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Pipeline Damage Detection Using Echo Sensors

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Abstract

This project is mainly focused to find out the obstacles that present inside the pipeline by using a robot. It is very useful to find out the minuet cracks that occurred inside the pipe. This application is very helpful for the industrial area. Find out any leakage and toxic-gas that happened inside the pipe by using this method.The heart of this equipment is a microcontroller-based system which controlled and co-ordinate all the parameters. The microcontroller-based system attached with a robotic vehicle. The program loaded in microcontroller, control the movement of robot. Ultra-sonic sensors are used to find out the obstacles of pipe and also RPM sensors are used to find out the distance of the robot from the starting point. By using this rpm sensor it's also finding out the cracks location by distance measurement. Gsm/Gprs modules are used to communicate with the vehicle for the forward and backward movement. If any inconvenient data is occurred, that data is transmit to the control station via ZigBee module. L293D IC is used to connect the dc motors.

1 .INTRODUCTION

One of the principal concern affecting all buildings and industries is the maintenance required. This means wasting time and money to prevent future damages and to settle those as of now. In particular great problems are associated with the maintenance of pipes conducts. Pipeline assessment is a long timed planned methodology now and it too not guarantees 100% grandee of damage fewer pipe ways. Here we execute a cutting-edge pipe assessment innovation which is quick and precise framework utilizing a ZigBee conveyed robot. Outline of the investigation robot relies upon two primary basic elements: size and shape of the pipeline. It will weigh strongly on the manoeuvrability of robot and its dimensions

An ideal robot should:

1. Drive through a pipe that can change its Diameter along this pattern.
2. Cope with elbows and branches, reducer, valves with unexpected mechanical damages that could

change its mechanical configuration

3. Have sufficient traction to move and to carry out tasks as measurements or clogging detection on a slippery and not plane surface as a pipe
4. Be robust and reliable

1.1 FEATURES

1. It totally replaces the present manual checking process which is for some time, high man powered one
2. It gives exact, sharp and time basic reaction.
3. It is extremely modest and simple to execute in an application.
4. It is very hopeful in high securable gas pipe way systems, where does happening a lot of accidents in recent days.

Robotics sensor networks are a promising technology for leak detection in pipelines. Inspection of these pipes, if done manually, costs a lot of time, labor, and effort, and it can be done only if it is a hazard free environment. Most of the time, this is almost not practical. Robots are designed in such way that they make human work simple, how intensive the work environment may be. Sometimes they are also used to explore inaccessible works which are not possible by the humans to take care of. Most of the time the pipelines that have to be inspected may carry toxic chemicals, fluids, and may have small internal diameter or bends which become inaccessible to human. These factors such as hazardous environment, small diameter etc. are the reasons lead to the designing of pipeline robots. These pipeline robots are used to check corrosion level of pipe, recovery of usable parts from pipes interior, the sampling of sludge and scale formation on pipe internal surface.

2.PROPOSED SYSTEM

This project is mainly focused to find out the obstacles that present inside the pipeline by using a robot. It is very useful to find out the minuet cracks that occurred inside the pipe. This application is very helpful for the industrial area. Find out any leakage and toxic-gas that happened inside the pipe by using this method.

The Microcontroller is the central unit that controls the functions that are performed in the pipeline by the robot. There are three ultrasonic sensors, a gas sensor, and an rpm sensor. All the sensors are interfaced with the microcontroller. Ultrasonic sensors are used to detect the position of the obstacle present inside the pipe structure. Rpm sensor is used to measure the distance of robot from the beginning. 10 rpm dc motors are used for forwarding and backward movement of robot wheel. The measured values are transmitted to

control station via GSM/GPRS module. Themicro scale controller occasionally screens the status of all sensors Ultrasonic sensor and Gas sensor interfaces with smaller scale controller. When an outer DC control supply is given to pipeline robot, sensors are interfaced with miniaturized scale controller. Furthermore, an ultrasonic sensor is distinguishing the obstructions from their position. The ultrasonic sensor is detecting the obstacles from their position. 10 rpm DC engines are utilized to the forward and in reverse development of robot wheel.

When the robot starts to move forward, rpm sensor starts to measure the distance of the robot from the beginning. In the event that an ultrasonic sensor measured estimation of separation surpass a specific range (remove esteem is more prominent than the pipe radius), ZigBee transmits that badly designed information to control station at that point controller of control station check the robot area by separate esteem and take the corresponding action. After achieving the last goal, we squeeze STOP button for stop the robot or press BACKWARD button to return back to the underlying point.

The ZIGBEEprotocol defines the wireless communication of low data processing rate sensors and control networks. ZigBee is exceptionally much suited to several applications such as the domestic robotization frameworks, building security frameworks, medical sensor systems, industrial sensor systems, mechanical control system sensing and telemetry.

ZigBee network is initiated by a ZigBee coordinator. This coordinator searches the other coordinators in the network. The ZigBee coordinator fetches the 16-bit network address (PAN ID). Upon establishing a network the routers and the end devices are also included in the network.

Forwarding a parent/child relationship is not required however it is needed to form a network and to acquire a network address. The coordinator notifies this change by broadcasting it to all the nodes under its management. At the start, the node looks up this previous network table initially tries to associate itself with the former network. A node can resign from the network at its will or can be deleted by its parent.

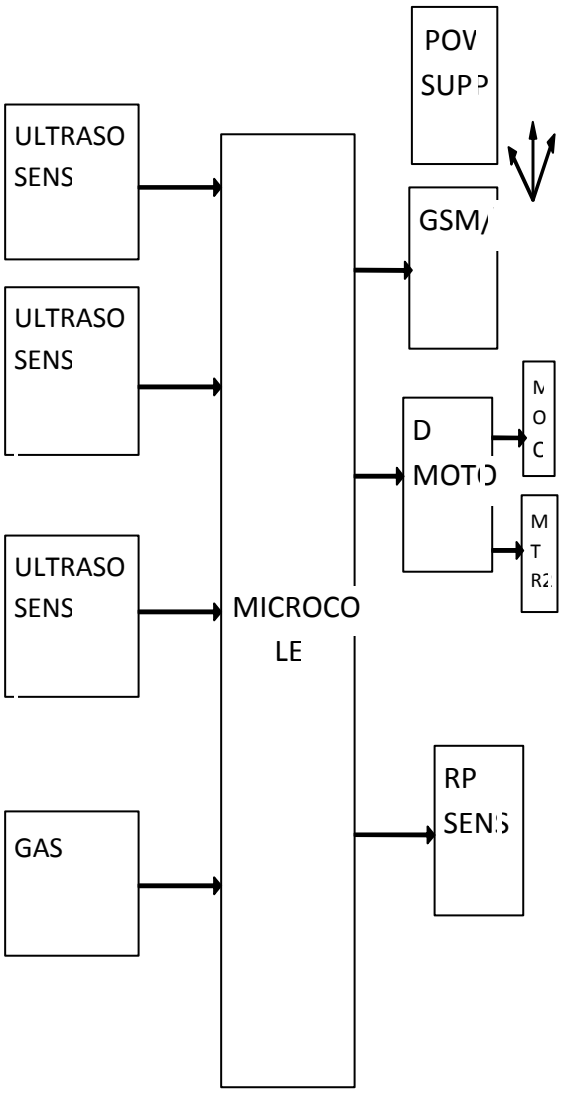


Fig 1.Block diagram of thesystem

2.1. REMOTE CONTROL OF ROBOT WITH IOT

Internet of Things (IoT) is the network of physical objects or things embedded with electronic devices, software technologies, sensors, and network connectivity, which facilitates these objects to collect and exchange data for availing various services. It is a concept demonstrating a connected set of anything, any one, any time, any place, any service and any network connection. The IOT makes the remote control of robot using devises such as computers and android enabled smart phones

3. ARCHITECTURE OF THE CRACK DETECTION SYSTEM

The system is formed of 2 sections:

1. The inspector robot

The important components in this section are:

1. Microcontroller
2. Ultrasonic sensors
3. Gas sensor
4. Rpm sensor
5. Dc motor
6. GSM/GPRS module

3.1 ULTRASONIC SENSORS

This "ECHO" Sensor is an incredible product as it provides very short (2CM) to a long-range (4M) detection and ranging. This sensor provides very precise, stable non-contact distance measurement which can range from 2cm to 4 meters with a very high accuracy rate. It is a very handy sensor for distance measurement and mapping because of its compact size, higher range, and easy usability. The triggering

and measurement on the board can be done using one I/O pin and the board can be interfaced to microcontrollers. The sensor produces ultrasonic waves and creates an output pulse that can correspond to the time required for the burst echo to return to the sensor. By measuring the echo pulse, it becomes easy to calculate the distance to a target.

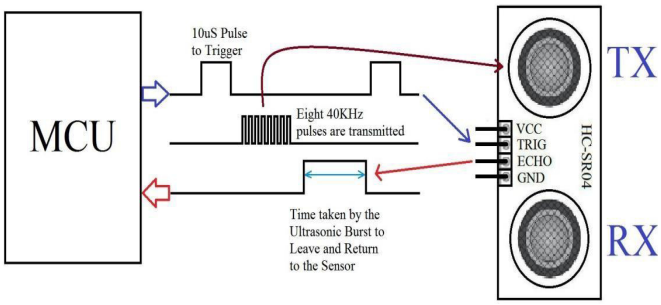


FIG 2.Finding distance using echo sensor

When in receiving mode, the host controller will have to wait for the low to high transition in the SIG pin. Whenever a transition is detected the host controller should start counting the time. It can either use a timer or any other programming logic to calculate the time. This counting should be terminated when next high to low transition is detected. It should also be noted that the time gap between the transitions will vary (PWM) with respect to the distance of the target. The value which is obtained (pulse width) in µSeconds represents the echo time and further calibrations of this data will provide you with the distance of the target. This calculated distance can be displayed either on an LCD or transmitted to your PC.

3.2GAS SENSOR

MQ-2 SEMICONDUCTOR SENSOR FOR COMBUSTIBLE GAS:

SnO2 is the sensitive material of MQ-2 gas sensor, which with lower conductivity in clean air. The sensor's conductivity is higher in presence of target combustible gas with the gas concentration rising.. The MQ-2 gas sensor has a high sensitivity to LPG, Propane and Hydrogen also it can be used with methane and other combustible steam.

3.3RPM SENSOR

MH 281 Low Sensitivity Unipolar Hall Effect Switches:

MH 281 is a unipolar Hall Effect sensor IC. It sports an advanced chopper stabilization technology and gives us an accurate and a stable magnetic switch point. In presence of an adequate string South Pole magnetic field when facing the marked side of the package the output transistor will switch on itself (BOP). In the same way, in presence of a weaker south field, the output will switch itself off (BRP) and remain off with "0" field.

3.4 GSM/GPRS

The baud rate can be easily configured using 9600-115200 through AT command. This modem has an internal TCP/IP stack which enables you to connect it to the internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface. Using this modem it can send& read SMS and connect i to the internet via GPRS through simple AT commands.

4. SOFTWARE CONTROL ON MONITORING SECTION

Embedded c is used in the control station of robot for sending commands and proteus for modelling and simulation purpouses.Proteus software used in the project for accessing the file system ,sorting of data, manipulation of datas and strings, interfacing with user and calculating logical and mathematical expressions. Thecommands send to the robot using the software to move forward and backward and to stop at particular locations where fault is detected.

5. RESULT AND DISCUSSION

The Proposed Design consists of robotic transmitter and receiver section. The controller section sends commands for controlling the robot . When an external DC power supply is given to pipeline robot, sensors are interface with micro controller. And ultrasonic sensor is detect the obstacles from their position. When we press forward by using the zigbee module and robot starts to move forward inside the pipe. When robot starts to move forward, rpm sensor is start to measure the distance of the robot from the beginning. Zigbee transmit that inconvenient data to control station .then controller of control station check the robot location by distance value and take the corresponding remedy. After reached the final destination we press stop button for stop the robot or press backward button to return back to the initial point.

Fig 4.Horizontal testing of robot

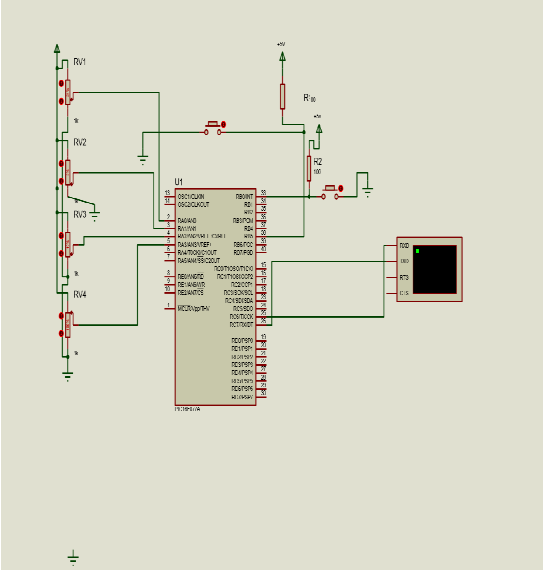
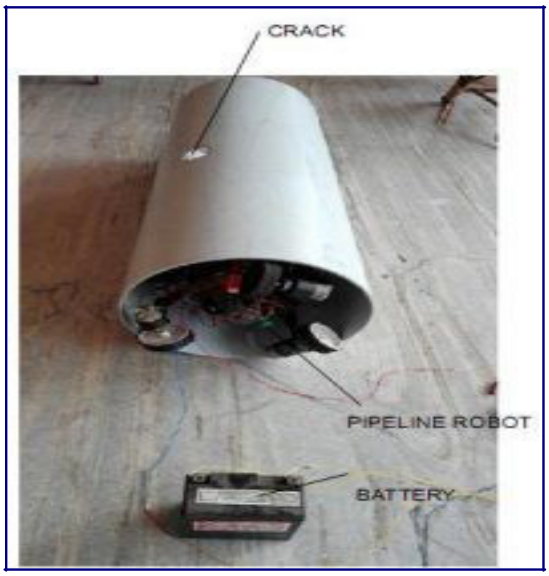


Fig 3 .Simulated output of the system

6. CONCLUSION AND FUTURE SCOPE

Thus, the system detects the cracks and damages in pipeline and the defects are displayed in monitoring node. The movementof robot is controlled by ZigbeeCommunication Network. Thus the



systemdetects abnormal geometric changes of the pipeline such as holes, clogs, and deformation online. This system highlights the dynamic problems associated with pipelines and other engineeringsciences. This system is one which gets easily adapted to the user needs and allow further expansion. This system is also economic. The presence of the local interface is the main advantage of this system. The IOT makes the system more reliable.

The much time consuming and high man powered manual checking process had been replaced by it. It provides an accurate, sharp and time-critical response. Easy and cheap implementation in any type of application. It is most advantageous in high securable gas pipe way system, where many accidents take place in recent days. In future the system can be enhanced by modifying the robot for fault detection of inclined pipes.

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