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Remote Based Water Pipeline Inspection Robot

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ABSTRACT: In this project a pipeline inspection robot build for monitoring the pipelines, the pipelines are the most commonly and widely used method of transporting fluids and gases. Regular inspection is necessary for the pipelines to work correctly. Humans must not enter potentially dangerous environments to inspect these pipelines. As a result of this, pipeline robots were created. These pipe inspection robots help in pipeline inspection, protecting numerous people from harm since human beings cannot enter the pipes and inspect them in case there is any such or kind of damage that requires repair. Despite of several advancements, pipeline robots continue to have a number of limitations. The introduction of this in pipe inspection robots helps to solve many problems, such as leakage of the gas or fluid pipelines, rustiness, and also if the pipe is broken from any part.

I. INTRODUCTION

Security Varieties of the in-pipe inspection robots have been developed over the past decades to examine built-up deposits, waxes or any cracks throughout a pipeline. The in-pipe inspection robotic system can be operated in oil and gas pipelines, water pipelines, sewerage system or any piping systems that require specific inspection. Research on the in-pipe inspection has been intensified over the years. For instance, focused on the un diggable pipeline by integrating a highly agile robotic platform and an Non-Destructive Testing (NDT) sensor. The method of attaching an NDT system which was an X-ray Real-Time Imaging Inspection Technique (RTIIT) on their robotic platform to locate and inspect welding conditions in the pipeline.

Used a Magnetic Flux Leakage (MFL) sensor attached to a robot to detect internal defects of the pipe. Exhibits the components of an MFL in-pipe inspection robot that was created by Jin et al. Utilization of the in-pipe inspection robot has led to new challenges regarding robot functionality. This includes the propelling mechanism of the robot which can be either self-propelled or assisted by a medium and the degree of adaptability with variations in the pipe diameter. Consequently, new solutions in regard to the in-pipe inspection robotic systems are constantly sought after. A large number of research studies involve conducting experiments of the in-pipe inspection robot such as those performed by Sane Mori and Okada (1985), Niewels and Jorden (1994), Hirose (1999), Qian et al. (2000), Roh et al. (2009). Despite considerable effort to conduct in-pipe inspection through real-time experiments or on-site studies, weaknesses of these methods can still be detected. Several in-pipe inspection robots in the previous research had difficulties maneuvering inside a pipe with different diameters, curves or bends, and T joints. The robots were regularly found stuck during the operation as reported by O'Donoghue (2003), Fung et al. (2006), Ferreira Lino et al. (2006), and Terenzi (2012). Hence, it is crucial to have a proper mathematical model to improve the maneuverability of the robot and to analyze its movement before the system can be developed and tested in real-time.

II. LITERATURE REVIEW

[1] A review over state of the art of in-pipe robot
Lei Shao; Yi Wang; Baozhu Guo; Xiaoqi Chen
This paper provides an overview of literature in recent five years on the state of the art of in-pipe inspection and cleaning robots. Firstly the overview explains the reasons why in pipe robots play a very important role in the rapid development of modern industry. Secondly, according to existent researches, type and feature of the traditional in-pipe robots have been systematically generalized which can be found in table1 and table2. Furthermore, the review specifically clarifies and analyses the latest conception and design of in-pipe robot from the global research institute after 2010, which are to solve the different kinds of difficulties in specially complicated working circumstances, such as

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vertical pipe, variable diameters, elbow pipe, branch pipe, mini pipe and poor driving force. Lastly, a conclusion about advantage and disadvantage of in-pipe robot is drew and the studying hotspot and trend in future for in-pipe robots are forecasted.

[2] Self-Powered Mobile Sensor for in-Pipe Potable Water Quality Monitoring
Ruoxi Wu, Wan W. Amani Wan Salim, S. Malhotra, Aaron Brovont
Traditional stationary sensors for potable-water quality monitoring in a wireless sensor network format allow for continuous data collection and transfer. These stationary sensors have played a key role in reporting contamination events in order to secure public health. We are developing a self-powered mobile sensor that can move with the water flow, allowing real-time detection of contamination in water distribution pipes, with a higher temporal resolution. Functionality of the mobile sensor was tested for detecting and monitoring pH, Ca2+, Mg2+, HCO3-/CO32-, NH4+, and Cl- ions. Moreover, energy harvest and wireless data transmission capabilities are being designed for the mobile sensor.

[3] Development of an Inline Robot for Water Quality Monitoring
Saber Kazeminasab; Mohsen Aghashahi; M. Katherine Banks
Water distribution systems are critical infrastructure that are expected to supply healthy water. Deliberate or accidental incidents such as terrorist attacks or pipe breaks can contaminate potable water in pipelines. Inline mobile sensors are promising solutions which have been designed and developed to monitor water quality and detect leaks in water pipelines. These mobile sensors can move towards the location of contamination or leak and provide more timely and accurate measurements. However, these sensors, which are often free-swimming spheres and move by water flow, have two problems: instability and passiveness. In this research, we designed a robot that stabilizes and automates our previously fabricated spherical mobile sensor. The robot empowers a water utility operator to control the mobile sensor motion in a pressurized environment with a high-speed flow. The robot has three spring-based adjustable arms for stability in pipes with diameters between 22.86 (cm) - 9 (in) and 55.88 (cm) - 22 (in). Each arm is actuated with a motor and a wheel at its end. The wheels are in contact with a pipe wall, and the motors keep the robot moving. Each motor is customized with a gearhead that provides required torque at its wheel for motion. A lithium battery attached to the sphere supplies electricity for motors and sensors. The proposed design is characterized and prototyped in this paper. To evaluate the controllability and observability of the robot, we have linearized governing equations. Results show the successful performance of the robot in pipes.

III. EXISTING SYSTEM

This project represents based Smart Water Quality Monitoring (SWQM) system that aids in continuous measurement of water condition based on four physical parameters i.e., temperature and electric conductivity connected with Arduino-Uno in discrete way to detect the water parameters. Extracted data from the sensors are transmitted to a desktop application developed in serial communication and compared with the WHO (World Health Organization) standard values. Based on the measured result, the proposed system can successfully analyze the water parameters using fast forest binary classifier to classify whether the test pipelining water sample is drinkable or not.

DISADVANTAGES:
• Low specification
• Wired communication
• Output based on given data and online data

IV. PROPOSED SYSTEM

Three caterpillar wheels are mounted on the first module at a 120° angle to one another, and the second module is infix at a 60° angle to the front module. This mechanism is being designed and developed with a low-cost- effective monitoring system for the principal parameters in real-time. In proposed work. Temperature, water pressure sensor ultra leakage sensor. Are used to measure the quality pressure of water continuously. In addition to physical parameter sensors Analyzer is used. In this work, the sensors are connected to the micro controller that it transmits the sensed data to receiver which act as 2.4GHz transceivers. Furthermore, the stored data retrieved and used for further analysis PC monitoring mechanisms. Same time controlling a pipeline robot in desktop side.

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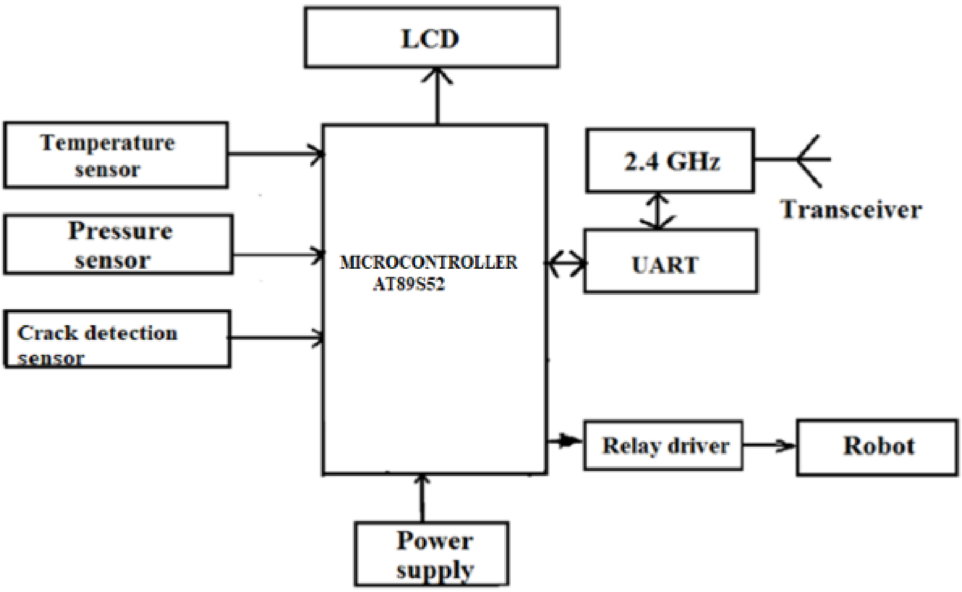
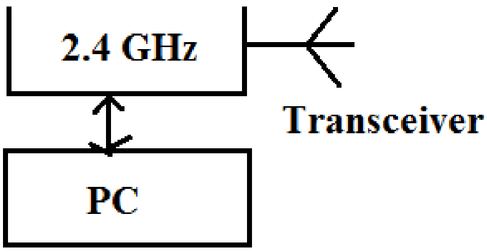
ADVANTAGES OF PROPOSED SYSTEM:

- Based on real time work
- Low cost highs efficiency
- Both monitoring and controlling robot

BLOCK DIAGRAM:





COMPONENTS

AT89S52 Microcontroller

Figure:2 Controller IV

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The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the Indus-try-standard 80C51 instruction set and pin out.

Relay module

Figure:3.Relay Module

A contactor is a high-power relay designed for direct control of electric motors, while solid-state relays utilize semiconductors for switching in power circuits, and calibrated relays with multiple coils protect electrical circuits from overload or faults, with modern systems using digital instruments termed "protective relays."

Transceiver 2.4 GHZ

Figure:4. Transceiver 2.4 GHZ

A Zigbeee protocol for wireless communication which is based on the underlying protocol IEEE 802.15.4, which defines the network physical layer, and controlling layer for media access, while Zigbee protocol defines the network layer, application layer and specifications of the network security services.

Ultrasonic Sensor

Figure:5. Ultrasonic sensor

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor.

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Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

LCD

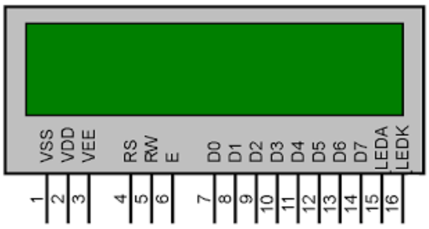

Figure:6. LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on

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Temperature Sensor

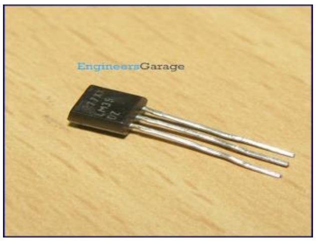

Fig 7 : Connect Page To The IOT

The measurement of temperature is one of the fundamental requirements for environmental control, as well as certain chemical, electrical and mechanical controls. Many different types of temperature sensors are commercially available, and the type of temperature sensor that will be used in any particular application will depend on several factors. For example, cost, space constraints, durability, and accuracy of the temperature sensor are all considerations that typically need to be taken into account.

DC MOTOR

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

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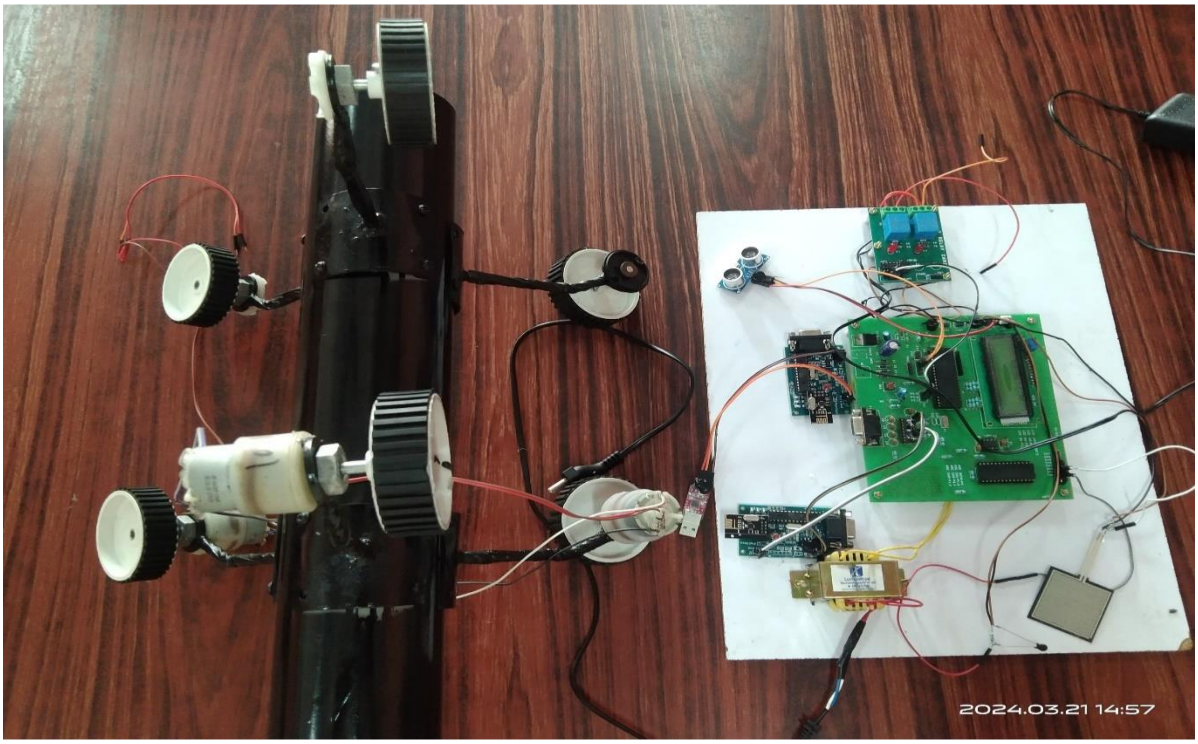
Control and Monitoring

Figure:8. Control and Monitoring

In order to control the robot and monitor the data provided by sensors such as ultrasonic, pressure, and temperature, as well as visualize the values in the Keil software, the robot's movements can be directed forward and in reverse through the pipeline. The data is readily available on the screen monitor itself. This project involves the inspection and monitoring of water pipelines facilitated by the robot.

PHOTOGRAPH OF MACHINE:



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V. CONCLUSION

A new generation of ultrasonic crack detection tool has been presented in this research using fully autonomous pipeline robot. The enhancements accomplished by the new design that make the In-Pipe Inspection Robots (IPIRs) with ultrasonic inspection more competitive. An actual prototype was developed to check the viability of inspection of this kind of robot. The major advantage is that the system has ability to record and display the view of the atmospheres on the employees monitor display screen for effective observation, detection, quick analysis, diagnosis and reliably in confined, darkish environments.

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