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PIPE CLIMBING INSPECTION ROBOTIC STRUCTURE FOR DETECTING GAS PIPE CHANNEL PARAMETER

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A B S T R A C T

Leakage is the major factor for unaccounted losses in every pipe network around the world (oil, gas, or water). In most cases, the deleterious effects associated with the occurrence of leaks may present serious economical and health problems. Therefore, leaks must be quickly detected, located, and repaired. In this paper, we present a new in-pipe leak detection system. It performs autonomous leak detection in pipes. This system focuses on the detection module and its main characteristics. Detection in based on the presence of a pressure gradient in the neighborhood of the leak. In this system consists of gas sensor (MQ-6), microcontroller (PIC16F877A), and relay driver, buzzer, geared dc motor and battery. The DC motor can be used to motion on pipeline. The gas sensor used to detect the gas when it leaking from pipeline. The gas sensor produces the electrical signal according to their receiving gas input. The PIC microcontroller has in-build ADC which is used to convert the analog signal from sensor into logical values. The predefined program stored into microcontroller it can be executing that program to enables the bu zzer when it receives because of sensor we can identify the leakages.

Keywords: *Pipe line leakage detection, climbing robot, Gas sensor etc.*

1. INTRODUCTION

Many kinds of pipes are being utilized to construct important lifelines such as water and gas supply in our contemporary society. Also pipes are widely used in chemical industries and in gulf countries for carrying petrol, diesel, oil etc. But after some years these pipes get damaged and defects are occurring in pipe. If the defects in the pipe are caused by rust and nature calamity, it is difficult to find out the defects and the place of the defects, and also there is great amount of loss. Thus scheduled inspection must be done. If we decide to do this inspection manually then large amount of time, effort and labour is necessary to grub up the pipes that are buried in the ground. If the robot can inspect inside the pipes, fast and accurate examination will be able to be done at low cost. There are several types of pipe inspection robots some are in-pipe inspection robot and some are out-pipe inspection robot.

2. LITERATURE REVIEW

The image depth information can be used to understand the geometric relationship of image scenes, and has important applications in robots, scene understanding, three dimensional reconstruction and other fields. Recent work has proved that depth estimation from stereo RGB image pairs can be realized by convolution neural network. However, the mainstream depth estimation deep learning algorithms rely on patch-based Siamese networks, which lack the ability to comprehensively utilize the context information and the environment texture information, and their performance is poor in complex regions and ill posed regions. The working environment of electric inspection robot is complex and the occlusion problem is serious, so the classical methods are difficult to be directly applied.

3. PROPOSED SYSTEM

Robots are used to remove human being from laborious and dangerous work. This project describes an in-pipe inspection robot. The springs are attached to each leg and the robot body to operate in pipes of 140mm to 200mm diameter range. Here, all major components of robot are designed.

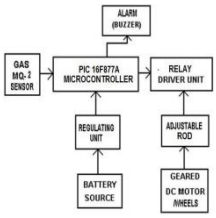

Fig. 1 - Block diagram of the system

Modeling and assembly of robot components is done in Solid works. Stress analysis of all major components is done in Solid works and Static stress

analysis of proposed in-pipe inspection robot assembly is carried out in Analysis. This robot is used for offline visual inspection of gas pipelines, water pipelines and drain pipes etc. This robot also has wide applications in chemical industries as well as in gulf countries for inspection of oil and gas pipelines. In this system consists of gas sensor (MQ-2), PIC 16F877A microcontroller, and Relay driver, buzzer, geared dc motor, adjustable leg spring mechanism and battery.

The DC motor can be used to climbing legs on pipeline. The gas sensor used to detect the gas leakage from pipeline during inspection. The gas sensor produces the electrical signal according to their receiving input. The output of the gas sensor is applied to the input of the PIC microcontroller. The PIC microcontroller has inbuilt ADC (Analog to Digital converter) which converts the digital values. The controller is used to control the robotic motion through relay drivers based on inspecting parameters. The motion of the robot is continuously running on the pipeline if the leakage is absent. The motion of the robot is stopped at exact place on the leakage area. The controller also used to activates the buzzer when the leakage is detected. The buzzer produces the alarm sound. It shows the detection of leakage.This system consists of Battery, Filter and Regulator. The parallel battery unit is produce the 9V DC energy which is used to operates all unit of the system. The filter is used to removes the ripple content if present. The 5V regulator is used to produces the constant +5V voltage for microcontroller function.Four different prototypes have been constructed for pipe diameters of 170, 70 and 40 mm, respectively. For smaller diameters, the batteries and the radio receiver may be placed on an additional body attached to the others.The autonomy of the prototypes is about 2 hours. This architecture is very simple and the rotary motion can be exploited to carry out scrubbing or inspection tasks.

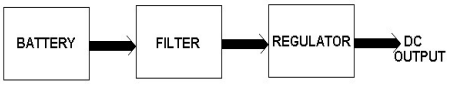

Fig.1.1 Block diagram of power supply unit

The DC motor can be used to climbing legs on pipeline. The gas sensor used to detect the gas leakage from pipeline during inspection. The gas sensor produces the electrical signal according to their receiving input. The output of the gas sensor is applied to the input of the PIC microcontroller.

4. HARDWARE DETAILS

4.1 PIC MICROCONTROLLER

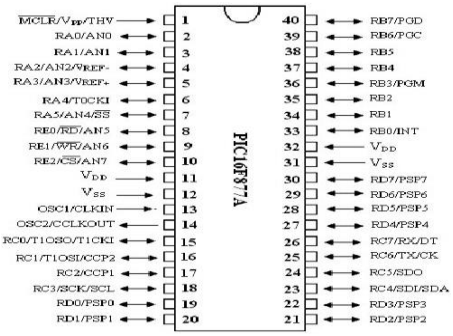

Fig. 2 - Pin Diagram of PIC16F877A

The PIC controller used in our project is PIC16F877A, the pin diagram of which is shown in figure. It is used to energize and de-energize the contactors during the weld and non-weld periods.

The advantages of PIC microcontroller are as follows:

1. Increased reliability through a small part count.
2. Reduced stock levels, as one microcontroller replaces several parts.
3. Simplified product assembly
4. Greater product flexibility and adaptability

4.2 MQ-6 GAS SENSOR

Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, i t is with low cost and suitable for different application.

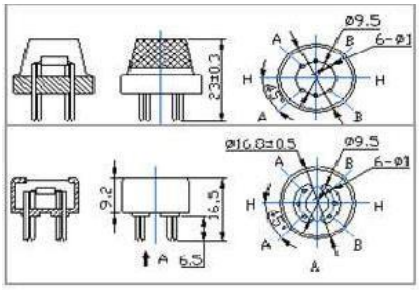

Fig: 4.2 configuration of MQ-6

4.3 BUZZER

Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries. Although the piezoelectric effect was discovered by Curie in 1880, it was only in the 1950s that the piezoelectric effect started to be used for industrial sensing applications. Since then, this measuring principle has been increasingly used and can be regarded as a mature technology with an outstanding inherent reliability.

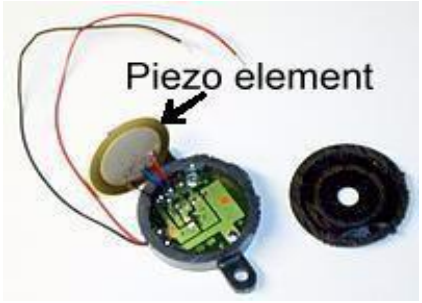

Fig: 4.4 schematic of cam buzzer

It has been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a pressure sensor in the touch pads of mobile phones. In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built in miniature piezoelectric sensor.

5. RESULT

6. CONCLUSION

This system, a leak detection concept and design are proposed and discussed. It is claimed in the beginning that the system is able to detect leaks in a reliable and robust fashion, because of the fundamental principle behind detection. More specifically, the detection principle is based on identifying the existence of a localized pressure gradient, which is apparent in pressurized pipes in the neighborhood of leaks.

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