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Pipe Line Inspection Robot

[1] AnandK A, [2]Gundala Srihari, [3]Manoj S, [4]Abhishek Gupta, [5]Rajmohan Biradar
[1] Assistant Professor, [2][3][4][5] UG Scholar
[1][2][3][4][5] Sri Sairam College of Engineering, Bengaluru, Karnataka.

***Abstract:*-- Pipe inspection robot (PIR) is a device that is inserted into pipes to check for obstruction or damage. These robots are traditionally manufactured offshore, are extremely expensive, and are often not adequately supported in the event of malfunction. This project is conceived to redesign the electronics control systems one of these PIR, utilizing the existing mechanical platform. It operates reliably in confined, dark and wet environments and provides a human-wear with a digital video feed of the internal status of the pipes.These robots should as much as possibly incorporate off-the-shaft components, cheap, and potentially onsite repair.The robot allowsfor detection of cracks, buckle, corrosions,pitting and many others.**

Key Words: Pipe Inspection, defect detection, robot, digital.

I. INTRODUCTION

Robotics is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labour intensive or dangerous work environments and also to act in inaccessible environment. The specific operations such as inspection, maintenance, cleaning etc. are expensive. The project aims to create a robotic inspection technology. It is beneficial to have a robot with adaptable structure to the pipe diameter, which possesses enhanced dexterity, manoeuvr ability and capability to operate under hostile conditions. Wheeled robots are simple, energy efficient and have a great potential for long range usage. Pipelines are proven to be the safest way to transport and distribute gases and liquids.

Periodic inspection is required to maintain that status. Pipeline systems deteriorate progressively over time through various means. A challenge in its design and implementation consists in combining the mobility with that of autonomy and low weight.

II. DESIGN PRINCIPLE

Design of the inspection robot depends on two main critical factors: size and shape of the pipeline. It will weigh strongly on the maneuverability of robot and its dimensions.

An ideal robot should:

1. Drive through a pipe that can change its diameter along his pattern;
2. Cope with elbows and branches, reducer, valves with unexpected mechanical damages that could change its mechanical configuration;
3. Be robust and reliable
4. To Have sufficient traction to move and to carry out tasks as measurements or clogging detection in a slippery and not plane surface as a pipe

III.DESIGN PARAMETER

The parameter for design of the robot is the diameter of pipe. We have chosen 8'' and 10''(approx. 200 mm and 260 mm) pipes as the lower and upper limits respectively for our robot. The wheels of the robot should be chosen such that they should be capable of moving without slipping in the vertical direction by exerting the required traction force. They should also not wear out easily with use. These factors are determined by the co-efficient of friction between the wheel and the pipe. Rubber wheels are a natural choice for this environment as they meet the above demands. The co-efficient of friction between rubber and two commonly used pipe materials (concrete and PVC) are considered.

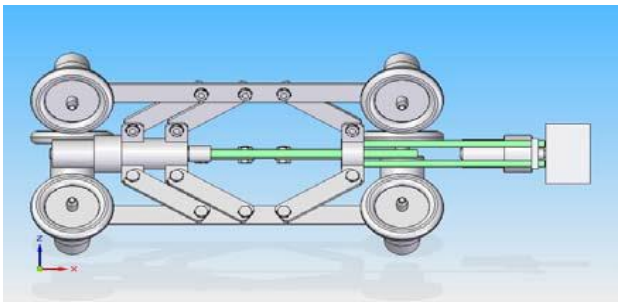

Fig.1: Assembly Front View

The robot mechanism is to be designed in such a way as to expand and contract between the chosen limits.

Working Principle

The fabrication phase of the project involves production of the parts designed. It also entails the selection of appropriate electronic circuitry which can be effectively used to achieve

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and control the robot motion. The various processes used in fabrication of the components are Cutting, Drilling, Welding, Turning.

Electronic circuit and components: The assembled robot needs to start or stop instantaneously. Also, its direction of motion ought to be easily switched over. This can be achieved by using a relay circuit and a remotecontrol.IR Remote control relay is a combination of Infrared Transmitter and Receiver which contains 4 Relays and 1 Fan with Speed Control through TRiAC which can be controlled wirelessly. DC (direct current) motor works on the principle, when a current carrying conductor is placed in a magnetic field; it experiences a torque and has a tendency to move.

If the direction of current in the wire is reversed, the direction of rotation also reverses. When magnetic field and electric field interact, they produce a mechanical force, and based on that the working principle of dc motor established. DC motors are used to achieve the drive on wheels and rotation of rods. Circuit integration and assembly: At the end of fabrication, the electronic circuitry is implemented onto the robot. The DC motors a refitted for the wheels, screw rod and camera plate rod. The 4-channel relay is integrated with all the DC motors. Appropriate wiring is done and a 12V battery is connected to all electronic components.

IV. REQUIREMENTS

1. DC Motor
2. Microcontroller
3. RF Transmitter
4. RF Receiver
5. Motor Drivers
6. Keypad
7. PVC PIPE
8. Fabrication structure
9. Light
10. Battery
11. Servo Motor

ADVANTAGES OF PROPOSED SYSTEM

1. The pipe inspection robot inspects situation inside the pipe which will be recorded and displayed on the monitor screen.
2. It also facilitates working personnel for effective observation, detection, quick analysis and diagnosis.
3. Saves comprehensive investment, improves work efficiency, more accurate detection.
4. Reduces the frequency of entering into the testing environment.
5. Operating cost related to other methods is low.
6. Cost of manufacturing of this robot is relatively low.

V. CONCLUSION

Robots can be effectively used as tools to carry out work in labour intensive, hazardous and unreachable work environments. Pipeline systems are one such environment. Robots can be successfully implemented in pipeline inspections for better detection of defects. The project aimed to create an in-pipe robot with adaptable structure, autonomy and achieve vertical motion.

VI.FUTURE ENHANCEMENTS

1. Use of tilted and guide wheels for traversing curves and bends in pipes.
2. Use of lighter material for the links to reduce the weight.
3. Infrared/Ultrasonic inspection for better detection of defects.
4. Implementation of long range sensors.
5. Implementation as a bore well rescue robot.
6. Alternate design without links to facilitate better motion.

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