

# PIPE LEAK DETECTION ROBOT

DARSHAN V.KALE<sup>1</sup>, VALMEEK S. DUSHING<sup>2</sup>, RAMDAS A.SHELKE<sup>3</sup>, NILESH B.PAWAR<sup>4</sup>, PROF. PRAVIN MALI<sup>5</sup>,

<sup>1</sup>UG student, Department of Mechanical, G.H.Raisoni college of engineering, Maharashtra, India.

<sup>2</sup>UG student, Department of Mechanical, G.H.Raisoni college of engineering, Maharashtra, India.

<sup>3</sup>UG student, Department of Mechanical, G.H.Raisoni college of engineering, Maharashtra, India.

<sup>4</sup>UG student, Department of Mechanical, G.H.Raisoni college of engineering, Maharashtra, India.

<sup>5</sup>Prof. Department of Mechanical, G.H.Raisoni college of engineering, Maharashtra, India.

## ABSTRACT

Pipelines for the urban gas-supply system require a robot possessing outstanding mobility and advanced control algorithms, since they are configured with various pipeline elements, such as straight pipelines, elbows, and branches. In this paper, we present a comprehensive work for moving inside underground urban gas pipelines with a miniature differential-drive in-pipe robot, called the Multifunctional Robot for in-pipe inspection.

One of the most important requirements in repairing and maintaining of pipelines is the ability to monitor and evaluate the pipes interior. This work deals with the design and prototyping of an apparatus to traverse piping systems for inspection, cleaning and or examination of the piping systems. At first, the existing pipe crawlers are studied and compared.

**Keyword:-** Robot ,Arduino Uno, Ultrasonic sensor, Rotary encoder

## INTRODUCTION:

**H.-B. Kuntze and H. Haffner** ,Numerous in-pipe inspection robots have been built for the last two decades based on wheeled type, caterpillar type, snake type, legged type, inchworm type, screw type, PIG type and helical-drive type. The construction for any robot based on the purpose which manufactured for it or in other term various working condition adaptability. Knowing the surrounding conditions for the pipes like the diameter, pipes material, the inspection distance and the direction, all these parameters it should be known before design stage.[1] For example wheeled type robot can use with T conjunctions in pipe network and elbow. Also for caterpillar type can move and face the obstacles inside the pipe.

**Gregory L. Hovis**, has been in many researches on going to develop the in-pipe inspection robot to improve its adaptability for different pipes diameters. Improve Traction force for it to be able to pull its self with its peripherals in horizontal and vertical pipes. Improve the signal transmission system to be able to move for long distance.[4]

### 1.1 PROJECT IDEA.

Robot is as a programmed mechanical device which executes activities usually controlled automatically. It is considered to be used in tasks that require high efficiency, large productivity and high precision, depending on which criteria the type of robots is required for. Robotics is meant for the whole production system with robots utilization. Robotics are now used widely in many industries such as automotive, oil and gas, railway, food & beverage, mining solution, chemical solutions, power generation and more.

The in pipe inspection robot designed is remotely operated with a console which is battery operated, it mainly consists of sensors, live feed mechanism, live camera feed display. And ultra-sonic sensor output console on the microcontroller module.

All the electronic components are managed and controlled by a micro controller named Arduino micro controller. This micro controller is programmed by arduino software. This integrated circuit controls the actuation mechanism of 12 v dc motor, locomotive mechanism of the robot, all the camera mechanism, (360 degrees panoramic camera), and ultrasonic sensor live feed on LCD screen, camera live feed on LCD screen (laptop).

**1.2 MOTIVATION OF PROJECT.**

Robot is as a programmed mechanical device which executes activities usually controlled automatically. It is considered to be used in tasks that require high efficiency, large productivity and high precision, depending on which criteria the type of robots is required for. Robotics is meant for the whole production system with robots utilization. Robotics are now used widely in many industries such as automotive, oil and gas, railway, food & beverage, mining solution, chemical solutions, power generation and more . In, shows the usage of robots from the year 1994 to 2011 where it can be seen that the supply of industrial robots gradually increases to 38% just from 2010 to 2011. These studies were taken from a press conference in Taipei conducted by the International Federation of Robotics Statistical Department in 2012. From this it shows that the growth and usage of robots have been increasing.

**2. COMPONENTS:-**

**2.1 Arduino uno r3:**

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

**2.2 Ultra sonic sensor:**

Ultra sonic sensor is used for the determining the distance of any obstacle inside the pipe from the bot position.

**2.3 Rotary Encoder.**

Rotary encoder is used for determining the position of the robot inside an opaque pipe, this will denote the exact position of the crack or the fault on the surface of the pipe.

**3.MANUFACTURING MACHINES AND SOFTWARES :-**

**3.1 LATHE MACHINE:-**

Lathe machine is used for the making of base rod for the robot and also the slider of the robot.

**3.2 WELDING MACHINE.**

As the material used for the robot is cast iron the arc welding machine is a suitable option and a feasible choice.

**3.3CATIA**

Catiav5 is used for the modeling and drafting of the parts of the robot and the total assembly for the robot.

**3.4SOLID WORKS**

Solid works is used for the analysis of the mechanical mechanisms.

**3.5ARDUINO PROGRAMMER**

Arduino programmer is used for the programming of the sensors and other electronic components, it is done with the Arduino micro controller named Arduino Uno and also the camera which is used with the led lights in order to get the video on the live feed.

**4. RESULT AND TESTING**

**4.1Testing in variable diameters and results:-**

The usable range of the robot is calculated as 260mm to 340mm. Also all the calculated ranges were checked and found to be feasible , we have chosen the average feasible diameter to be 300mm which a standard used in sewage or industrial pipe lines.

Sr No:	Fluid	Force on each axis N	$\mu$	Velocity cm/s
1.	Gas pipe	33.33	0.5	10
2.	Water	37	0.45	8.9
3.	Oil	41.06	0.38	8.3



**Fig:- Leak Detection Robot**

## 5. CONCLUSIONS:

A Robot that offers significant improvements, compared with similar ones is proposed. It has wide industrial usage where pipe inspection under various conditions becomes an issue which includes traversing through vertical pipes, elbows and long horizontal pipelines. Presence of obstacles within the pipelines is a difficult issue. In the proposed mechanism the problem is solved by spring rear arms and increasing the flexibility of the mechanism

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