

Design and Simulation of RC Pipe Inspection Robot

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ABSTRACT

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In recent days, most of the industries are facing many problems to find out damages inside the pipe line. The pipe inspection Robot was made to avoid this problem and to find out the exact place of damage and to reduce the time of evaluating, repairing and managing of interior surface pipes. One of the most important requirements in inspection, repairing and maintenance of interior pipelines is the ability to monitor and evaluate interior surface of pipes. This research work deals with the modelling of robot for inspection, cleaning, maintenance to evaluate the interior surface piping systems. The design of pipe inspection robot has been done in NX Cad (UNIGRAPHICS).the robot is designed in such way that it can be used for different pipe diameters. The design and development of pipe inspection robot involves a mechanism which in turn is connected to two opposite sides of frame of links, joints and wheels. So by using this pipe inspection robot one can find out the exact location of damage inside the pipe, so that it will be very easy to resolve the problem.

Keywords : DC motor, NXCAD, microprocessor, mechanism, inspection.

I. INTRODUCTION

A robot is any automatically operated machine which can reduce Human efforts and time. The study of robot is called as Robotics. Robotics is an interdisciplinary branch of engineering and science. This technology is basically used to develop machines that can substitute for humans and replicate human actions. Robots are used in critical situations and for special purposes. These are mainly replacing the humans in many purposes which are performing in

repetitive, dangerous and hazardous working environments. These are mostly used for achieving high productivity, accuracy and time management. Industrialized developments are costly, necessarily the implementation of the design results to be one of the most prepossessing condition. A lot of improvements can be made with the use of this inspection robot in piping organisation, fittings, corrosion, cracks, and mechanical damages are possible. The essential target of the task is to develop a robot evaluation and cleaning of pipe, as the name

suggests that the robot will be established to reduce the residues that are built up inside surface of interior piping system. This design establishes through a brushing mechanism. Not only this robot clean the residues that are built up inside the pipe but also able to relay live video

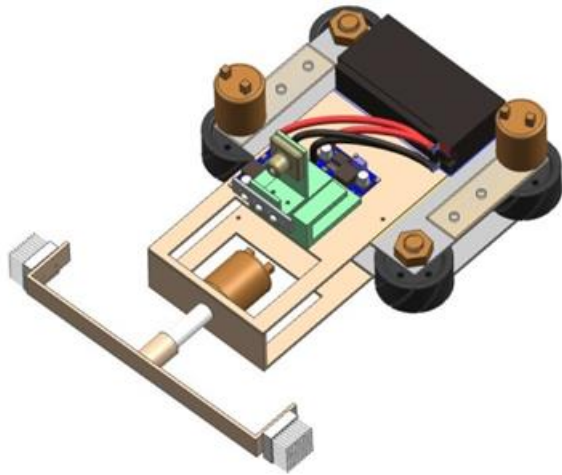


Fig.1 pipe inspection robot

Observation from the ground to the controller. This concept consists of a battery, a DC motor and an wireless camera. Battery is developed to make a contribution for the energy that is provided to the Robot. DC motor followers are electrical strength to the mechanical energy. Brushes are attached to shaft, which are used to clean the interior surface of the pipes. wireless camera is fixed to the robot body, which gives the continuous live video.

II. OBJECTIVES

The main purpose in design and development of this pipe inspection Robot is to inspecting the damages inside the pipeline and to clean the scale and sludge formed inside the pipe line. The conventional structure of a project is consisting of the pipe inspecting, repairing and cleaning robot (PIAC).

The main objective of this project is as following,

- It will inspect the damages like cracks, holes or any other damages inside the pipe line with help of camera provided.
- It will reduce the time as compared with manual inspection and it will increase the quality of checking
- It will go vertically and horizontally.
- Cost per checking the damages also will reduce compared to manual checking.

III. DESIGN OF THE ROBOT

The basic methodology of a design is to develop the robots that are used for cleaning the scale and sludge that are built inside the surface of pipelines. Not only cleaning the residues present in inside the pipe surface but can also able to relay live video monitoring from the ground to the controller. the parameters of pipe inspection robot has shown in the below figure.3.1

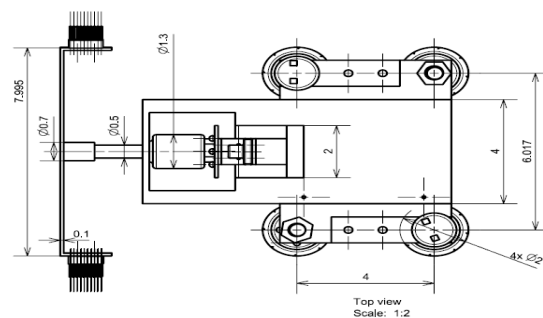


Fig.3.design parameters of pipe inspection robot

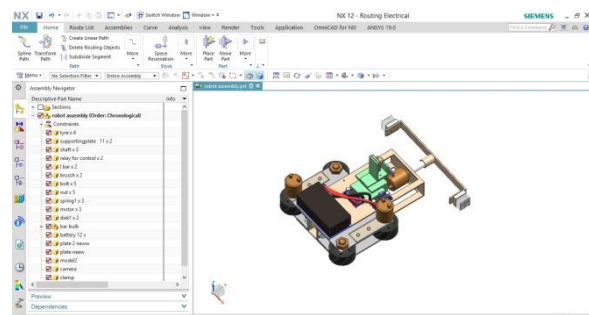


Fig.3.1.Modeling of pipe inspection robot in NX CAD

IV. PRODUCT ARCHITECTURE AND COMPONENTS

The components used in the pipe inspection robot are given below

- DC motor(60rpm)
- DC motor(30 rpm)
- Relay
- Wireless camera
- Remote control
- Battery
- Brush for cleaning

The architecture of the model is as shown in the fig.4

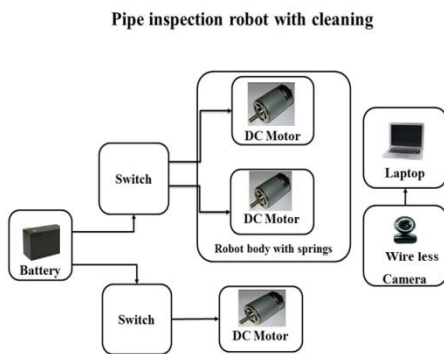


Fig 4.1.Main components in the robot

DC motor:

The DC motor is a device, which generally converts electrical energy into mechanical energy.in this project the DC motor used to produce motion in pipe inspection robot.

DC motor will work with the help of battery. The below figure is showing the DC motor used in the pipe inspection robot.



Fig 4.1.DC motor

Relay:

Control relay is a sequence of Transmitter and Receiver which involve Relays and Speed Control through two-way switches is shown in Fig. 4.2 This makes the system very easy to operate and integrate with actual systems. The control switches works the similar relay on the receiver board.



Fig.4.2 Relay

Wireless Camera:

A wireless camera is a video camera that feeds its image in real time to a computer or computer network. Their most attractive use is the establishment of video links, permitting computers to act as videophones or videoconference stations.. An alternative popular use consists of security surveillance, computer vision, video broadcasting, and for recording social videos. Wireless cameras are established for their low manufacturing cost and flexibility, making them the lowest cost form of video telephony. They have also become a source of

security and privacy issues, as some built-in wireless cameras can be remotely activated. The wireless camera is shown in fig. 4.3.



Fig.4.3 wireless camera

Remote control:

Remote control is a device with which one can control the robot from some distance.

Battery:

Batteries provide supply for a motor and camera and relays Motor and radio frequency gets 6v supply from the central body and camera gets supply from a 9v battery. And 3v batteries for transmitter which has two toggle switches. One is for motor forward and reverse control and the other one is for glowing LED's.as shown in fig. 4.3.



Fig.4.3. battery

Brush for cleaning:

The brush provided in the front of the robot is used for cleaning inside the pipe. The brush is also operated with the help of dc motor only, this brush also controlled with remote.

V. WORKING OF THE ROBOT

The complete design of the robot leads to the next development of the project Working. Here the robot is monitor for its performance of the desired functions.

Drive to the wheels is obtained through DC motors. These motors are attached through relay switches which control the start/stop work and rotational direction of the motors.

The robot functions through the electronic circuit - mechanism interface. One relay switch, worked manually, is used to manage the development of the pipe evaluation robot. camera fixed at the one side of the robot is switched on manually and the other side of the robot brushing mechanism is located on the robot. This brushing mechanism is necessary role to clean the interior pipes. RF receiver is set up with connections made to a TV monitor. The DC motors to the wheels are connected through the channel relay circuit and it is controlled with remote. This makes the wheels rotate at a set rpm.

Once fixed abundantly inside the pipe, the manual relay switch is influenced and controlling the robot so as to accommodate to the pipe diameter. The development is continued till suitable gripping is achieved. The gripping establish motion in horizontal or vertical direction. The channel relay circuit is controlled through the remote for forward motion and back ward motion of robot.

Camera plate is monitored through another relay on the circuit board. This is activated to initiate rotation of camera. As the robot proceeding inside the pipe,

signals are transfer to the receiver providing outlook of the inside surface of pipes.

VI. SIMULLATION OF THE ROBOT

A simulation is an imitation of the operation of a real-world process or system. The act of simulating something first requires that a model be developed, in which this model represents the key characteristics, behaviours and its functions of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the operation of the system over time.

The simulation of the pipe inspection robot has been done NX CAD. The modelling and simulation both are done in NX cad only .

the simulation of the pipe inspection robot is as shown in fig.6.1.

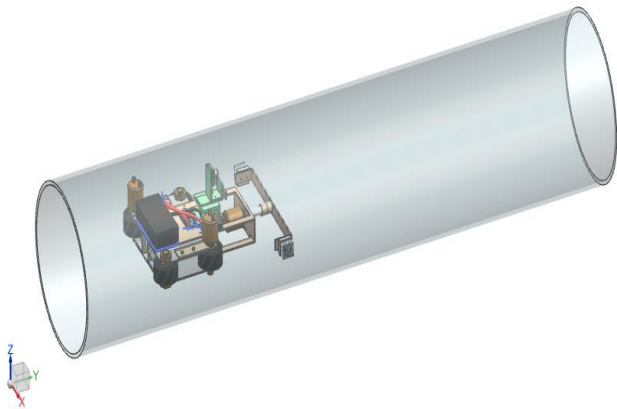


Fig 6.1 simulation of pipe inspection robot in NX cad

VII. ADVANTAGES, DISADVANTAGES AND CONCLUSIONS

Advantages:

Following are the main advantages of the pipe inspection robot

- It can reduce the human efforts
- The time for inspection and the cost for the production of the robot is less.

- It can detect the damages inside the pipe
- It can move front and back & up down also
- It can be used for different diameters of the pipes.
- It can be controlled with remote

Disadvantages:

- As the pipe inspection robot is operated with remote the frequency for the control of the robot is less so it is difficult to inspect the pipes for higher depth.

VIII. CONCLUSION

The robots were designed in a good way to traverse horizontal and vertical pipelines. These robots were developed to determine the interior defects, fittings and corrosion etc. The important tasks of the robot are inspection, repairing and maintenance in interior surface of the pipes. These robots were specially designed and implemented for standard diameter of the piping systems.

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