ERADICATION OF MANUAL SCAVENGING USING VISION AIDED HYDRO-JETTER WITH INBUILT CUTTER

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Abstract – Data from Indian government indicates that the inhuman profession of Manual Scavenging still exists in the country and that there are more than 11000 such manual scavengers in the country. While at work, they tend to inhale various poisonous gases which are harmful for their health and sometimes it causes loss of life too. This project is aimed at designing and fabrication of a low cost Hydro - Jetter Cum Cutter for Sewage Cleaning. Cleaning is done by flushing water using high pressure nozzle to remove debris, grit, sand etc. and a root cutter to clear tree-roots.

I. INTRODUCTION

According to the social justice and Empowerment Ministry the number of sanitation workers who died while cleaning septic tanks and sewers has risen, despite a ban on manual scavenging, with 620 cases reported since 1993 of which 88 occurred in past three years. Number of deaths due to manual scavenging rose by 62% in the year 2019. Around 110 people died in 2019 while cleaning sewers and septic tanks. The National Commission for SafaiKaramcharis (NCSK) reveals that a minimum of 50 persons have died cleaning sewers within the primary 6 months of 2019.

Manual scavenging deals with the act of humans cleaning sewers or elimination of waste from toilets without the use of safety equipment. In simple terms, untreated human excreta are away from pit latrines or bucket toilets using buckets or shovels by hand. Manual scavengers use basic tools like a bucket lined with a sack and a handle. The worker then carries the waste manually to dispose it at the disposal sites. The scavengers are exposed to gases like hydrogen disulfide, carbon (IV) oxide, ammonia, and methane. Long exposure to hydrogen disulfide can lead to death by asphyxia. Also the individual may experience epileptic form convulsions and may fall unconscious and later die. The gas is also associated with visual acuity.

Another major health concern is that the musculoskeletal disorder like the osteoarthritis. Exposure to infections within the sewer is additionally common thanks to the various bacteria residing within the sewers. The common infection is that the Leptospirosis, which is an industrial disease in people that are in touch with an animal like the pigs and their refuse.

Drain clogs are a drag for each homeowner, business, commercial, industrial and institutional establishment at some point. Materials build up and obtain stuck in toilets, sink drains, showers, bathtubs and in your main sewer main due to tree roots that end in slow drains or overflows. Manual scavenging exists because India may be a resource rich country and an outsized human resource and a scarcity of jobs.

II. LITERATURE SURVEY

[1] Nguyen Truong-Thinh, [2011] This paper presents a new approach for design and development of cleaning robots in an unknown pipe workspace. Pipe cleaning and inspection robot is one of the new concepts of professional service robots. Sewer pipes are typically of non-man-entry classification (less than 0.8 m diameter). In this paper, a pipe-cleaning and inspection robot specifically designed for this function is proposed.

[2] Robin Bardbeer, [1997] This paper describes the design of an autonomous mobile robot for use in the inspection of water-filled pipes. The design is based on ultrasonic communications, thus obviating the need for an umbilical cable. The control of the robot is distributed on a local area network, which connects all the actuators and sensors. The robot has four legs, powered by compressed air, which allows the robot to 'walk' over obstacles. As it can have negative buoyancy, it can also 'walk' along the roof of the pipe if there are obstacles on the floor.

[3] Amir A. F. Nassiraei, [2007] This paper describes the development of a fully autonomous pipe inspection system, requires design and development of an un-tethered mobile robot equipped with the required sensors using for autonomous pipe assessment and damage detection, and

capability of navigating, completely, autonomously inside of sewer networks including different types of pipe-bends such as curves and junctions KANTARO prototype robot, including a novel passive-active intelligent moving mechanism, can move into the straight pipe and pass various kinds of pipe bends without need to any intelligence of the controller or sensor reading. It has a fusion with a fish eye camera to assess the pipe state and fault detection.

[4] L. Paletta, [1999] This paper describes about the detection system which identify objects, e.g. inlets, in sewage pipes. A camera attached to an autonomous sewer robot provides images that are interpreted by an attention driven recognition module. Local appearances in the input image are represented in an environment specific description subspace extracted by principal component analysis. The vision system is evaluated in various experiments where it proves successful with respect to the local classification rate, to the generalization behavior in recognizing similar objects, and to detection, that requires a minimum of positive falses.

III. PROPOSED SYSTEM

The proposed work involves the integration of the root cutter, hydro-jetter and the robo module. With the pressure from the nozzle or front jet, the ball bearing starts to rotate which also makes the cutter rotate. The cutter is placed in the form of fins in the module. While the module moves, the cutter keeps cutting the roots, soil, debris, etc. And the hydro-jetter directs the water towards the inner sides of the pipe. The module is controlled by an outside mobile source. The robo module is controlled by using an Android smartphone instead of any other method like buttons, gesture etc. Here, the robo module can be controlled by using the touch buttons in the Android smart phone in forward, backward, left and right directions. In this module, Android smartphone is used as transmitting device and Bluetooth module placed below the hydro-jetter cum cutter is used as receiver. Android smart phone will transmit command using its in-built Bluetooth to robo module and based on the button touched the robo module moves in the required direction like moving forward, reverse, turning left, turning right and stopping. Microcontroller is the main component used to control the bluetooth which is used to drive the motors.

IV. IMPLEMENTATION DETAILS

1) Hardware requirements

a) Microcontroller(pic16f877a)

PIC16F877a may be a 40-pin PIC Microcontroller is employed mostly in Embedded Projects and Applications. Few of its features are as follows: it's five Ports thereon

ranging from Port A to Port E. its three Timers in it, two of which are 8 bit Timers while 1 is 16 Bit.

b) Bluetooth(HC-05)

HC-05 module may be a simple to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. This interface bluetooth module is fully qualified Bluetooth V2. It has a 0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband.

c) Driver module (L293D)

L293D, a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC, which can control a gaggle of two DC motors simultaneously in any direction. It means you'll control two DC motor with one L293D IC. Dual H-bridge Motor Driver microcircuit (IC).

d) ESP-32 Camera

The ESP32-CAM, a really small camera module with the ESP32-S chip that costs approximately $10. Besides the OV2640 camera, and variety of other GPIOs to connect peripherals, it also features a microSD card slot which can be useful to store images crazy the camera or to store files to serve to clients.

2) Software requirements

a) Pic kit 3

The PicKit3 may be a politician Programmer cum Debugger from Microchip Technologies for PIC Microcontrollers.

b) MPLAB

MPLAB could also be a proprietary freeware integrated development environment for the event of embedded applications on PIC and dsPIC microcontrollers, and is developed by Microchip Technology. MPLAB X is that the latest edition of MPLAB, and is developed on the NetBeans platform. ... PICKit programmers also are supported by MPLAB.

V. SYSTEM DESIGN AND SPECIFICATION

The robo module is controlled by using Android smart phone rather than the other method like buttons, gesture etc. Here, the robo module are often controlled by using the touch buttons within the Android smart phone in forward, backward, left and right directions. During this

module, Android smart phone is employed as transmitting device and Bluetooth module placed below the hydro-jetter cum cutter is employed as receiver. Android smart phone will transmit command using its in-built Bluetooth to robo module and supported the button touched the robo module moves within the required direction like moving forward, reverse, turning left, turning right and stop. Microcontroller is that the main component wont to control the bluetooth which is employed to drive the motors.
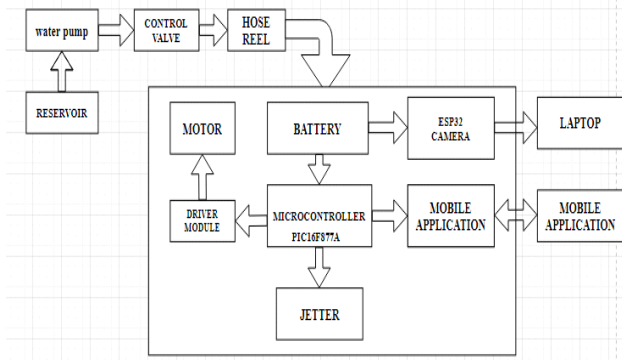

FIG 1 SYSTEM DESIGN

The Bluetooth module after purchasing from market, because there is no need to change any setting of Bluetooth module. Default baud rate of new Bluetooth module is set to 9600 bps. The module just needs to be connected rx and tx to a controller or serial converter and give 5 volt dc regulated power supply to the module.

Bluetooth controlled robot module moves according to buttons touched in the android Bluetooth mobile app. To run this module, first the Bluetooth app should be downloaded from Google play store. We can use any Bluetooth app that supports or can send data.
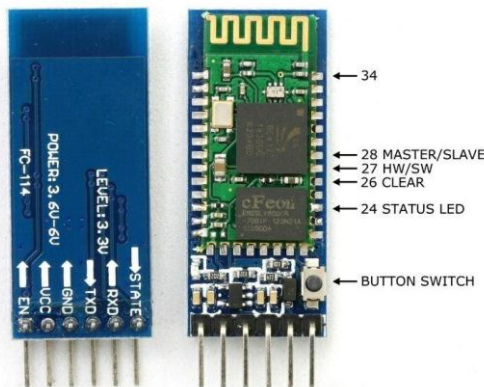

FIG 2 BLUETOOTH MODULE

Bluetooth protocol is a reasonable communication method in PAN network, with a maximum rate of 1Mb/S, working during a nominal range of 100 meters using 2.4 G frequency may be a common way of wireless communicating. The connection are often point-to-point or multi-point where the utmost range is 10 meters. HC05 module may be a Bluetooth module using serial communication, mostly utilized in electronics projects. Its IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). Bluetooth mechanism uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.

VI. CONCLUSION AND FUTURE ENHANCEMENT

The hydro-jetter cum cutter is an industrial tool capable of cutting a spread of materials(like roots), employing a very high-pressure jet of water, or a mix of water and an abrasive substance. There are many other enhancements for the proposed system; one among the important enhancements would be to waterproof the robo module, so on avoid short circuits within the presence of water. Subsequent enhancement would be to integrate waterproof miniature cameras for inspection of the sewer pipe. The grease, silt, fats, soap, detergents, dirt, mineral deposits and other components of sludge inside the pipe are often the precursor to recurrent sewer clogs. Unfortunately, a rotating snake does little aside from punch a hole within the clog to revive flow.
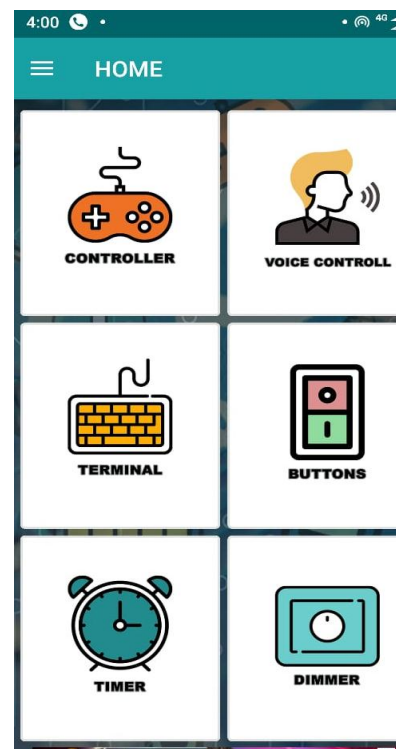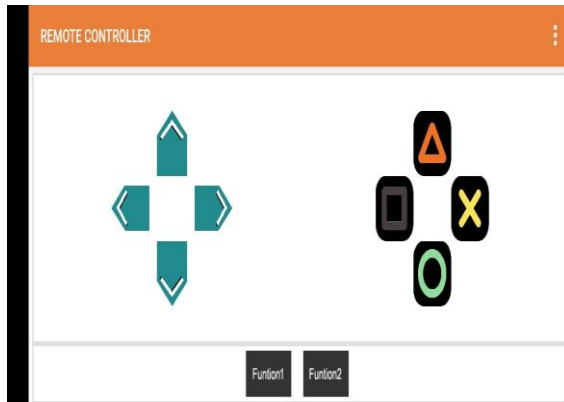

FIG 3 HOME PAGE

FIG 4 REMOTE CONTROLLER

It doesn't address the ongoing issues of sludge that are likely to result in a recurrence very soon. High pressure Hydro-Jetting also can be wont to remove roots in drains by using specialized cutting tools driven by the water jets. Hydro-Jet cleaning is right for sewer lines, kitchen blocked drains, laundry lines, tubs, showers, lavatory sinks and floor drains.

A single pipe cleaning with a Hydro-Jetting system can delay the necessity for an additional trip to clear blockages or tree roots up to fourfold longer than a typical procedure with a mechanical snake. Water from the jet removes the clog completely, safely, preventing self-healing clogs of substances such as grease from re-forming and in a very environmentally safe way. Hydro-Jetting saves money in the long run and it reduces maintenance costs too.

There are many other enhancements for the proposed system, one of the important enhancements would be to waterproof the robo module, so as to avoid short circuits in the presence of water. The next enhancement would be to integrate waterproof miniature cameras for inspection of the sewer pipe.

VII. REFERENCES

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