International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

PIPE INSPECTION AND CLEANING ROBOT

Raza Mohammed Masroor, Khan Shadab, Baing Kedar, Rizvi Mohammed Abbas

Rizvi College Of Engineering, Mumbai, India

ABSTRACT

The pipe inspection and cleaning robot is one of the most important system developed for a proper maintenance of underground pipes. Due to Large Development and increase in usage of fuel, oil, gas and the pipes used for such process need to be maintained properly. There are many ways to do that so but Biggest problem arises with such maintenance machine are heavy cost and durability to work in and out of the pipes.

We have come up with a solution of efficient Underground faulty pipe inspection and even cleaning the pipes by only one single robot. Our goal is to achieve this by using a robot that will be equipped with all necessary sensors and equipments to detect fault and even clean the pipes.

The objectives of this project are as follows:

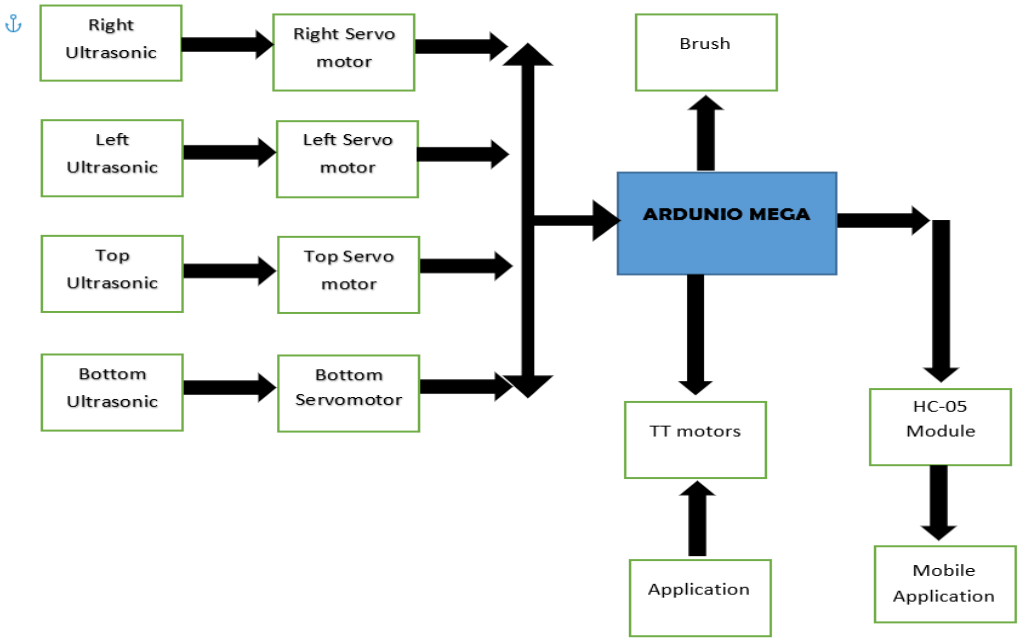
- Design and assemble robot that will be carrying sensors and equipments.
- Write codes for moving robot and working of sensors.
- Adjust the range for ultrasonic sensors to detect the crack.
- Test the code and troubleshoot to increase the robot efficiency and accuracy.
- Study the shortcomings and improve them.
- Test the robot performance with many faults and even increase the cleaning efficiency.
- Determine other parameters which would affect robot reliability.

INTRODUCTION

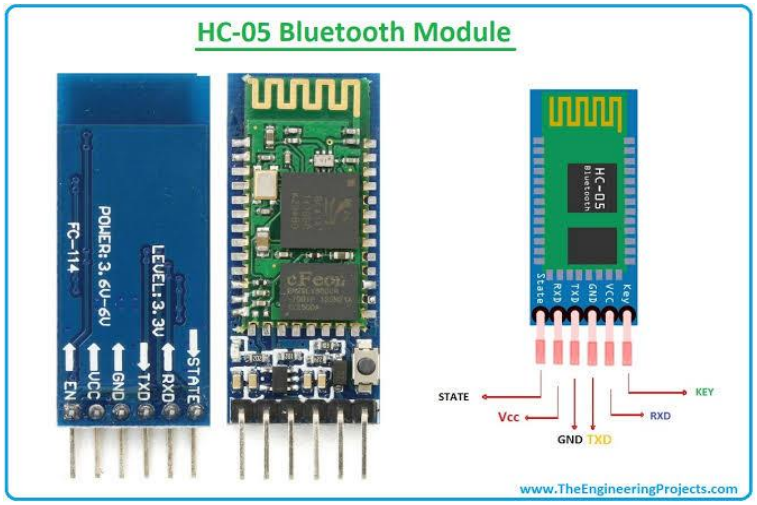
Providing maintenance for small pipes makes the task very difficult. First detecting the spot of problem and trying to rectify it is definitely not that efficient. So we have taken a step and tried to create a project that can actually detect faults out in pipes even clean that pipe if there are any debris we can even modify it and reduce the size for small pipes and through this project our aim is to remove one of the biggest problem we often face during extraction of minerals from earth. This is first step using some
robot system with sensors and other equipments to do so. In our project we are trying to implement a 4 wheel TT motor robot that will be used to transport whole robot forward and backward in the pipe. On the top of this robot we have 4 ultrasonic sensors which are mounted on 4 servo motors which rotate in 90° each which in total makes full 360° and covers the whole pipe without missing even a single spot. Ultrasonic sensors and so programmed that if there are any crack detected then the whole robot stops moving and with the exact location data is forwarded to Mobile Application that we are using. This data is transferred to Mobile App using HC-05 Bluetooth module which is interfaced with Arduino mega.

CONSTRUCTION

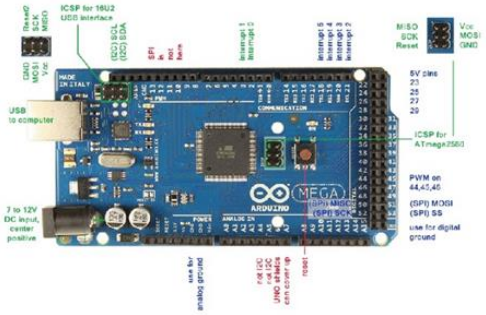
So, in our proposed robot we have embedded Arduino Mega which is controlling unit of the whole project which is working for 4 TT motors used for creating a robot on top of it there are 4 servo motors which rotate in 90° each to cover whole of 360° and ensure every spot inside the pipe. The important parts of the project are ultrasonic sensors which are so programmed that if there is any crack been detected it sends a low signal to the Arduino and this low signal is further transferred over Arduino using HC-05 to Application we have created. In the application we receive the input and send the command back to Arduino to make a move Forward or backward respectively.



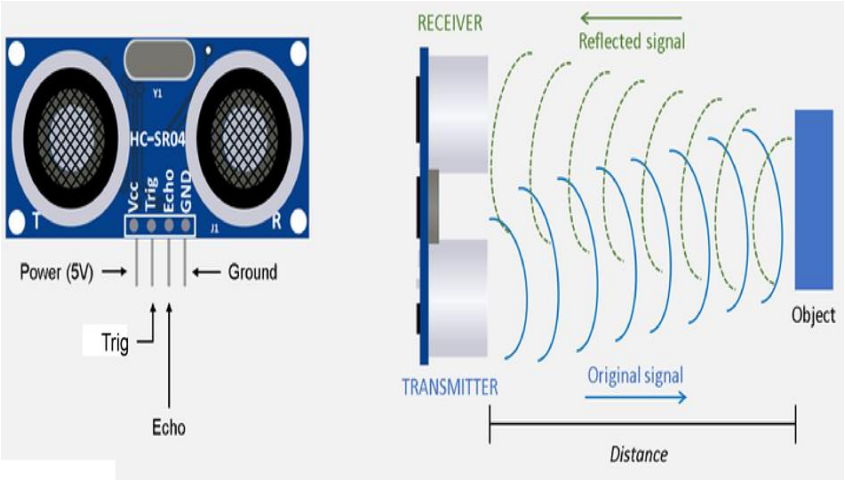
Arduino mega:



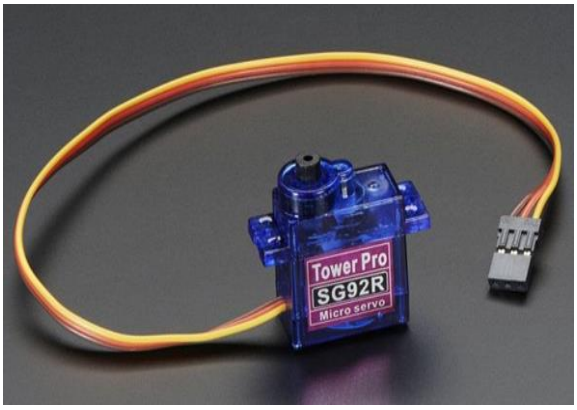
HC- 05 Bluetooth module:



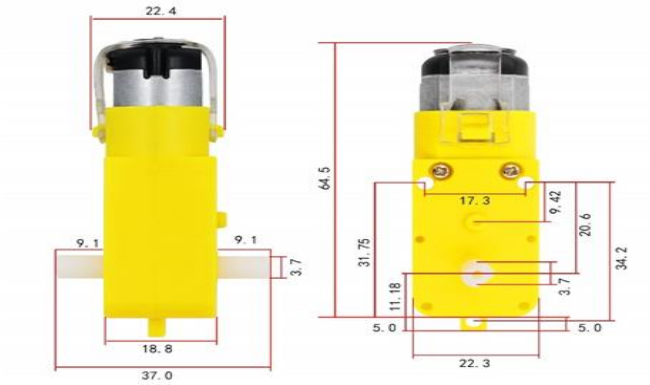
HC- SRC04 Ultrasonic Sensor:



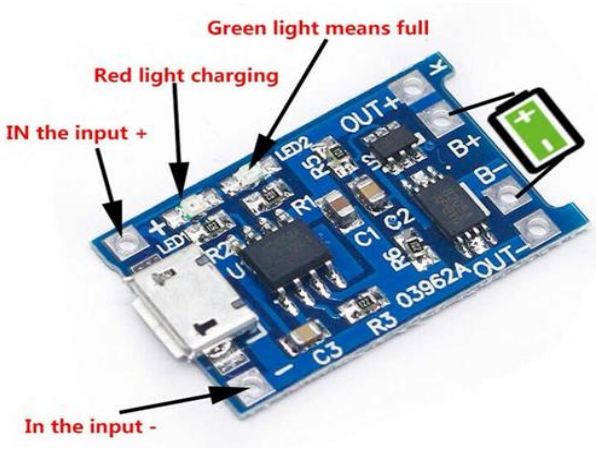
Servo motors:



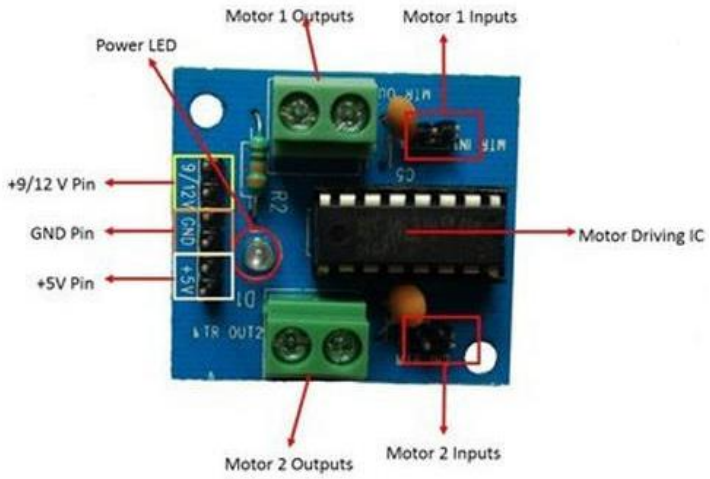
BO motors:



18650mAp Battery and Charger:



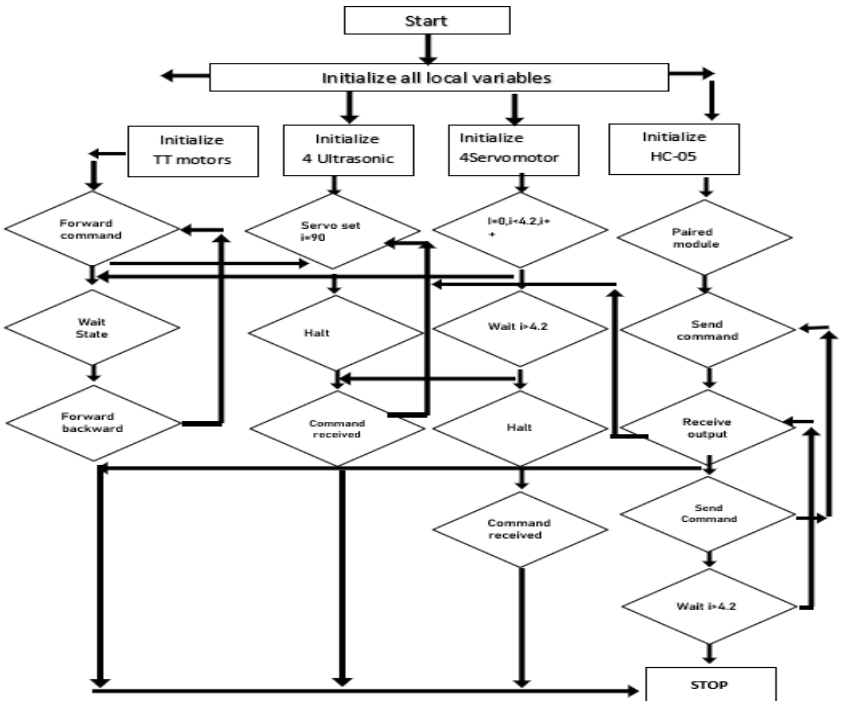
L293D motor driver Module:

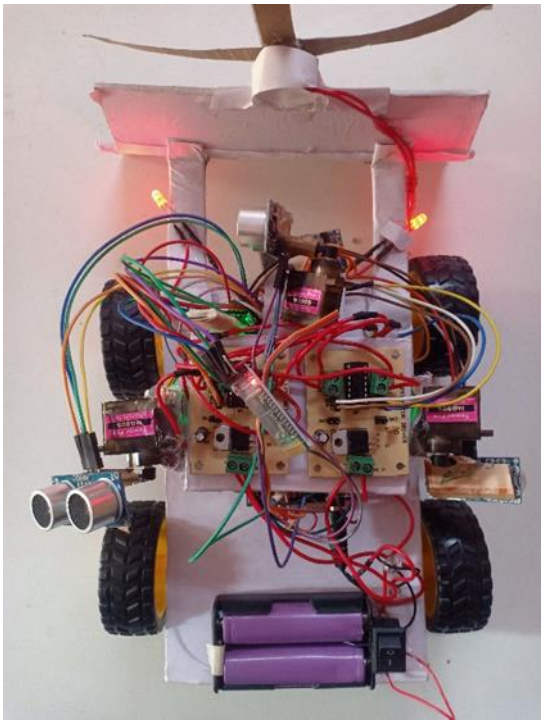


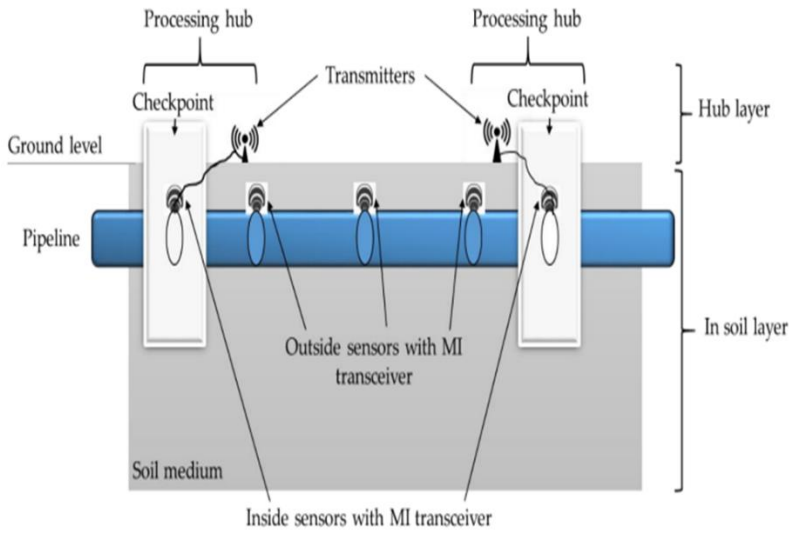
WORKING

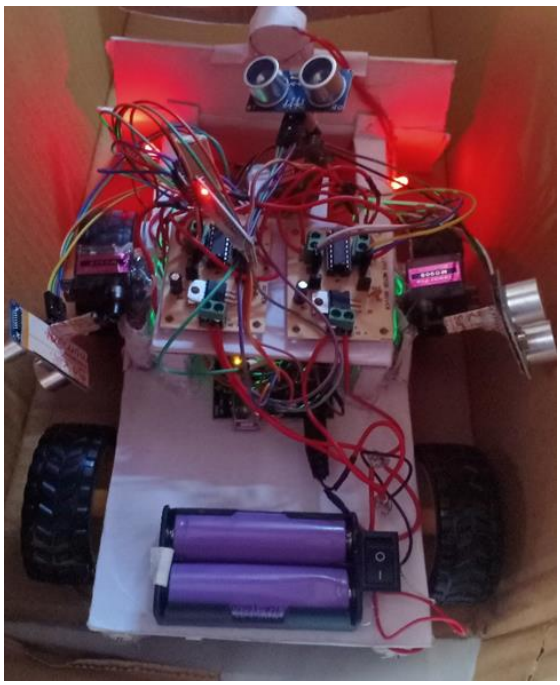
- When the switch is turned on the voltage from the 2 Li - ion which produce a total voltage of 7.5 v is transferred to 4 TT motors via L293D motor driver IC module and the same supply is provided to Arduino mega which in future converts this 7 v to 5v using internal voltage regulator.
- Now the important step of connecting Arduino Mega with HC 05 Bluetooth module. Firstly we open our Bluetooth option in our mobile device and pair the module if password is required then 1234 is selected and waiting for few time to let the fast blinking Led to slow down for a while. After which we can confirm a perfect connection between Mobile Application and Arduino. This is first Important step often it is observed in many application pairing is big issue.
- After proper connection with Arduino now the whole robot is let to move in the pipe with some faults cracks and if there are any debris present in it.
- After which command is provided from mobile application to HC-05 to move forward and robot starts to move forward. And the Servo motors that are connected also starts to rotate for 90° each, the ultrasonic sensors also come into action and later the output is produced.
- Now robot is moving in the pipe. The ultrasonic sensors that are placed are programmed to receive signal reflected back from the pipe walls for a certain centimetres only e.g. for 4 cm. If there is any crack present then there will be no signals received that means the signal that was send by Tx of Ultrasonic was not received by Rx of Ultrasonic because of the presences of crack in the walls of the pipe and hence this detected signal is transferred along with the distance that is travelled by the robot all information is forwarded to the application.
- District is calculated by a counter that is used when command is provided for robot to move in forward direction. As we understood how ultrasonic detected crack same logic is used by all the ultrasonic sensors and output provided on the application is as follows " There is a crack detected at ____ Cm at _____ Coordinates."
- After inspection of the crack the moving robot stops sends the signal with exact location and waits for the command of move robot in forward direction or in backward direction.
- The brush that is attached to the motor and interfaced at the Front end rotates continuously and removes all the dust or waste materials any presents in the pipe
- The programming of an Arduino Mega 2560 can be done with the help of an IDE (Arduino Software), and it supports C-programming language. Here the sketch is the code in the software which is burned within the software and then moved to the Arduino board using a USB cable.

- An Arduino mega board includes a boot loader which eliminates an external burner utilization to burn the program code into the Arduino board. Here, the communication of the boot loader can be done using an STK500 protocol. When we compile as well as burn the Arduino program, then we can detach the USB cable to remove the power supply from the Arduino board. Whenever you propose to use the Arduino board for your project, the power supply can be provided by a power jack otherwise Vin pin of the board.









CONCLUSION

From experimental procedure, analysis and literature referred we conclude that Underground faulty pipe inspection and cleaning robot has the following advantages:

- Working and Handling the project is very much convenient and effective.
- Now maintaining underground pipes are more efficient.
- If produced at large scale we will be able to reduce the cost to very minimal rate. As we can buy components at cheaper rate and this will increase the employment rate.
- We can modify the size if the robot and this project can be used for any size of pipes. By making changes in the programming we can achieve the required output.

REFERENCES

- 1. Karoui, T.; Jeong, S.Y.; Jeong, Y.H.; Kim, D.S.; Karoui, T.; Jeong, S.Y.; Jeong, Y.H.; Kim, D.S. Experimental study of ground subsidence mechanism caused by sewer pipe cracks. Appl. Sci. 2018, 8, 679.
- 2. Oren, G.; Stroh, N. Antileaks: A device for inspection and discontinuation of leakages in domestic water supply systems. Eur. J. Young Sci. Eng. 2012, 1, 10–13.
- 3. Kwak, P.J.; Park, S.H.; Choi, C.H.; Lee, H.D.; Kang, J.M.; Lee, I.H. IoT (Internet of Things)-based underground risk assessment system surrounding water pipes in Korea. Int. J. Control Autom. 2015, 8, 183–190.
- 4. Rosdi, M.A.H.M.; Othman, A.N.; Zubir, M.A.M.; Latif, Z.A.; Yusoff, Z.M. Sinkhole susceptibility hazard zones using GIS and Analytical Hierarchical Process (AHP): A case study of Kuala Lumpur and Ampang Jaya. ISPRS Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci. 2017, XLII-4/W5, 145–151.
- 5. Jaya, P. Two Pedestrians Fall Into 3m-Deep Sinkhole in Seoul. Star Online. 25 February 2015. 6. De Waele, J.; Gutiérrez, F.; Parise, M.; Plan, L. Geomorphology and natural hazards in karst areas:
- 7. Han, Y.; Hwang, H.W. Discussion on the sinkhole forming mechanism. Int. J. Adv. Sci. Eng. Technol. 2017, 5, 42–44