DESIGN AND FABRICATION OF INTERNAL PIPE DEFECTS DETECTOR

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Introduction:-

The project focuses on the development of a wireless system that can inspect the pipeline networks internally. Goal of the project is to design and build a prototype of a defect detector that can navigate through a pipeline network.

Inspection robots are used in many fields of industry. One application is monitoring the inside of the pipes and channels, recognizing and solving problems through the interior of pipes or channels. Automated inspection of the inner surface of a pipe can be achieved by a mobile robot. Because pipelines are typically buried underground, they are in contact with the soil and subject to corrosion, where the steel pipe wall oxidizes, and effectively reduces the wall thickness. Corrosion also occurs on the inside surface of the pipe and reduces the strength of the pipe. Along with corrosion other defects like scaling, cavities, cracks and other geometrical defects like pitting and bends also occurs in pipelines. If a crack goes undetected and becomes severe, the pipe can leak and, in rear cases, fail catastrophically. Extensive efforts are to be made in order to mitigate defects.

Pipe inspection is necessary to locate defects occurring due to wear while the pipe is transporting fluids. This ability is necessary especially when one should inspect an underground pipe. In this work, Internal Pipe Defects Detector (IPDD) with ability to move inside horizontal and vertical pipe sections has been designed and fabricated.
The device consists of a motor for driving and camera for implementing visual inspection and a battery pack to power the device wirelessly.

**Objectives:-**

- To design and fabricate a pipe defect detector for inspection of internal surfaces of pipe carrying fluids.
- Pipes are subjected to various defects such as corrosion, eating away of metal, cracks…etc and for efficient working of the pipes, detection and maintenance becomes an important function.
- Our aim is to detect these defects through visual inspection as a primary mode.

**Methodology:-**

The methodology for any study mainly depends on the nature of the problem. For a problem as stated in the objective, initial literature survey is carried out to know the different aspects of the problem.

From the fig representing the front and side view, the various parts such as central frame, spring, transistional element, power pack, links required etc are designed. Simultaneous to the design, drawings are prepared on SolidEdge to study the proper assembly and most importantly to prepare the bill of materials and hence simplify the overall process.

The next step lies in fabrication of all the individual parts maintaining accurate dimensions. Sub assemblies are carried out to avoid last minute issues of fabrication. The Electronic circuit is developed which is to be incorporated in the device.

Once all the parts are fabricated, the assembly follows where all the parts are assembled. This includes the assembly of the machine and also connecting the power pack and camera to the Device.

The final activity lies in the testing. The machine is tested for overall smooth functioning of all the components. The electronic parts are checked thoroughly before the start of inspection.

Also the reception of camera is checked.

**Results and Conclusion:-**
In this report, the issues regarding the manual inspection of pipelines was discussed and a solution has been found in the form of IPDD. According to the experiments, IPDD could navigate almost all kinds of pipeline configurations, regardless of the effect of gravity, its postures, and the direction of movement, except in few cases which has possibility of improvement.

However, according to our experiences on this work, the mechanism of the in-pipe robot should be adaptable to the characteristic condition of the pipelines, and it is the preliminary requirement for successful movement. The use of a general-purpose robot may not be possible in in-pipe applications. For that means, IPDD has the possibility of being used in practical applications, although it is still under development and can be improved by testing infield conditions.

**Scope for Future work:-**

The working prototype of our device has been completed and tested successfully. The device can also be improved further for multitasking inside the pipelines by mounting certain accessories on the device i.e, A robotic arm can be mounted on the device to simultaneously rectify the problem inside the pipelines such as filling of cracks, removing blockages, cleaning-maintaining and painting can be carried out.

Various sensors can be used such as ultrasonic sensors for ultrasonic 3D imaging of internal surfaces which can also be used to detect the extent and position of the defect. Also certain sensors can be implemented on the device to determine the type of flow and fluid through the pipelines.

Some sensors can also be used to determine percentage corrosion using MATLAB programming. The device can also be further developed to navigate inside the active pipelines which reduce the downtime required to inspect the pipelines.