Industrial Pipe Inspection with Rust Removal

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***Abstract*— project aims to create an autonomous robot used for in-pipe inspection and removing the rust. The mechanism used involves a central rod upon which a translational element is fitted which in turn is connected to three frames of links and wheels. DC motors are attached to the wheels to achieve the drive required. The mechanism allows for small accommodation in pipe diameters. The camera is mounted on the top of the assembly, motor is attached with the buffering wheel to remove the rust. The robot allows for detection of cracks, buckle, corrosions, pitting and many others.**

INTRODUCTION

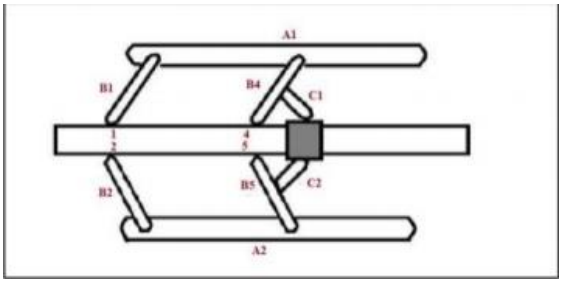
Pipelines are proven to be the safest way to transport and distribute gases and liquids. Periodic inspection is required to maintain that status. Pipeline systems deteriorate progressively over time through various means. Robotics is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labour intensive or dangerous work environments and also to act in inaccessible environment. The use of robots is more common today than ever and it is no longer exclusively used by the heavy production industrial plants. The specific operations such as inspection, maintenance, cleaning etc. are expensive. Thus, the application of the robots appears to be an attractive solution. 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, manoeuvrability and capability to operate under hostile conditions. Wheeled robots are simple, energy efficient and have a great potential for long range usage. A multi – frame robot as shown in fig. 1 offers few advantages in manoeuvrability with the ability to adapt to in-pipe unevenness, move vertically in pipes, and stay stable without slipping in pipes. This type of robot also has the advantage of easier miniaturization. A challenge in its design and implementation consists in combining the mobility with that of autonomy and low weight. Major design objectives are represented by the adaptability of the robot to the inner diameters of the pipes and making the machine autonomous.

FIELD OF APPLICATIONS OF PIPE INSPECTION

- Conventional power plants
- Refineries
- Chemical and petrochemical plant
- Offshore
- Long distance city heating pipelines
- Food and drinks industries
- Communal waste water pipe systems
- Gas pipelines
- Video Inspection
- Visual Inspection
- Ultrasonic inspection

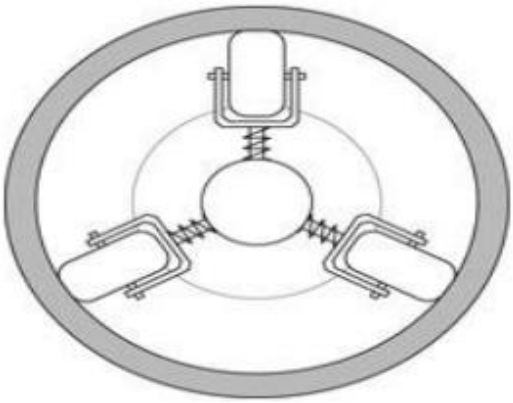
CONSTRUCTION

A pipe inspection robot consist of central element having 12.7 mm dia, , 3 mm thickness and 176 mm in length , one translational element having 15mm dia. 3mm thick & 20mm in length. There are 12 links out of which 3 links are 105mm (A1, A2, A3),6 links of 85mm(B1,B2,B3,B4,B5,B6) & another 3 links of 30mm(C1,C2,C3).The spring is 90mm in length. The central element are joined to the 6 links the length of 28mm.On the central element links a lateral spacing at the points 1,2,3 resp. as shown in fig. Also 3 links are B4,B5,B6 are attach to another point 4,5,6 which are 50mm from point 1,2,3 as shown in fig. in the same way as in p in lateral spacing & the another end is attach to the links B4,B5,B6 at point with pin joint as shown in fig. The another link with length (A1,A2,A3) is attach to the end of the links (B1,B2,B3,B4,B5,B6) at the distance as shown in fig. The motor & wheels are mounted on the links (A1, A2, A3) as shown in fig..The front end of the structure is attached with the swiveling& turning head consist of camera & fitted with BO motor. The camera & lights are mounted in a swiveling head are attached to the cylindrical body. The swiveling head are integrated to the lighting device a typically used in LED. The LED is used to illuminate inside the pipe line. The camera is pan & tilt by remotely. The motor wiring as shown in fig. are supply with 12v dc power supply through adaptor. The 3v dc power is supplied to the BO motor of camera.



Operate the motor wheel the robot remote is connected. The camera is connected to the display equipment(output) via long cable wound upon a winch There are 6 wheels the dia. Of wheel 72mm.There are 6 D.C motor having 10rpm & 12v.There are 2 BO motor having 60rpm & 3-9v.The BO motor is used for actuate the camera & light and it is fixed to the front side of the robot. The spring is attached to

the end of the robot and it provide expand & compression motion to the links with the help of translational element.



WORKING OF THE PIPE INSPECTION ROBOT

As Pipe Inspection Robot is designed mainly for circular bore pipes, it have ability to move inside any bore diameter pipes ranging from 8 inch to 10 inch(203mm to 254mm). Suitable mechanisms are provided so that it gains ability to move inside pipes. This made possible by mounting the surveillance camera and LEDs on head. The perfect fitness between the pipe and robot is first conformed after inserting the robot in the pipe. Then the supply of DC 12Vdc current from is on for working of robot and the camera is also started. With the help robot control having three buttons, working of robot can be easily control the motions which is forward and reverse by one button, Using the friction between wheels and pipe, the motion of wheels become possible.at the rear end of the robot motor is fixed with buffering tool which can rotare up to 1000 rpm enough to scrub the rust metal to be polished. this vehicle is operated through on and off switches

COMPONENT USED

- Ms pipe
- Ms sheet metal
- Dc motors
- Camera
- Buffering wheel
- Toggle switch
- Battery

CONCLUSIONS:

Robots can be effectively used as tools to carry out work in labor intensive, hazardous and unreachable work environments. Pipeline systems are one such environment. Robots can be successfully implemented in pipe line inspections and remove the rust from the inner surface.

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