LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock.LCD display contains 16 pins interfaced to arduino to display the water level in the tank.

4. CIRCUIT DIAGRAM:

The circuit diagram of the proposed system is shown in the following figure(6),

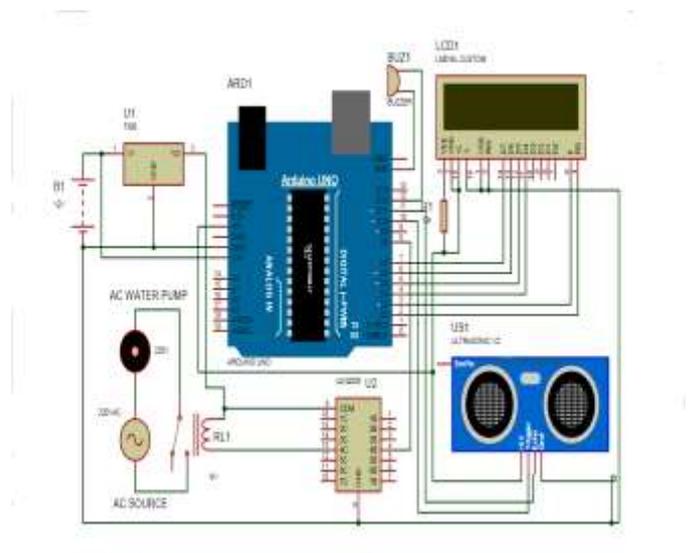


FIG.6:CIRCUIT DIAGRAM OF AUTOMATIC SEPTIC TANK CLEANING SYSTEM

5. FLOW CHART:

The flow chart of the proposed system is shown in the following figure(7),

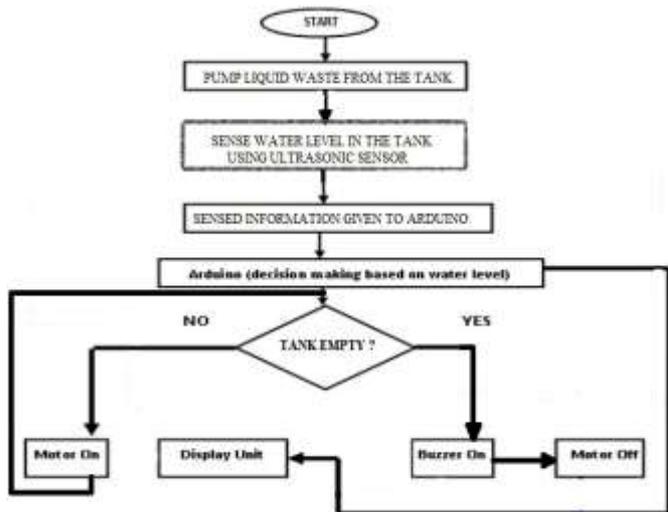


FIG.7:FLOW CHART OF CLEANING SYSEM

6. ADVANTAGES OF PROPOSED SYSTEM:

The high pressure sewage cutter pump requires less power supply. **Water is not needed in the cleaning process.90-95% efficient removal of solid waste is possible.** Portable and efficient cleaning process. Manual scavenging is completely eliminated.

7. APPLICATIONS:

This project can be practically implemented in domestic septic tank cleaning systems.

8. CASE STUDIES:

A survey says 1,470 manual scavengers died at work between 2010 and 2017.Tamil Nadu ranks the highest in the number of deaths due to manual scavenging. Of the 323 deaths reported across the country since 1993, 144 were from Tamil Nadu.

9. RESULT AND DISCUSSION

The prototype of the proposed system has achieved 80-85% removal of sludge and waste water. The practical implementation of this proposed project would achieve higher efficiency and effective cleaning.

10. CONCLUSION

The proposed system eliminates the inhumane method of employing manual labour to remove blockages. The machine dealt here is portable, cheap, and highly efficient. Thus this project helps in making our nation clean and healthy.

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BIOGRAPHIES



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