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Identify the Deterioration in Pipe by Using Wheel Operated Robot

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Abstract— Nowadays, Robots are used in many industries for various purposes. Inspection is the one of the field in which robot used as the inspector. One application is monitoring the inside of the pipe, Recognizing and solving problem through interior of the pipe. So, Inspection of pipe can be achieved by using wheel operated robot. Various problems related to pipe line such as corrosion, erosion and cracks. They can effectively reduce strength and wall thickness of pipe. Pipe inspection is necessary to locate defects due to corrosion and wear to avoid failure. In this work, Pipe inspection robot with ability to move inside horizontal and vertical pipes has been designed and fabricated. The robot consists of motor for driving and camera for monitoring.

Keywords— Wheel operated robot, Pipe defects, and In-Pipe inspection.

I. INTRODUCTION

Recently,Technology is growing in such a way that machines are the part of human life. Robots can control the whole process and work is easer, reduce the production time and increase the safety. Pipelines are commonly used in manufacturing sites as sewer pipes, gas and oil pipes. Pipes are also used in agriculture sector and nuclear power plants. Pipeline inspection robot system improves safety and reduces work time.

There is several type of the robot some are in-pipe inspection robot and some are out-pipe inspection robot. Wheel operated robot is used for in-pipe inspection purpose. Robot is used to identify defects present in pipe such as corrosion, erosion and crack. An in-pipe inspection robot has been designed that can deal with many kinds of pipe with various diameters such as plastic pipes or metallic pipes which are in horizontal or vertical manner.

II. OVERVIEW OF ROBOT

As shown in fig. 1, Robot consists of three parts called body frame, driving module and charged-coupled device assembly. Three driving module attached at the distal end of foldable legs of the body frame, and they are located circumferentially 120^{o} apart from each other. The charged-coupled device assembly is mounted on the front side of the body frame. The radial dimension of the robot is changeable from 20 to 30 cm, while the axial one is 150 mm constant. Also robots can exert 9.8 N of tractive force and 0.15 m/s of speed in maximum just with 0.87kg of its own weight.

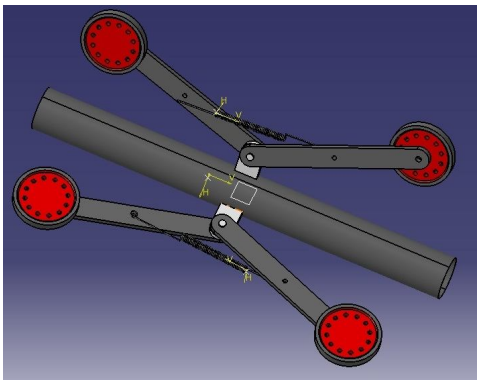

Fig. 1. Wheel operated pipe inspecting robot.

A. Body Frame

Body frame is the central part of the robot. It supports all other components of the robot such as driving module and charged-coupled device assembly. Fig. 2, the joints are brazed on the central frame at 120^{o}. The central body is drilled and its ends are threaded internally for the insertion of pencil batteries and closing with externally threaded caps. Wireless camera is fixed at end of the frame.

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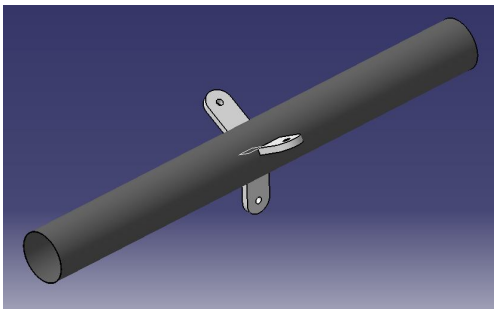

Fig. 2. Central Frame.

Fig. 3, shows the tensile spring used in robot. Spring is an elastic object used to store mechanical energy. Spring used here is made out of hardened steel. The purpose of springs is as follows: The force that the mini robot mechanism exercises on the pipe walls is generated with the help of an extensible spring. The spring disposed on the central axis assure the repositioning of structure, In the case of the pipe diameter variation.

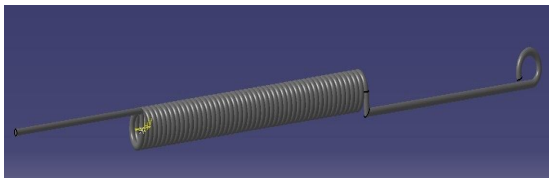

Fig. 3. Tensile spring.

Each resistant body in the machine which moves relative to another resistant body is called kinematic link or element. Fig. 4, shows the schematic view of link. Links are resistive body which transmits the motion. Length of link 120 mm, width is 15mm and 3 mm thickness. Three holes are drilled on link for connecting purpose.

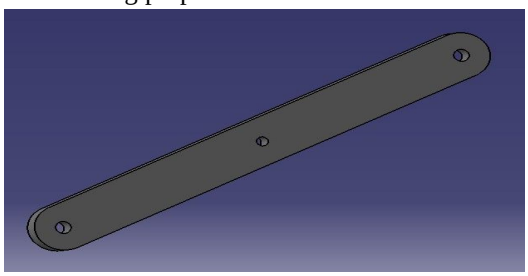

Fig. 4. Link.

B. Driving Module

Driving module is attached at the end of the legs on the body frame. It is used to drive the robot. Which consist of 3 DC motor which is operated on 12 volt battery supply. For motion of the wheel it required to overcome gravitational force acting on body. Driving module are controlled by remote and amplify traction forces, which let the robot have sufficient traction forces on moving upward in vertical pipelines.

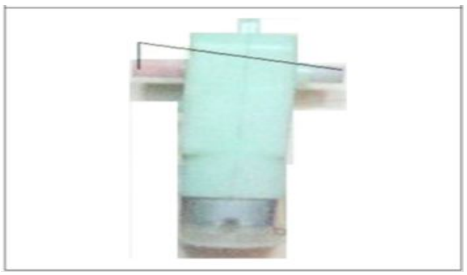

Fig. 5. Driving module.

C. Charged-Coupled Assembly

As shown in fig.6, the CCD assembly is composed of wireless camera lamp for illumination. Wireless camera have a channel also

receiver has channel to tune in and then you sent it by transmitter. The receiver collects the single and output it to Television or Desktop by using TV tuner card. Camera is fixed at the one end of the frame and the robot meant for inspection inside a pipe which could be monitored in a desktop camera transmit signal to the receiver which receive the signal and is connected to the monitor to view the inner side of the pipe.

Fig. 7.Wireless Camera.

III.MATERIAL SELECTION FOR PIPE INSPECTING ROBOT

The materials used for the robot are light different material can be used for different part of robot. Material should be ductile, less brittle, malleable and high magnetic susceptibility. Among the metals, aluminum is the materials chosen for the linkages and for central frame stainless is used. Central frame is made as hollow for reduction in weight. Aluminum is light in weight and a high strength. It can be used in variety of applications. Stainless steel is tough, ductile with cryogenic and high temperature strength property and it is easy to weld with aluminum.

IV.MACHINING PROCESS FOR PIPE INSPECTING ROBOT

Aluminum and stainless steel having good machinability, while manufacturing the robot drilling, boring, gas welding and surface finishing operation are carried out. The drilling was the on the aluminum sheet for required dimension. Boring process can be carried out on lathe for smaller operation. Gas welding can done by using oxyacetylene welding, polishing and buffing are finishing process for smoothing a work piece surface using abrasive and a work wheel.

V. WORKING AND DATA ANALYSIS

By using spring robot is able to move freely inside pipe of 50 cm to 60 cm diameter range. Wireless camera is installed on front part of four leg system and wireless controlled system is mounted on robot body. For inspection purpose robot is put into the .When electric supply starts robot covers distance perimeter of robot wheel and then it get stop. Wireless camera continue provide the video information of pipe power supply which is on board provide power both camera and driving module, LED's are attached at front and back which give us visual vision during inspection because in pipe there is no other light source. In this way we get size and location of crack from starting point on display screen on computer. During crack detection process, wireless camera does visual inspection of pipe and it gives an image of robot path in each crack detection cycle.

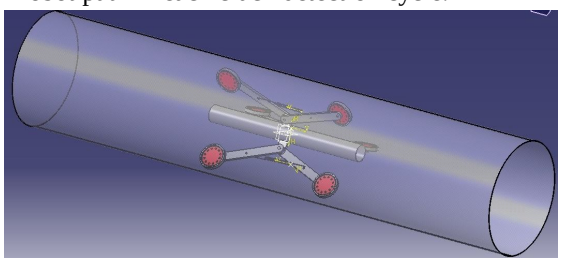

Fig. 8.Working of pipe inspecting robot.

VI.CONCLUSION

A very important goal of the robotic systems is the adaptability to the inner diameter of the pipes. Robot reduces human efforts making work simple and efficient. There are many fields where they are employed that include pipelines inspect and maintenance too. So, we had proposed a new design in inspecting pipelines. The major advantages are that it could be used in case of pipe

diameter variation with the simple mechanism. We developed a pipe inspection robot that can be applied 20-30cm diameter pipeline. Robot is designed for vertical and horizontal purpose. So, Pipe inspecting robot is used in many industry for inspection of pipe.

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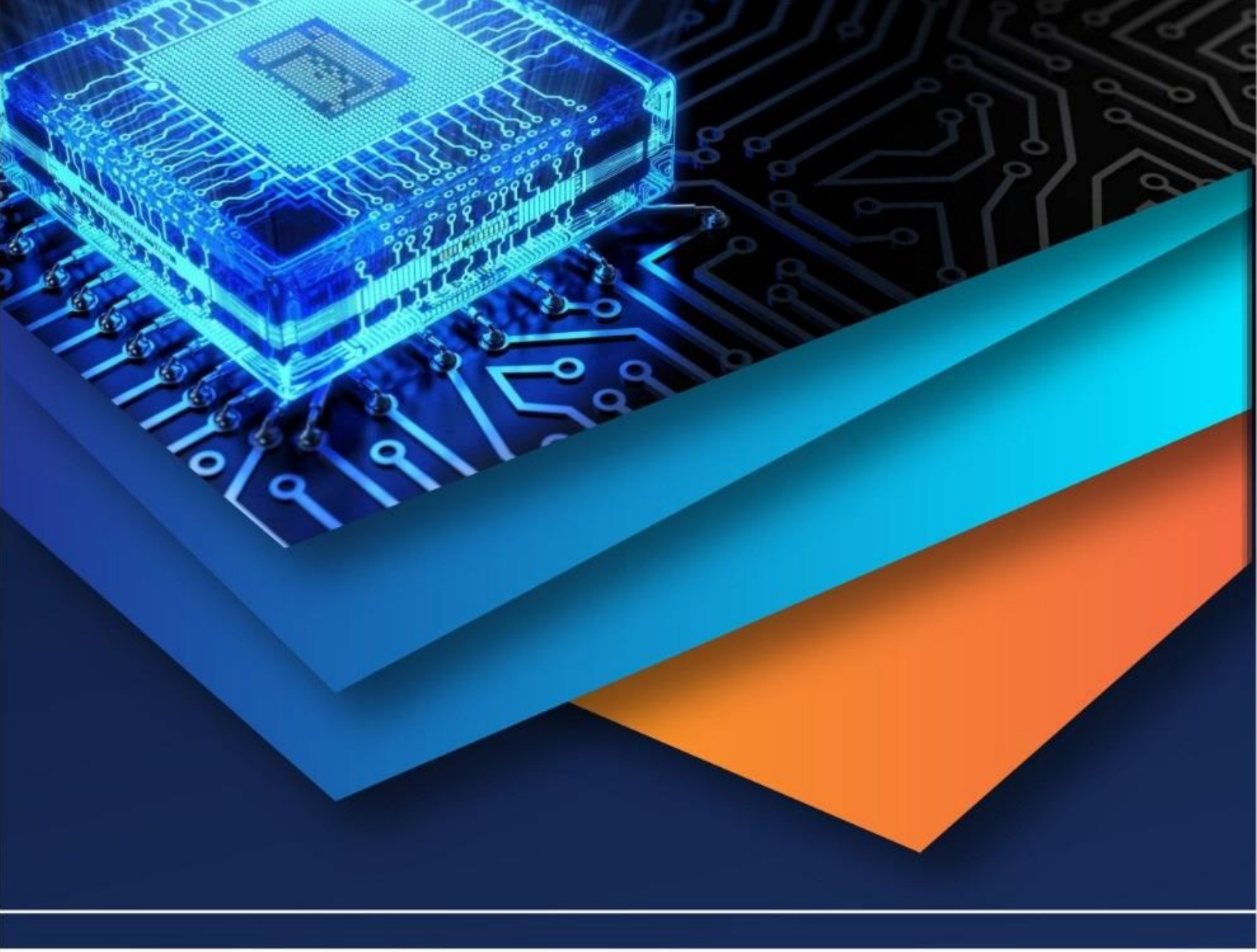

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