“Design and Fabrication of Wireless Pipe Inspecting Smart Robot”
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Abstract— This work is described the robot design and fabrication for the application of inspecting different size and shape pipes internally. The pipe inspection robot is specially planned to design and fabricate for reduce human effort in pipe inspecting work which is very complicated by manually and different methods. It consists of six arms out of which on four arms, motor will be fitted. A single motor will be fitted on each suspension arm. All the wheels are mounted on a suspension to accommodate for changing tube diameter and curves in the pipe. A motor is powered by battery (source) which is operated by remote control. A wireless camera will be fitted on robot for inspection of pipe through which we can easily detect the problem such as cracks; obstruction inside the pipeline for the trouble shoots the problem.

Key words: Pipe, inspection, robot, wireless, camera

I. INTRODUCTION
The pipe inspecting robot is available in the market but they are too expensive and very difficult to manufacture. Hence we the group of our class found the need of designing and manufacturing such a system, which will make the Robot less expensive easy to manufacture, maintenance and repair easy to movable without compromising the quality of work.

Underground infrastructure is a major section of the urban infrastructure and major cities invest considerable amounts of budget in their infrastructure including water and sewage pipes. Sewer pipes are prone to damage due to aging, excessive traffic geological change, earthquake etc. Thus in order to ensure an optimal functioning sewer system, extensive inspection is necessary. The rehabilitation of underground pipes is costly and slow for the inspection process, because the size of the most pipes eliminates the possibility of the direct human inspection and requires employment of sophisticated equipment. (Computer Based Autonomous Robot for Sewer Pipe Inspection)

In current conventional pipe inspection system the inspection is done using a telephone operated robot which has an on board video camera system and is remotely controlled by a tethered cable by a human cable. To realize the autonomous pipe inspection system, mobile robot should carry all required sources on board. Navigation should be completely performed by the control programs running on on-board computing equipment. Status messages may be communicated to a human inspector over a radio link. Although a few researches have been done in development of a fully autonomous mobile robot, these robots are not yet marketable system today. Most of the current robot has a complex moving mechanism and multi sensor equipment for navigation and motion control. These complexities and data processing make not easy to realize reliable commercial products especially for small range of pipes up to 300 millimeter in diameter. Navin Prasad, M Kannan et.al. had worked on a very important design goal of the robotic systems is the adaptability to the inner diameters of the pipes. So, a new design is proposed for inspecting pipelines. The major advantage is 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 to 140-180mm pipeline. The kinematics of mechanism and actuator sizing of this robot have been investigated. A real prototype was developed to test the feasibility of this robot for inspection of in-house pipelines. In the proposed mechanism the problem is solved by a spring actuation and increasing the flexibility of the mechanism. The propulsion of the robot has been successfully conducted using only three motors, a radical simplification over existing efforts. The robot was designed to be able to traverse horizontal and vertical pipes. [1]

Kentarou Nishijima, Yixiang Sun et.al. has described on rotating probe in vinyl chloride pipe was tested and a new inspection robot system for drain pipe was developed. They developed a drain pipe inspection robot that can be controlled by wireless radio communication in the inside pipe and can also transmit image information of the inside of the pipe in real time. They used a 19m cleaned ceramic pipe with a diameter of 25cm and 30cm. [2]

II. OBJECTIVES
With this project our team objective is to over-come our following needs
1) By the market survey it is found that the cost of available robot for pipe inspection is higher most.
2) Designing a system smarter than available system by collecting necessary data.
3) Planning for troubleshoot the earlier problems and produce smart pipe inspecting robot within less cost.
4) Learnt actual and practical fabrication processes of the sub-components of the system.

Fig. 1: pipe inspecting robot
We had found that there is an impending need to make such a robot with a flexible structure, may boast adaptability to the environment, especially to the pipe diameter with enhanced skilled, easy to movable, capability to operate under difficult conditions.

III. SCOPE OF PROJECT

Engineers are always focused towards challenges of bringing ideas and concepts to life. Therefore, sophisticated machines and modern techniques have to be constantly developed and implemented for economical manufacturing of Products. At the same time, we should take care that there has been no compromise made with quality and accuracy design into reality. New machines and techniques are being developed continuously to manufacture various products at cheaper rates and high quality.

In the age of automation machine become an integral part of human being. By the use of automation machine prove itself that it gives high production rate than manual production rate. In competition market everyone wants to increase their production & make there machine multipurpose. The engineer is constantly conformed to the challenges of bringing ideas.

IV. METHODOLOGY

Robotic is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labour intensive or dangerous work and also to act in accessible environment. The use of robots is more common today than ever before and it is no longer exclusively used by the heavy production industries.

The inspection of pipes may be relevant for improving security and efficiency in industrial plants. These specific operations as inspection, maintenance, cleaning etc. are expensive, thus the applications of the robots appears to be one of the most attractive solutions. The pipelines are the major tools for the transportation of drinkable water, effluent water, fuel oils and gas. A lot of troubles caused by piping networks aging, corrosion, cracks, and mechanical damages are possible, So continuous activities for inspection, maintenance and repair are strongly demanded.

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Table 1. Components used in Pipe inspecting robot

The robots with a flexible structure may boast adaptability to the environment, especially to the pipe diameter, with enhanced dexterity, maneuverability, capability to operate under hostile conditions. The wheeled robots are the simplest, most energy efficient, and have the best potential for long range. Loading the wheels with springs, robots also offer some advantages in maneuverability with the ability to adapt to in-pipe unevenness, more vertically in pipes, and stay stable without slipping in pipes. These types of robots also have the advantage of easier miniaturization. The key problem in their design and implementation consists in combining the capacity of self-moving with that of self-sustaining and the property of low weight and dimension. A very important design objective is represented by the adaptability of the in-
pipe robots to the inner diameters of the pipes. This project is specially designed to travel in pipeline of various angles which is very much difficult for other Robot. This Robot can easily move into pipeline without slipping and without stopping in any case. This Robot helps the inspector to check the pipeline in convenient way without any error. With this Robot we can easily find the cracks, corrosion and obstruction within pipeline. This Robot is specially designed for inspecting empty pipe line i.e. when there is no fluid inside the pipe because the camera which is to be installed is not fluid resistant.

VI. WORKING OF PROTOTYPE ROBOT
As pipes varies in diameter hence leg must be flexible to fit in the pipe. Every leg is provided with spring as its will force the leg to extend up to its maximum limit. Mechanical spring are designed to work in maximum compression position as well as expansion position. Due to this spring will exert force on the leg and leg will be in contact with walls of pipe. Design of wheel is important parameter in absorbing the shock. As shock and sudden jerks on wheels will scatters the images or video taken by the camera, we have taken care that wheel are capable to absorb the shock with spring attached to it.

Fig. 4: Robot Prototypes
This robot is made light in weight .This will help in reducing the torque of motor & electricity. Indirectly it will reduce the weight of Battery. All joint are provided with hinges as it will convenient during maintenance and repairs.

VII. CONCLUSION
After studying this project in a well versed we finally came to know that this Robot will be very much useful for the process of pipe inspection especially to the pipe of various sizes. But since the implementation of pipe inspecting Robot will always demand some modification in existing life, which will also add up to its implementing cost but since this is first step towards its making and there are many more possibilities of better designing and modification of this system for future use.

VIII. SCOPE FOR FUTURE WORK
While selecting this project or while modifying the robot we always kept one thing in our mind i.e. scope of project. The scope behind this project is that this robot is going to be sophisticated one which will be useful for inspecting pipe of varying diameter and various fitting which is very much difficult in day today life and will be always in demand. This will not only help to reduce the bursting of pipe but also to save the life of people in case of accident which occurs normally due to improper maintenance and due to lack of inspection. This Robot can easily move into the pipe compare to other Robot which is available in the market. The main scope behind the project is that it can be operated easily, required less maintenance, repair and manufacturing cost is also low. Due to low cost it can be easily available and can be used for inspecting pipe whenever it will be required.

With addition the future robot can be more sensitive, flexible and intelligent by using sensors and additional equipment’s.

It can be made for larger size pipes with changing the design parameters.

ACKNOWLEDGMENT
We would like to take this opportunity to express our gratitude towards all those who helped us in completing this project work. We are very thankful to our guide Prof. Mankar N.A. for his continuous guidance. We would like to express our deepest gratitude towards him. We are also thankful to Prof. R.R. Kharde HOD of Mechanical Engineering Department and all Faculty of Mechanical Engineering Department PREC Loni for their constant support in our work.

Last but not the least we would like to thank our friends for support and motivation.

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