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Smart Septic Tank Cleaning Machine

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Abstract
The aim of this However, we have yet to discover a technique that would remove the fatal practise of manual scavenging. The current procedure of manhole cleaning needs a physical arrangement for sewer rods that are inserted into the sewer line, but this equipment are ineffective in cleaning manholes. The goal of this project is to tackle this issue by designing an automated system that will entirely remove manual scavenging and does sewage job more efficiently, with a cleaning efficiency of 95 to 98 percent. As a result, this project is concerned with the transformation of manholes into machine holes.

Keywords: *Septic tank, scavenging, Manholes, Machine holes, Automated system.*

1. Introduction

Eighty percent of sewage workers die before they reach fifties. Ignoring the fact that a law against manual scavenging was implemented in 2013, the activity continues to be unlawful. Rather than a man entering the manhole, the suggested system uses a sewage cutter pump connected to an Arduino microcontroller to eliminate the sludge, which is controlled via an LCD display. Septic tanks provide for the safe disposal of wastewater and are therefore common in places where the drainage system is inadequate or when the sewage system is not connected to the mains. They collect wastewater and excreta in a single large tank and are primarily utilised in rural areas.The design of a septic system is straightforward. It's a watertight container composed of fibreglass, plastic, or concrete that's buried underground. Two pipes link the tank to the rest of the house. Water waste is collected in the septic tank through the intake pipe, which is long enough to separate the solid and liquid waste. The exit pipe, also known as the drain field, links to the sewage line and transports the pre-processed effluent from the septic tank. The wastewater divides into three layers in the septic tank.Oils and grease make up the upper layer, which floats above the waste. This is referred to as slime. The wastewater, coupled with trash particles, make up the intermediate layer. The microorganisms present in the wastewater break down solid waste throughout the tank, creating a tough sludge layer that is heavier than water in texture. It is ineffective and takes some time for larger septic tanks to use this method. However, wastewater breaks down solid waste and helps separate the liquids.

It is proposed that the project will remove the sediment layer of sludge from the layer by using suitable methods ("chemical and mechanical") instead of traditional techniques by accelerating the bacterial degradation by using chemical and mechanical techniques. Pumping and hauling your septic tank can be performed by contractors who destroy the scum layer, combine it with the liquid area of the tank to recover everything. Alternatively, you can drain the septic tank by using the two central access ports, rather than the small inspection apertures above each baffle. Pumping and re-filling the liquid is an effective method of accomplishing this. The baffle inspection ports may be damaged when pumped through, resulting in only partial removal of sludge and scum after pumping the tank through them.For sewer line cleaning, a worker must physically position a sewer jet or a sewer rod within the manhole to clean the sewer line. However, these machines designed to reopen sewer lines are ineffective in cleaning manholes. Conventional manhole cleaning procedures are ineffective, which is why, despite government prohibitions, these workers are obliged to totally immerse themselves in manholes laden with toxic fumes and contaminated liquid waste in order to eliminate the solid wastes and clear blockages. It's no wonder that hundreds of scavengers die every day from ailments like amnesia and sickness. Only about 60-70 percent of the solid waste gets removed. The suction pump requires a large amount of electricity and performs poorly. The sludge layer in the septic tank must be flushed out with a large amount of pure water. The cleaning method sometimes necessitates human entrance into the manhole, which might be dangerous.

1.1 Objective

The aim of this work is to create and build an automated drainage cleaning system to avoid humans from contracting diseases caused by infectious bacteria found in sewage when cleaning physically. The goal of this proposed system is to reduce or eliminate the problems associated with using a man-operated equipment, as well as the waste dumping rate.

2. Literature Review

Samie et al (2009)MSTPs **(“**Municipal sewage treatment plants”) were investigated, and treated wastewater specimens were taken, for recognizing the approaches of treatment employed in STPs and to measure the efficacy of the plants in treating wastewater in the province on mpumalanga. An average of 14 STPs was examined, and the obtained data were tested using standard procedures for physicochemical and microbiological characteristics. Ponds, activated sludge, and trickling filters were among the treatment options discovered. The plants reduced turbidity by 6.2 to 99.6%.

Bendz et al (2005)The study's goals were to see how a large and relatively steady load in sewage influent affected downstream proportions, as well as to see if chemicals that are highly in a real aquatic environment. Water collected from the STP's and also from a sequence of dammed reservoirs heading to outflow into Sweden's Hoje River and at many points along the river downstream of the outfall.The chemicals were examined using GC-MS or LC-MS/MS. The findings of this work highlight the need for a more comprehensive understanding of persistence that takes into consideration loading rates as well as removal processes at various geographical and temporal scales.

Boyd et al (2003) designed an analytical approach. Using this approach, PPCPs (“Naproxen, ibuprofen, oestrone, 17beta-estradiol, bisphenol A, clorophene, triclosan, fluoxetine, and clofibric acid”) and endocrine-disrupting compounds that may be extracted and quantified simultaneously Naproxen levels of 81-106 mg/l were found in Louisiana sewage plant, and 22-107 mg/l in Louisiana and Ontario surface waterways. The findings of this study show that certain PPCPs can be effectively removed using current water treatment technology. Furthermore, our research highlights the necessity of gathering information on the removal methods and products associated with PPCPs.

Abbasi et al (2018)this study examines two cutting-edge septic tank systems for onsite wastewater treatment. As part of this activity centered on new decentralised wastewater treatment technologies, the concepts were installed and tested. The renovated septic tanks were put through their paces at various hydraulic loading rates for long enough times to assess performance. Systems were created using aerobic and anaerobic sections in order to distinguish between linked and suspended growth. The systems were used for 4.3, 3.2, and 2.6 days of incarceration. Despite the fact that all systems attained two logs of E. coli elimination (99 percent), E. coli quantities are enough to require treatment. Septic tanks that had been changed is an affordable solution with reduced O&M costs and energy.

3. Methodology

The internet of things is referred to as IoT. As a result, the Arduino software is being used. Input and output are obtained from the beginning point using coding. When the septic tank is fully loaded, the IR sensor transmits a message to the mobile phone, and the drainage process is the input. This is the completed output. Microcontroller Arduino is utilised in the IoT process for easy hardware and software usage.The smart septic tank used in research is made up of several modules such as gsm, IR sensor, and microcontroller. The microcontroller is attached to the infrared sensor. When an IR sensor detects that the dustbin is full of trash, the signals are relayed to the microcontroller.As part of the project, software and hardware testing will take place in two stages. The software component will be tested using the Arduino IDE, but the hardware component will need to be physically tested. We will use a meter tape to measure the distances indicated by the sensor to verify the accuracy of the readings. Verifying the accuracy of the readings is important.

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3.1 Materials

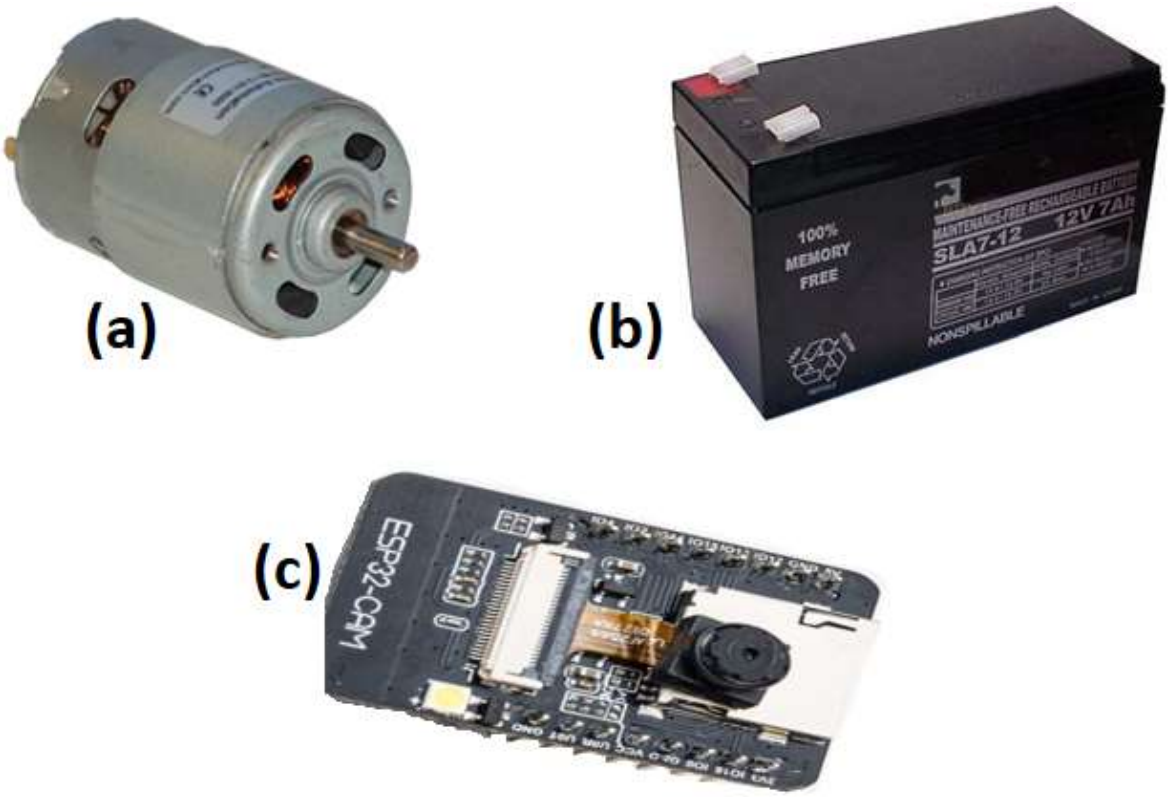

Figure 1 (a)DC motor (b) Battery (c) ESP32 CAM

3.1.1 DC Motor

The principle of DC motor is based on an electric and magnetic field interact to produce a mechanical force. When a current-carrying conductor is kept in a magnetic field, it gains torque and has the tendency to move. In other words, a mechanical force is created when electric and magnetic fields collide.

3.1.2 ESP32 CAM

This camera module, which has a footprint of 27*40.5*4.5mm and offers a deep sleep current of 6mA, is extremely compact and capable of functioning independently as a minimum system. It is suitable for use in numerous Internet of Things applications due to its compact and compact size. Additionally, it has been proven to be suitable for Internet of Things applications such as smart home devices, industrial wireless control, wireless monitoring, QR wireless identification, and wireless positioning systems. It is easy to install the ESP-32CAM into the backplane for rapid product development since it is a DIP package. It is an excellent choice for IoT applications. Clients are able to access a wide variety of IoT hardware terminals through the platform's high-reliability connection option.

Figure 2 ESP32S Camera module

3.1.3 Lead Screw

An actuator or positioner which converts rotational motion into linear motion is known as a lead screw. The thread of the screw is also known as a power screw or translation screw. Since the male and female members have a large sliding contact area, screw threads are more likely to lose frictional energy than other linkages. It is more common to use them occasionally in low-power actuator and positioner systems as opposed to for carrying high-power applications. Linear actuators etc., are all common applications.

Figure 3 Lead screw

As with other thread types, lead screws can be made with split nuts, or half nuts, meaning they allow the nut to be freed from the threads and moved apart from the rotation of the screw.

3.1.4 Speed Calculation

It is usually not possible to run the lead screw faster than 80% of its calculated critical speed, which is the speed at which the screw's natural frequency is excited.

$$N = \frac{(4.76 \times 10^6) d_r C}{L^2}$$

where

- N = critical speed in RPM
- d_r = smallest (root) diameter of the leadscrew in inches
- L = length between bearing supports in inches
- C = .36 for one end fixed, one end free
- C = 1.00 for both ends simple
- C = 1.47 for one end fixed, one end simple
- C = 2.23 for both ends fixed

3.1.5 ATMEGA328P

Arduino UNO, Arduino Pro Mini and Arduino Nano are all based on the Atmega328 microcontroller. AVR enhanced RISC architecture is used to make the ATmega48PA/88PA microcontroller, which has an EEPROM and a

SRAM memory of 1KB and 2KB, respectively. By executing powerful instructions in one clock cycle, the system achieves throughputs nearing 1 MIPS per MHz by combining the 8 ADC pins into PortA (PA0 – PA7). It was designed to optimize power consumption versus processing speed.

Figure 4Pinout ATmega48PA/88PA/168PA/328P

3.1.6 NODEMCU

It can work as a individual programme or associated with MCU because it has self-contained and complete wi-Fi networking capabilities. The application is quickly booted up from the external flash when the ESP8266EX hosts it. The integrated high-speed cache aids in improving system performance and memory efficiency. Through interfaces ("SPI / SDIO or I2C / UART") ESP8266EX is used as a Wi-Fi adaptor.

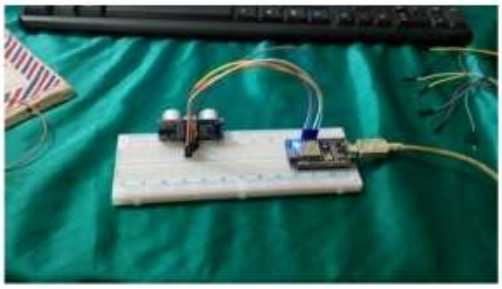

Figure 5 NODEMCU

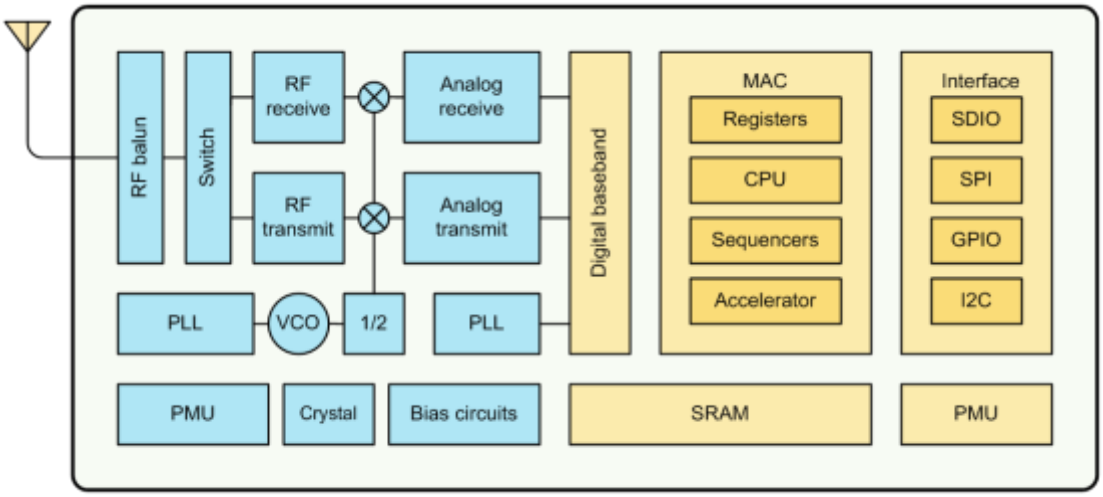

Figure 6 ESP8266EX block diagram

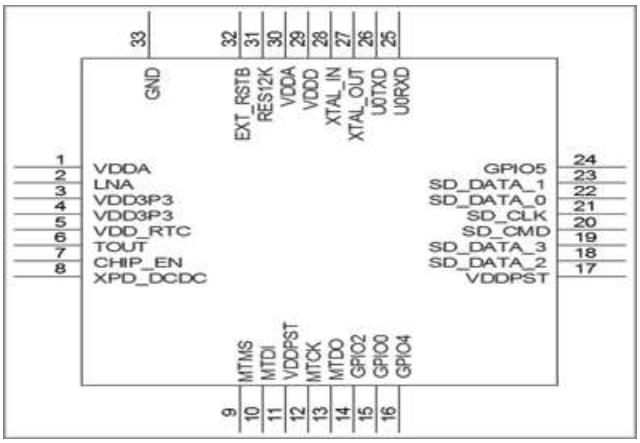

Figure 7 ESP8266EX pin assignments

3.1.6.1 Schematics

In order to reduce the number of components required, the ESP8266EX chipset has a highly integrated design. For a complete wireless communication module, a crystal oscillator, ten resistors, capacitors, and one SPI flash are all required in addition to ESP8266EX.

3.2 Connection Diagram

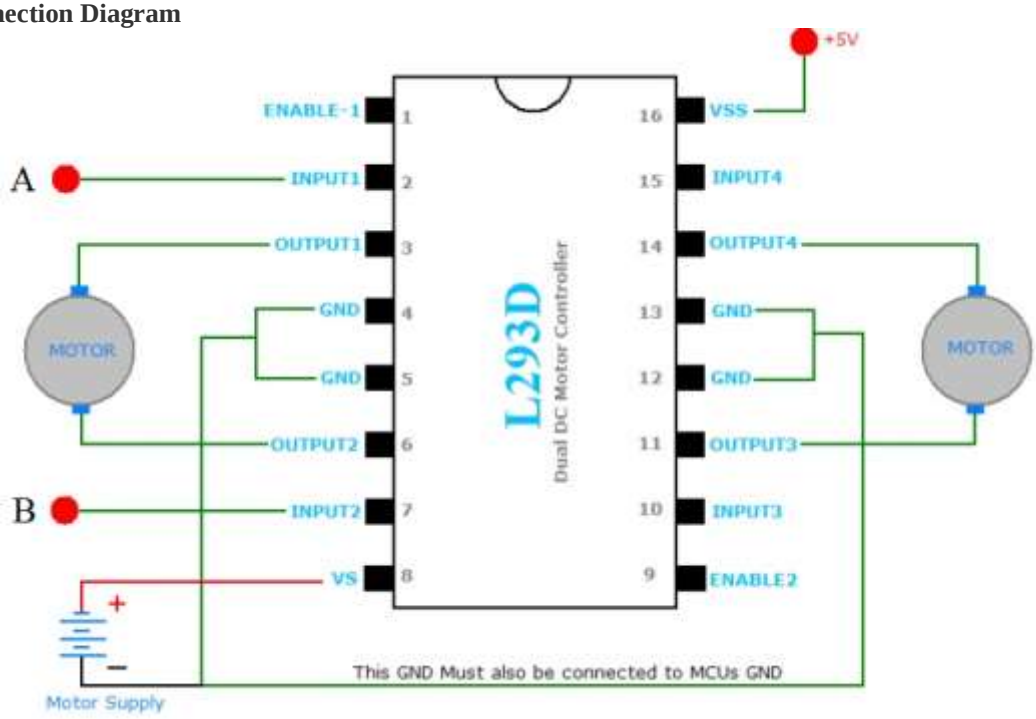

Figure 8 Connection diagram

3.1.7 LCD

There are a variety of applications for LCD screens ("Liquid Crystal Displays"). An LCD screen with a size of 16x2 is very basic and is commonly used in various devices and circuits. Compared to seven segment LEDs and other multi segment LEDs, these modules are preferred. In this LCD, each character is displayed in a 5x7 pixel matrix. It has two registers, namely, Command and Data. A 16x2 LCD can display. This LCD has two registers, namely, Command and Data.

Figure 9 LCD screen

3.1.8 Relay

An electromagnet and a set of contacts are the components of a relay, which are able to be operated electrically or manually. Relays are basic switches that are easily controlled by either electrically or manually. The electromagnet performs the switching mechanism. In addition to these criteria, there are many other factors which govern its operation. However, they differ in their applicability. There are relays in almost every gadget. The relay's primary function is to control a circuit with only a low-power signal.

Additionally, it is used when only one signal is available to operate a large number of circuits. Telephones have been equipped with relay devices since their invention. They were indispensable for switching phone calls in telephone exchanges. They allowed long-distance telegraphy to be carried out. Computers were also used to perform Boolean

calculations and other logical calculations when they were invented. A relay changes the direction of a signal from one source to another. High-end applications require electric motors and other devices that consume a lot of power to operate.

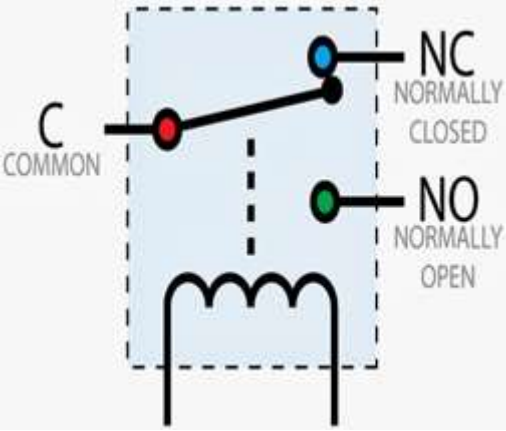

Figure 10 Relay circuit

3.2 Test Case

Three inputs are necessary for this project:

- An electronic circuit must be supplied with a power supply. Here we are using a 5V dc battery to power the Arduino. It is also possible to connect a computer directly to the Arduino's power supply. We also need a 12V power supply for the GSM module.
- It is also possible to power the circuits using two 9V batteries by means of a circuit divider. The Arduino circuit will receive the distance signal taken from the ultrasonic sensor as input.
- The temperature and humidity can be measured using a DHT11 sensor.

3.3 Steps

The Arduino is connected to the power supply using a computer and it can also be done using batteries. Once the whole testing circuit has been built, the level of solid garbage is changed, and the GSM module is used to message the change in garbage levels. Test procedure summary:

- Follow the diagram to properly connect the circuit.
- Turn on the power.
- Change the level of garbage to produce the appropriate output.
- Measure the DHT11 signal.
- Utilize the GSM modem to transmit messages.

4. Results

The suggested system's prototype removed sludge and waste water to the tune of 80-85%. The suggested project's practical implementation would result in increased cleaning efficiency and effectiveness.

5. Conclusion

The suggested methodology removes the harsh practise of removing clogs with manual labour. The gadget in question is lightweight, inexpensive, and extremely effective. As a result, this endeavour contributes to keeping our country clean and healthy. The polarisation of modern services is increasing. Modern services are getting increasingly unmanned as more and more automatic terminal services arise. As a result, this semi-automated sewage cleaning system aids in the automatic cleaning of sewage and the reduction of disease spread caused by direct human intervention in the sewage.

Acknowledgement

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