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SEWAGE CLEANING AND INSPECTION MACHINE

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ABSTRACT

Inspection of underwater pipelines has been a task of growing importance for the detection of a variety of events, such as inner coating exposure and twists, which might indicate risks for future leakages. The purpose of developing a sewage system in a society is to channelize the waste coming out from houses, industries and other facilities. Due to diverse discharge coming out from different sources the pipeline tends to get blocked. Even in dry weather, large quantities of water will be discharged into the sewer; therefore detecting the point of blockage and inspecting them in the sewage pipeline is difficult. Legal guidelines require scheduled, regular and systematic detection and recording of a sewer system's structural and operational condition. The inspection and cleaning systems to be designed should effectively do away with walk–through sewer inspections. In this project, we are creating a solution of using an underwater vehicle that can move in the sewers. This is remotely operated using a joystick. The robot is designed to sustain in harsh conditions and to detect the blockages in the sewer pipelines. This proposed model of robot can be used to replace the traditional method of using manual scavengers to detect and remove blockages.

1. INTRODUCTION

Inspection of underwater pipelines has been a task of growing importance for the detection of a variety of events, such as inner coating exposure and twists, which might indicate risks for future leakages. Manual scavenging was ruled illegal due to reportedly death of manual scavengers increased by each year. To provide a complete Solution to this deplorable situation an automatic sewage cleaning machine is used as a replacement to manpower. The sewage inspection and
cleaning is done by a mechanical device working on the basis of Arduino is driven by electronic arms and human monitoring and controlling. A camera installed at top of the robot that carries out live streaming of the interior of the pipeline. These visuals are viewed by the operator in software to be recorded for future reference. As the robot nears the obstacle, the scrubber starts cutting through the obstacle, thus, clearing the obstacle. Thus, this device effectively decreases all the predicaments associated with sewage cleaning and inspection. This machine reduces the human risk factor and makes an effective cleaning process. Other than the cleaning process, it can also be used for the inspection and monitoring of drainage pipeline, to prohibit the person from being engaged or employed for cleaning of sewage, and to correct and timely identify the insanitary latrines and manual scavengers.

2. METHODOLOGY

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The methodology of this project design can be divided into two sections; hardware and software implementations. The hardware implementation consists of the development of the main controller, servo systems, joystick and the camera while the software implementation focuses on the programming of Arduino using Arduino Integerated Development Environment (IDE). The following actions is carried out by the system. First the machine is placed inside the drainage system where the pipeline is to be inspected. The Wi-Fi camera which is controlled using the joystick inspects and detects the unwanted disturbances and sends the image to the PC. The scrubber which is driven by servomotors is allowed to cut through the disturbances and make it to flow along with the water. The servomotors that drive the camera and the scrubber are programmed using Arduino IDE. The two joysticks are used to operate them easily from outside of the pipeline either 180 degrees vertically or horizontally. Main controller is the most important part of the system in this project. Main controller will be the interface between the user and the system. Arduino mega is used as the "brain" of the main controller. It has 54digital input/output pins 16 analog inputs, 4 UARTs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply by connecting to battery . Motors are the devices which make the machine movable. Motors convert electrical energy into physical motion. The vast majority of motors produce either rotational or linear motion. The machine uses four DC gear motor which runs at 500 rpm at a voltage of 12V. These motors are used to run the wheels of the machine. A motor can maintain a constant speed only if the torque is greater than
the combined forces in opposite of the robot movement. If the motor torque is smaller than the opposition torque, the motor will stop and may be damaged since the electrical energy cannot be converted into torque. The machine uses differential steering that separately driven the wheels. The machine can change direction rotating each wheel at a different speed. The microcontroller decides the speed and direction of the motors; it cannot drive them directly because of its very limited current and voltage output. The motor controller, on the other hand, can provide the current at the required voltage but cannot decide how the motor should run. Thus, the microcontroller and the motor controller have to work together in order to make the motors move appropriately.

Another direct current motor which runs at a speed of 1000 rpm is used to rotate the scrubber placed at the front of the machine. The scrubber is connected by a rod to the shaft of the motor. The 1000 RPM 12V DC Geared Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Although motor gives 1000 RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque. The hardware and the software implementation is done by Integrated Development Environment (IDE) is a software application that provides comprehensive facilities to computer programmers for software development. Visual programming is a usage scenario in which an IDE is generally required. Visual Basic allows users to create new applications by moving programming, building blocks, or code nodes to create flowcharts or structure diagrams that are then compiled or interpreted. These flowcharts often are based on the Unified Modelling Language. An IDE is used to create software applications, drivers, and utilities. These are the capabilities available to you when you turn your computer on. IDE's bring everything needed together to develop and test these entities. Some of the operations ide can perform include:

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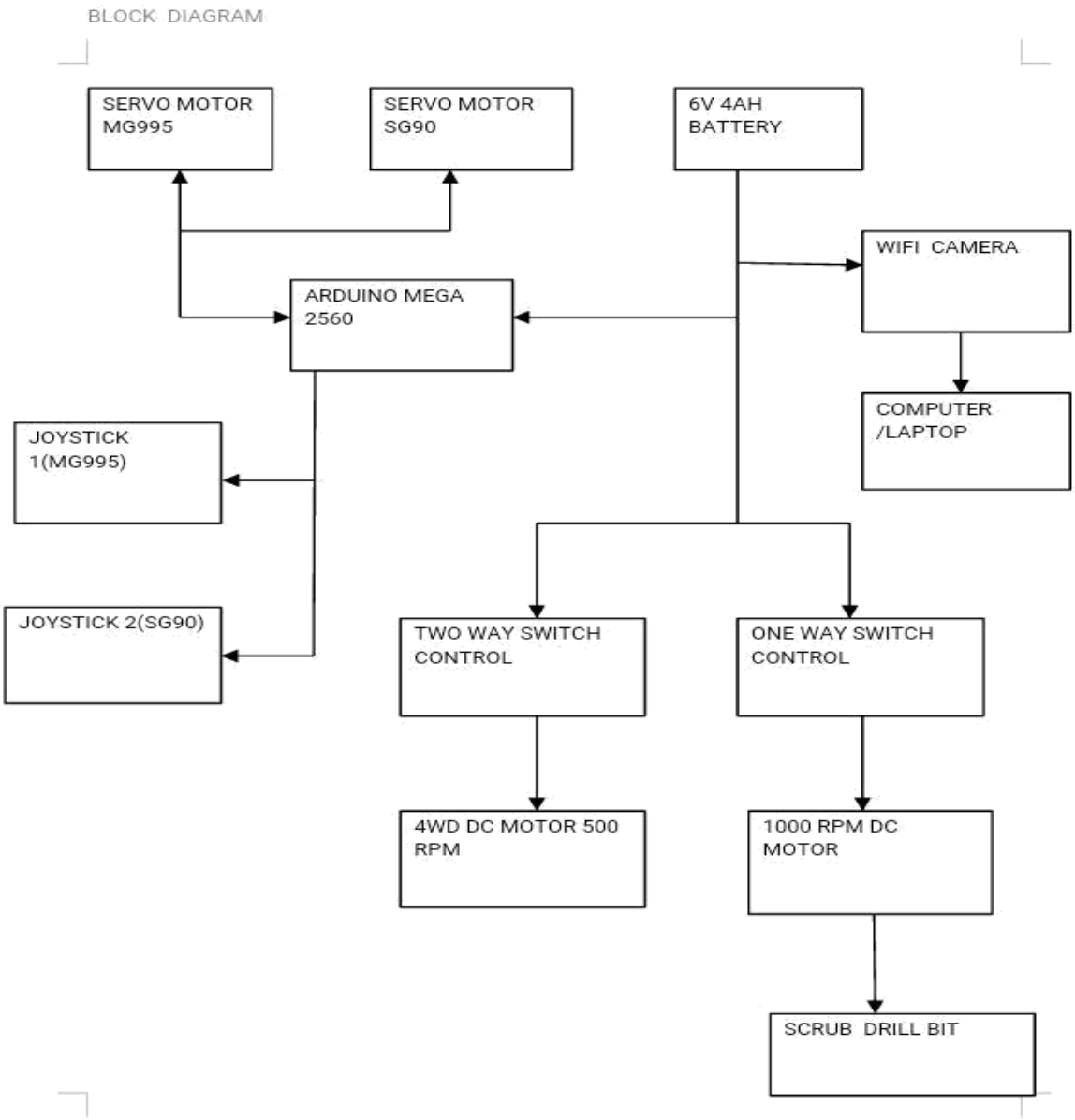
- Writes Code - You have the ability to enter and modify the program code that performs the tasks needed.

- Compile Code - Gives you the ability to translate program code into machine executable code.



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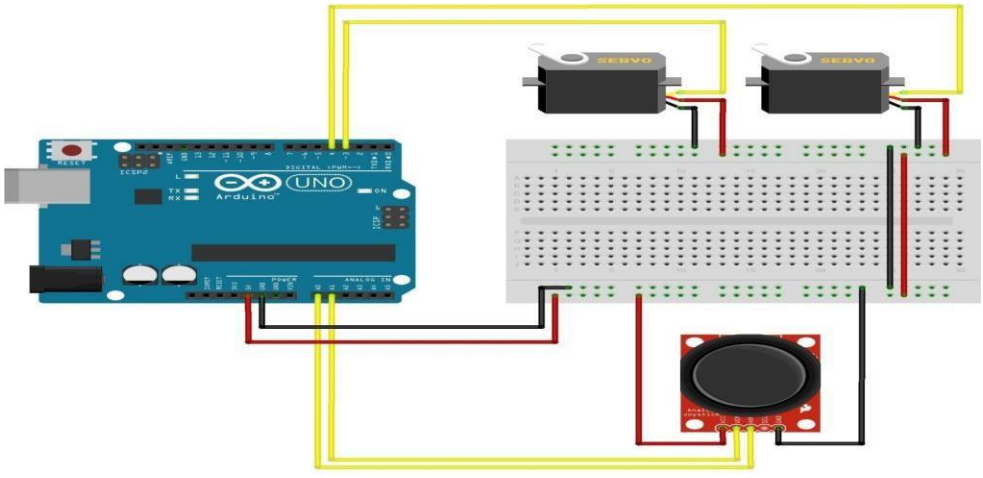
3. HARDWARE AND SOFTWARE DESCRIPTION

This explains about the hardware components that are used in this system. A number of hardware components such as Servo motors, geared DC motors, camera, microcontroller and other communication modules are used in this project. The main part is the servo motor which is used to operate the scrubber and the camera. Since this is an industrial based application, with the use of SCAIR in the sewage pipeline cleaning and monitoring can easily be performed. This robot has limited operating range and battery use. Most programmable microcontrollers that are used today are embedded in other consumer products or machinery including phones, peripherals, automobiles and household appliances for computer systems. Due to that, another name for a microcontroller is "embedded controller." Some embedded systems are more sophisticated, while others have minimal requirements for memory and programming length and a low software complexity. The microcontroller used here is Arduino mega microcontroller. Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The device which varies the voltage/current of the motor is called as the controller of the motor. This can be achieved using servo motors. A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire. There is a minimum pulse, a maximum pulse, and a repetition rate. A servo motor can usually only turn 90° in either direction for a total of 180° movement. Wi-Fi cameras are used to upload pictures automatically to your computer from any location as long as there's an Internet connection. In these days, it may seem a cumbersome to connect something, such as a camera, to the computer to transfer information. Wi-Fi camera sets up access to your home Wi-Fi and setting up the location you want your pictures to go. The Wi-Fi camera should have a switch to enable the wireless local area network (WLAN), which gives the camera access to the network and allows sending the pictures. Wi-Fi equipped cameras still include a USB cable and connection so this helps to hook it up to any computer.



The joystick module is the simplest to use and it has greater flexibility. It can be used with many microcontrollers especially in Arduino. Analog Joysticks return analog values. They are a great source of input for a project. They are mostly used in the field of robotics. Joysticks can control servo motors when connected to an Arduino. In this project, we are going to control two servo motors by using a joystick module. When the joystick moves in the horizontal direction, the first servo will move towards right or left. When the joystick is moved in the vertical direction, the second servo will move towards the right or left. When the joystick will be in resting position, then the analog value will be 512. The Arduino analog pins will read the data from the horizontal and vertical pins and the digital pin will be used to read the button. The joystick module has 5 pins, which are Supply voltage (VCC), Ground, X key (Horizontal key) and Y key (Vertical Key).

CONCLUSION

This paper proposes an innovative, fully autonomous and un-tethered sewer inspection and clearance robot which fits into pipes of variable diameters. Inspection is carried out by live streaming of the interior of the pipeline. Since the visual obtained can be recorded in the software, the data can be utilized for study of sewer pipelines. In conclusion, the objectives of the review paper were met where the robotics application in in-pipe inspection was understood, reviewed and discussed. Further research can be done to detect the navigational landmarks such as manholes and pipe joints independently. Modern services are becoming polarized. With the emergence of more and more automatic terminal services, modern services are also gradually becoming unmanned. Thus this semi automated sewage cleaning system helps in cleaning the sewage automatically and helps in decreasing the spread of diseases due to direct human intervention into the sewage. Since the system operation mainly depends on high level programming, it can be extended as per requirements. This system is time saving, portable, affordable, consumes less power and can be made easily available so that can use this system whenever and wherever. Drainage from industries is treated through this project to meet the national emission standards, with stable operation, low cost and good effect. This system functions move effectively during heavier rains, which have more volume of garbage running water.

4. FUTURE SCOPE

Sewage backlogs are the common cause of sewage water drainage damage to a particular area. When waste water pipes/drains are blocked, sewage water overflows from the pipes into our home through its plumbing system. The sewage waste may cause substantial property destruction, and also the growth of disease causing bacteria which is hazardous to our health. Hence, it is necessary to have sewage removal performed quickly and properly by a proper mechanism. This machine is used in almost all types of drainage (Large, Small, and Medium) and is an efficient way to control the disposal of sewages. It will be useful for cleaning and maintenance of sewer line drains in industries, hospitals, schools, colleges, roadsides and other public and private places. In India, sewage drains are open and people throw many non degradable wastes in them. This project will be very useful in inspecting and cleaning these areas. In future, it is possible to make it a fully automated system without the use of joysticks. The cleaning system is easy to operate and cheap to fix the

drainage problems. And, there is a reduction of labor oriented method of cleaning, thus upgrading dignity of labor. It is a light weighted portable machine that requires less power. Thus, this project helps in making our nation clean and healthy.

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