

Pipe Cleaning Robot Using Microcontroller

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Abstract: Our project is about Pipe cleaning robot using microcontroller for industrial appliances which is very useful for cleaning the underground pipelines. Pipelines are very essential for transporting water and oils from one place to another [1]. They are used to interconnect networks from one station to another station and they are in various diameter sizes and fitting to compensate intended directions. And due to the continuous flow of water and oil fluids, pipelines are get damaged and the layer like dust is formed in the pipelines. To avoid this, frequent cleaning of pipeline is mandatory, but cleaning this small pipeline with a help of human is a tedious and expensive process [2]. To tackle these issues, We have developed a robot which travel inside the pipeline and clean it. This robot is light and compact and made up of simple and cheap components.

Keywords: Pipeline Operation, Smooth Mobility, Pipe Cleaning Robot.

1. Introduction

Application of pipelines is very important in all over the world. Pipeline are majorly used to transport the water, oil and other chemical fluid at certain length of distance in a closed pipelines. Pipelines are also used to transport fluids within one station to another station, building or even thousands of distant kilometer, which is long and interconnected networks that involved various diameter sizes and fitting to compensate the intended fluid direction [3]. Due to the closed pipeline, it is very difficult if it got blocked or damaged or even clogged than can affect its flow speed of water and oil fluids. Research has identified that number of cause that can affects its performance. Meanwhile, a sticky concoction of soap grease, hair, soap, food particle or even dissolved minerals in the water or oil [4]. Once this layer of sludge is formed, more sludge tends to accumulate in the pipelines, which will narrowing the size of the pipeline that will reduce the efficiency of the pipeline.

Routine cleaning of pipelines are can be considered as a preventive maintenance which is to ensure smooth pipeline operation at optimum level and also prevent blockage by removing dust and clog like substances [5]. There are numerous methods being used to clean the pipeline. Some times chemical substances like Calcium Carbide (CaC₂) are also may be used. However, they are not used for all types of pipelines because the usage of chemical will probably erode the pipeline. Advance method use special devices namely Power-Rodding and Hydro-Jetting. These methods are work best if the blockage happened nearby the pipelines [6]. However, the methods are not suitable for industries due to safety issues and its inefficiency as sometime the cleaning process itself can damage the pipeline. Therefore there is a strong need for the technology to assist the pipeline operation.

2. Existing Methodology

There are several cleaning system that have been proposed for pipeline cleaning using arduino board and raspberry pi. They are very costly when compared to our PIC Microcontroller. The pipe cleaning system for robots are used to develop and prevent the water loss system [7]. The work presented in describes development and design a mechanism used for pipe developing water loss prevention redevelopment of project. Oil pipeline and water pipeline crawling robot for leakage, in order to examine the flaw and corrosion in oil pipeline and the original mobile pipeline robots in the crawler drive unit, central control unit, and wave inspection device is developed. Fully Autonomous pipelines cleaning robot, Fully autonomous pipeline robot was used for clean the mud inside the pipe [8]. The autonomous pipeline cleaning robot has four tracks to make a smooth mobility inside the pipelines.

3. Proposed Methodology

The main our project is to clean the harmful substance which are accumulated in the pipe make it very difficult for humans to work in the pipes. To travel a robot inside a pipeline onwards forward and reverse

direction. Which was used to construct a robot in which we can minimize the mud scale level inside the pipe. We can able to move in various circumference of pipe. The robot was design to move vertically inside the pipe.

4. Block Diagram

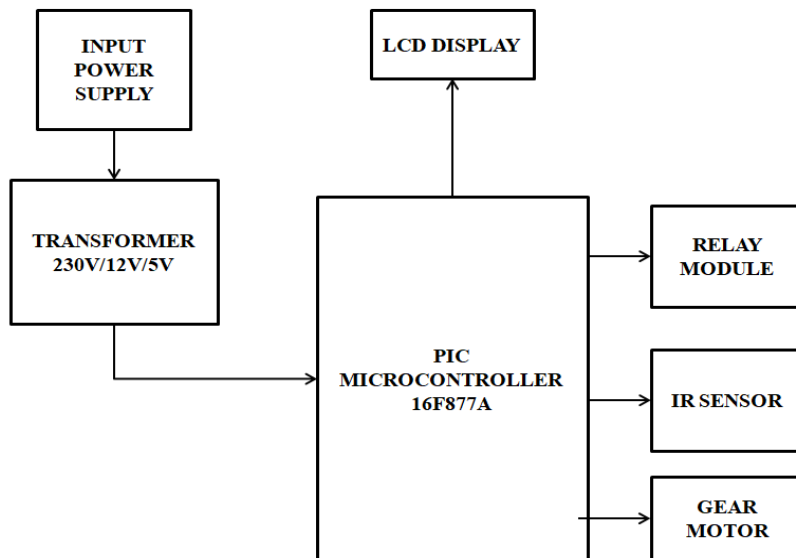


Fig. 1. Block Diagram of Pipe Cleaning Robot Using Microcontroller

Working Principle

The block diagram of the research and the complete flow of this project is shown in figure. The input power supply of 230v is given to the step down transformer which is then converts (230v to 12v ac). The 12v is given to the power supply board which is then converted to 5v. Then the 5v of DC supply is given to microcontroller PIC16f877a, LCD display and to the switch. By using, the receiver the data received from the transmitter then it is decoded. With the help of the IR Sensor the pipelines will be completely monitored and all the harmful solid particle in it will be detected. Once the dust is detected with the help of sensor it will be cleaned by the brushing mechanism.

Input Power Supply

An input power supply is the basic component in every electronic and electrical device. There are various requirements that need to be considered at the time of choosing an electronic device. The function of an input supply is to change the electrical current from a source to the correct voltage and current.

Transformer

A transformer is an electronic device which follows the electromagnetic induction. With the help of a transformer, the 230v is converted to 12v. Then 12v is given as input to a power supply board and is then converted to 5v.

LCD Display

The LCD is used as an output device. If an object is detected by the IR sensor, 'OBJECT DETECTED' will be displayed on the LCD screen; otherwise, it displays 'OBJECT NOT DETECTED'. This is the first interfacing example for the Parallel Port.

PIC Microcontroller 16F877A

The PIC16f877A is a very famed microcontroller. This microcontroller is mostly used and appropriate for the controller and easy to use. The main advantage is we can easily write and erase as multiple times because in it we used flash memory. It contains 40 pins and 33 mins for input and output.

Relay Module

A relay is the electrically operated switch. The main property of relay function is circuit powering coil and completely discrete form the circuit switched on the relay. This was the main purpose for using relay where a low voltage controls the high voltage.

IR Sensor

An infrared sensor is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED.

Gear Motor

The gear motor is cogwheel or gearwheel is a part of rotating cut having the teeth of the machine is inserted part of another toothed transmit torque is known as informally cog of gear.

5. Flow Chart Algorithm

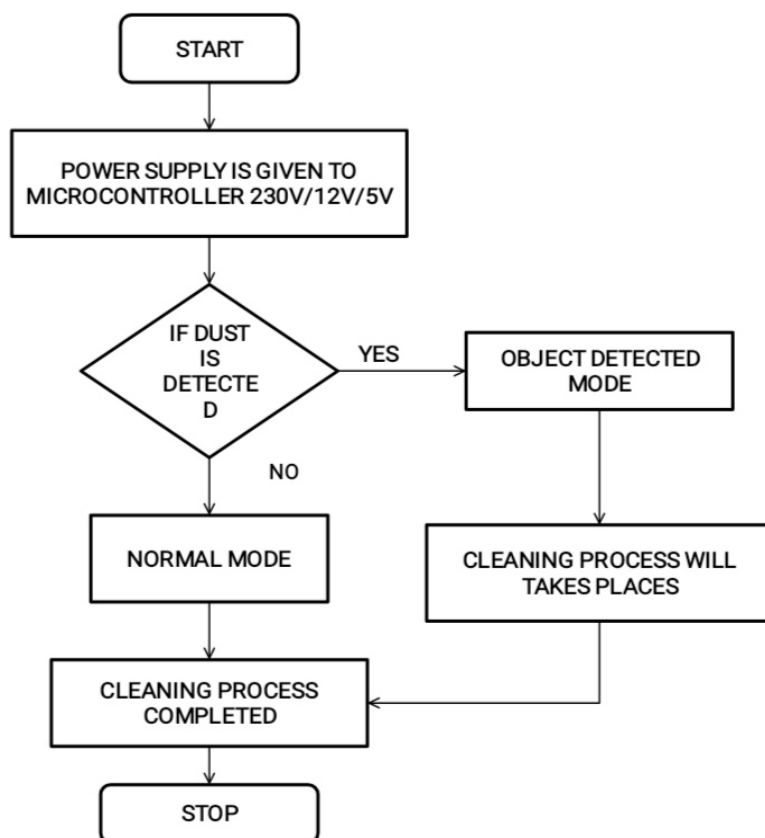


Fig. 2. Flow Chart of Cleaning Process

Step 1: Start the process.

Step 2: Power supply is given to microcontroller (230v is converted to 12v. 12v is as input to power supply board and then is converted to 5v).

Step 3: If dust particle can be detected with the help of IR sensor.

Step 4: Object detected mode.

Step 5: Cleaning work will takes place.

Step 6: Else Normal Mode.

Step 7: Cleaning process is completed.
Step 8: Stop.

6. Result and Discussions

After testing the following results were we achieved: That the robot did not move with the lower power motors so Higher torque motors were added and the robot did not clean the bottom of the pipeline. The pipeline cleaning robot that actuate using four DC motor. The robot front of object to detect the use of IR sensor. The robot front of object to detect the use of IR sensor. The pipelines in front of vertically move to a robot designed and pipeline top of side is used for cleaning process to designing the robot. The successfully designed to our project work and implemented. The next new robot developing and designed, improvement of future to abilities and provide benefits this type robot reconstruct in some modifications.

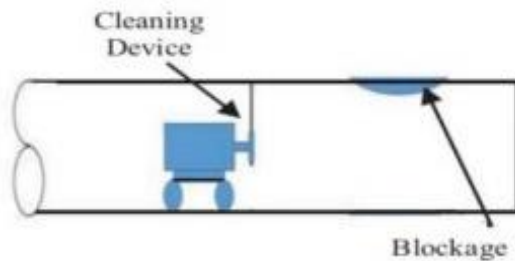


Fig. 3. Schematic Diagram of Cleaning Article

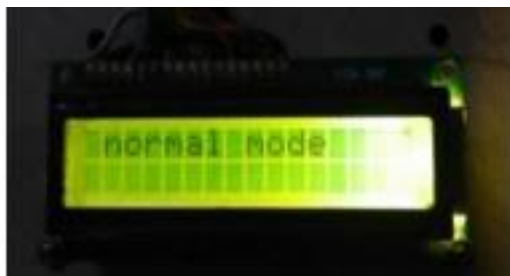


Fig. 4. Operation in Normal Mode



Fig. 5. Operation in Objected Detected Mode



Fig. 6. Transmitter Section



Fig. 7. Robot Model

7. Conclusion

Our pipe cleaning device project has achieved its initially set objectives and we have finally been able to make a device that can cleans the inferiors of the pipeline and also monitored it. During our testing we are able to see that there would be many improvement made in this system. We have also tested the cleaning ability of the motor and found out the robot is effectively able to clean the interior part of pipeline. Our project only works on a pipe of fixed diameter of 10 inches in this case. We would definitely like to overcome this challenges in the future. There are many things we learnt during the course of this project, which includes undertaking pressure, electrical system and system integration.

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