

# Review on Design And Working of Pipe Inspection Crawler

Tejas H Salunkhe<sup>1</sup>, Omkar M Jadhav<sup>2</sup>, Ajay D Patil<sup>3</sup>, Niranjan Nhavkar<sup>4</sup>, Prof. Rinky Maity<sup>5</sup>  
<sup>1, 2, 3, 4, 5</sup> Vishwaniketan's institute of Management Entrepreneurship and Engineering Technology,  
 Kumbhivali, Tal. Khalapur, Maharashtra 410202.

**Abstract-** A Structural monitoring is the ongoing measurement and analysis of factor affecting a structure. This can take place either before, during and/or after the construction phase, or throughout the life of a structure, where it acts as a permanent monitoring solution ensuring you are able to resolve problems before they develop into more costly structural issues. Structural monitoring is required for the smallest of structural changes can make a difference to your structure or a neighboring one so it's important to be able to react fast when they occur. Advance structural monitoring provides engineers with information about structural changes in real time, giving them the ability to react quickly, safely and efficiently. So we prefer visualizing inspection crawler for structural monitoring which works on Arduino programming and give us a high resolution video clip data used to inspection out of dark and into the office giving you information at your fingertips. It can be used in all kinds of hidden space, small space and other real time image detection such as mine detection, seismic prospecting, weld detection, search and pipe inspection, tunnel acceptance.

**Keywords-** A Pipelines, Pipe Inspection Robot, Leak Detection, Pipe Leakage, Water Distribution System.

## I. INTRODUCTION

A robot is an electromechanical machine that is controlled by computer program to perform various operations. Industrial robots have designed to reduce human effort and time to improve productivity and to reduce manufacturing cost. Today human-machine interaction is moving away from mouse and pen and becoming much more pervasive and much more compatible with the physical world. Android app can control the robot motion from a long distance using Bluetooth communication to interface controller and android.

Microcontroller ATMEGA328P-PU can be interfaced to the Bluetooth module through UART protocol and code is written in embedded C language. As per the commands received from android app the robot motion can be controlled. The output motion of a robotic vehicle is accurate and

repeatable. Pick and Place robots can be reprogrammable and tool can be interchanged to provide for multiple applications. The purpose of this work is to design and implement an Android Controlled Bluetooth Robot which is used for Surveillance, home automation, wheelchairs, military and hostages Rescue applications. The pipeline inspection robots are very useful to detect the pipelines or small tunnels internal cracks. It is more important as per the performance and life of pipelines used. There are many pipeline inspection robot systems have been developed, and this pipeline inspection robots which are classified into several elementary forms according to the movement mechanism.

Thus, many kinds of mechanisms have been developed, such as wheel type, inchworm type, legged mobile type, screw type, crawler type, PIG type, caterpillar type and passive type. Among them, wheel type and caterpillar type pipeline inspection robots were mostly popular. If a small water pipeline bursts or leak, it can be a problem but it usually does not harm our environment. However, if a petroleum or chemical pipeline leaks, it can be the environmental and ecological disaster.

In India, we can see many pipeline accidental reports at the National Transportation Safety Board's Internet site. Thus, for keeping pipelines operating safely, periodic inspections are performed to find cracks and damage before they become cause for serious concern. When the pipeline used after a period, there exist possibilities of cracking or damage, also the pipeline was gotten into siltation or squeeze that made the pipe wall making irregular varieties. Therefore, the activities for periodic maintenances are required. Because the pipeline is restricted by many environmental factors, that limit makes more difficult to inspect the pipeline. For this problem, inspecting them by using robots is considered as a good alternative.

## II. THE METHODOLOGY

A robot can be control using Bluetooth module HC-05 and ATMEGA328P-PU microcontroller with android Smartphone device. The controlling devices of the whole system are a microcontroller, Bluetooth module, DC motors

are interfaced to the microcontroller. The data receive by the Bluetooth module from android smart phone is fed input to the controller. The controller acts accordingly on the DC motor of the robot.

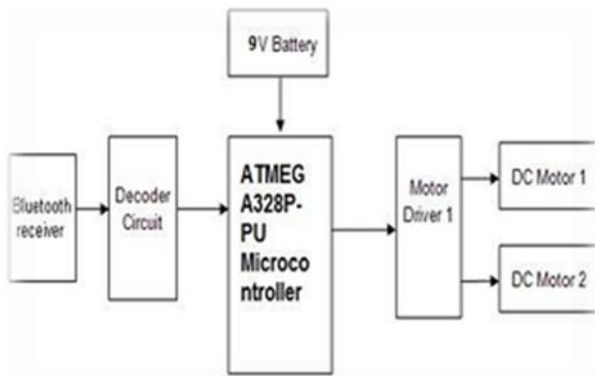
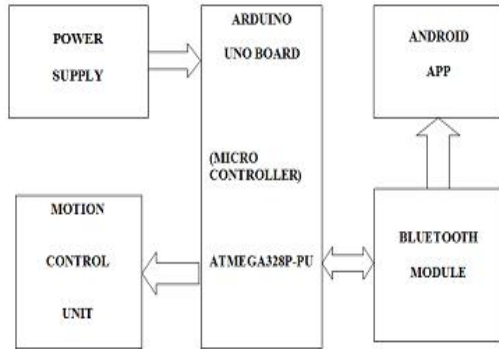


Fig 1. Block diagrams of Proposed Systems.

**THE SYSTEM ARCHITECTURE**

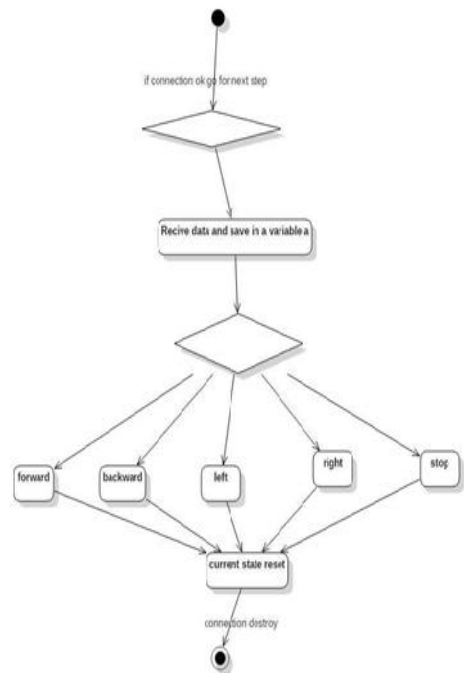
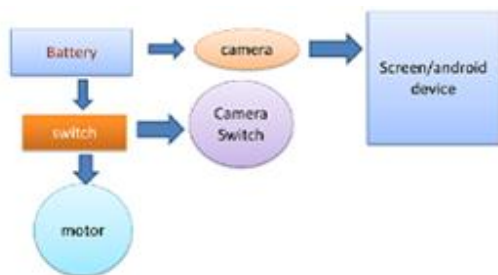


Fig 2. Component Diagram 1

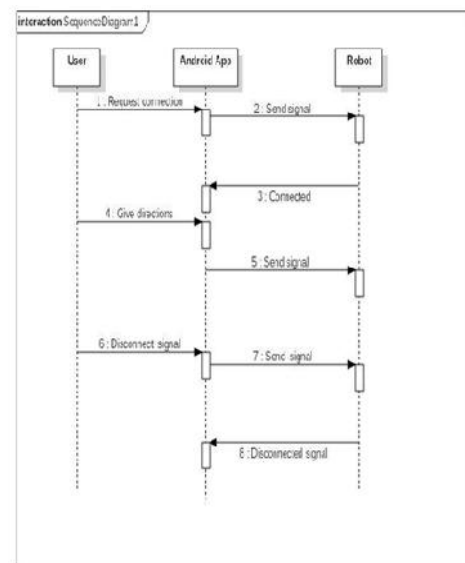


Fig 3. Component Diagram 2

**DC Moto**

In HC -05 Bluetooth module .D.C. motor is controlled by DC voltages and moves in forward, backward, left and right, direction according to the polarity of voltage applied. Mostly all mechanical movement which robot performs is accomplished by an electric motor.

**UART**

Universal asynchronous receiver/ transmitter is usually an individual integrated circuit used for serial communications for computer or peripheral device serial port. UART are now commonly used in microcontrollers. A dual UART combines two UARTS into a single chip. Many modern ICs come with a UART that can also communicate synchronously; these devices are called UART. UARTs are commonly used in conjunction with communication standards such as TIA (formerly EIA) RS-232, RS-422 or RS-485. The universal designation indicates that the data format and transmission speeds are configurable.

**L293D Motor Driver IC**

Microcontroller cannot supply the current required to run DC motor. So satisfy this requirement IC's are used to drive the motor. The L293 and L293D are quadruple high-current half -H drivers. The L293D provides bidirectional drive currents of up to 1A at voltage from 4.5V to 36V. The L293D is designed to provide bidirectional drive currents of up to 600 -mA at voltages from 4.5V to 36V. The L293 and L293D are characterized for operation from 0°C to 70°C.



**HC-05 Bluetooth modules**

This module is capable of communicating with pc, mobile phone or any other Bluetooth enabled device. It is interfaced with the microcontroller over the serial UART port of micro-controller

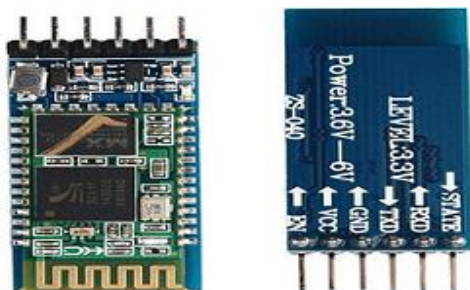
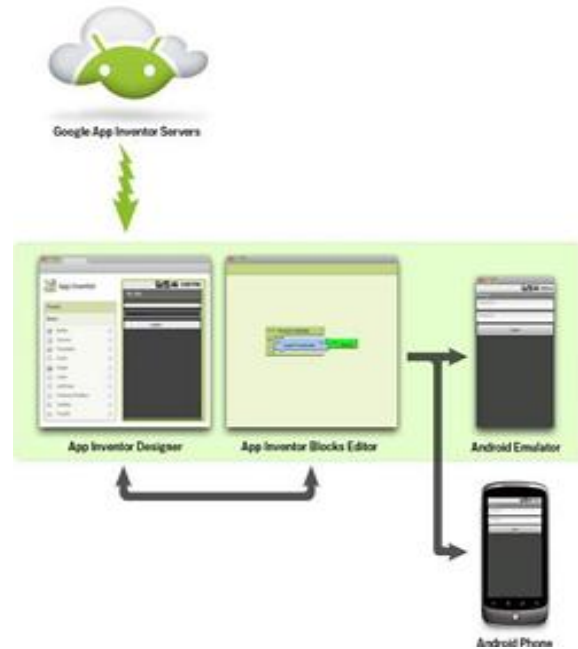


Fig -5: HC-05 Bluetooth modules

Bluetooth is a wireless communications protocol running at 2.4 GHz, with client-server architecture, suitable for forming personal area networks

**MIT App Inventor (to build GUI for Android application)**

App Inventor for Android is an open-source web application provided by Google and now maintained by the Massachusetts Institute of Technology (MIT). It allows computer program to create software applications for the Android operating system (OS). MIT App Inventor is an innovative beginner's introduction to programming and app creation that transforms the complex language of text-based coding into visual, drag-and-drop building blocks. The simple graphical interface grants even an inexperienced person to create a basic, fully functional app within an hour or less.



**Android Application**

Spy Robot is the name of the android application designed for this project. It was designed through App Inventor. The basic function of the application is to control the robot (created with Arduino and Chassis). It has different buttons integrated to it and each button has different functions. There is a total of six buttons in the application. One of them for preparing the device to communicate with the robot. Four of them are for commanding the directions. One is for stopping the motion of robot. For writing code in assembly and simulation of code, Arduino software plug-in to write code in C. Compilers: IAR, Image Craft. Code Vision Arduino Program type: Application Clock frequency: 7.372800 MHz Memory model: Small.

### Arduino Uno Board

This is the brain of robot loaded by a program written in embedded c language to do the required functioning and is interfaced with bluetooth module. The motor driver are used to make the system work as required.



### III. CONCLUSION

In this type of hybrid system manages to increase the flexibility of the robot in terms of move skillfully or carefully with image capturing ability. With hybrid type, it is possible to design a robot with multiple types of motion.

This review paper discusses on the current development of in-pipe robot. The results achieved by the experiments show that by employing hybrid system, most of the robot can overcome motion singularity problem especially when navigating branches and curved pipelines.

### IV. ACKNOWLEDGMENT

We remain immensely obliged to Prof. RINKY MAITY for providing us with the moral and Technical support and guiding us with his expert opinion and valuable suggestions at every stage. This acknowledgement is incomplete without thanking teaching and non-teaching staff of their kind support.

We would also like to thanks DR. BR PATIL principal of ViMEET for providing the infrastructure and resources required for project.

### REFERENCES

- [1] Awith Grippers for Visual Inspection of External Pipeline Surface, Procedia Computer Science, INDIA 2018.
- [2] J.L.Li, L. Z. Chen, X.G. Song, Multi Objective Design

- Optimization Of a Pressure Safety Valve, Procedia Computer Science, China 2015.M. Manjunathaa, A. ArockiaSelvakumarb, Vivek P Godeswarc, R. Manimaran, A Low Cost Underwater Robot
- [3] Ying Qu, Peter Durdevic, Zenyu Yang, Smart Spider: Autonomous Self-Driven In-Line Robot For Versatile Pipeline Inspection, IFAC Papers Online, Denmark 2018.
- [4] Rupert Gouws, Prototype Line CrwalerFor Power Line Inspection, South Africa 2013.
- [5] Piotr Gierlak1, Krzysztof Kurc2, Dariusz Szybicki3, Mobile crawler robot vibration analysis in the contexts of motion speed selection, Rzeszow University of Technology, Rzeszów, Poland, 2017.
- [6] VandanaShrivastava, A Methodical Study of Web Crawler, VandanaShrivastava Journal of Engineering Research and Application, Jaipur 2018.
- [7] DrSuvarnaTorgal, Non Destructive Inspection of Pipe using Pipe Inspection Robot, IOSR Journal of Mechanical and Civil Engineering, Indore 2016.
- [8] Kazuto Kamiyamaa, MikitaMiyaguchia, Hiroki Katob, Automatic Inspection of Embankment by Crawler-type Mobile Robot, International Symposium on Automation and Robotics in Construction, 2018.
- [9] HadiFekrmandi, John Hillard, William Staib, Design of a Bio-Inspired Crawler for Autonomous Pipe Inspection and Repair Using High Pressure Cold Spray, South Dakota 2015.
- [10] Fischer, Wolfgang; Caprari, Gilles; Siegwart, Roland; Moser, Roland, Robotic Crawler for Inspecting Generators with Very Narrow Air Gaps, Zurich 2009.
- [11] <https://www.irjet.net/archives/V7/i8/IRJET-V7I810>.
- [12] [https://www.researchgate.net/publication/220565655\\_In-Pipe\\_Inspection\\_Crawler\\_Adaptable\\_to\\_the\\_Pipe\\_interior\\_Diameter](https://www.researchgate.net/publication/220565655_In-Pipe_Inspection_Crawler_Adaptable_to_the_Pipe_interior_Diameter)
- [13] <https://ieeexplore.ieee.org/abstract/document/640842>