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Inspection Robot For Pipelines Through Video Signal Transmission

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ABSTRACT

In most water distribution systems, a fairly sizable amount of water is lost because of leaks and faults in pipes. For this reason, the identification of leaks is extremely important for the optimization and rationalization of water resources. The main aim of this paper is to automate the pipe line checking. Many industries use ladder or crane for checking over the pipe lines. Though there are many systems which are computerized now, some of them require the pipes to be de-watered/de-oiled. It may be very risky and manual faults may occur, to avoid the problem the automatic checking system with help of robot is proposed. The proposed system injects the robot onto the pipeline with a fixture of camera that is capable of transmitting video. The camera captures the video of the pipe section where the robot is traversed and detects the leak. This equipment has less maintenance. Not only does the adoption of the developed system leads to accurately pinpoint the leak, but it also allow to dramatically reducing the required inspection times.

Index terms – RF transmitter and receiver, AF transmitter and receiver, Inspection robot, tuner card.

I. INTRODUCTION

Pipe inspection robots have been studied for a long time, and many original locomotion concepts have been proposed to solve the numerous technical difficulties associated with the change in pipe diameter, curves and energy supply. Although an exhaustive review of the literature is impossible due to the limited space available. The impact of the pipeline systems damage on environmental safety is very important, so an in-pipe inspection system is necessary. Even an arguably small release could cause a devastating effect on the local area, particularly if the product enters the water system. An example of this is the 2014 leak from China’s biggest oil company, China National Petroleum Corporation. The contamination affected 2.4 million people after entering the water supply.

Most of the pipeline are underground or inside of walls, with very big length and complicated trajectories, so that the inspection must use a mobile robot moving like an explorer inside of the pipes. Recently, to overcome these problems, several types of inpipe inspection robots such as PIG type, wheel type, wall-press type and caterpillar type are being introduced. Wall-press type inpipe inspection robots of them have high performance to inspect vertical pipelines and curved pipelines. However, because most of the wall-press type robots use spring tension to press the inside wall of pipelines, these robots have many restrictions to control the wall-pressing force.

This paper proposes a system where the robot is injected into the pipeline. The design of the robot is compact and a secondary motor is also provided in case of failure of the primary one. The robot is wirelessly controlled by the user by a PC. The camera is mounted for video transmission. Transmission and reception of video signal is done through AV transmitter and receiver. The controls for the robot are done separately through a RF transmitter and receiver so that there is no collision of signals.

II. LITERATURE SURVEY

A new system for water leak detection, based on time domain reflectometry (TDR) technique is presented. As well known, TDR is largely used for diagnostic and monitoring purposes, thanks to its high measurement accuracy, high versatility, and robustness; thanks to the relatively low implementation costs, and thanks to the possibility of carrying out continuous, automated, remotely-controllable, real-time measurements. Some typical application fields relate to dielectric and spectroscopic characterizations of materials impedenziometric measurements; fault diagnosis on wires and failure in interconnections mechanisms soil moisture measurements and also qualitative, quantitative and/or structural controls on several kinds of materials devices and components . Currently, leak detection surveys are usually carried out through electro-acoustic techniques, which identify the sound of water escaping a pipe. In these surveys, the technical staff employs specific 'listening devices', which must be put in contact with the pipeline through the accessible points of the water distribution system (i.e., valves, manholes or fire hydrants). In this way, it is possible to obtain a rough idea of the possible presence of leaks (or faults) and of their location.

In another method exploring the potentialities and the difficulties of electric multiagent navigation. In this perspective, we will consider a set of rigid slender probes (or agents) able to move in the same horizontal plane. The motion of each agent is directly controlled using a kinematic model, here reduced to that of a nonholonomic unicycle. Thus, as this is the case in many UVs, the motion of each agent is controlled through the axial velocity V (aligned with the sensor body axis) and the yaw angular velocity ω (orthogonal to the plane of the sensors motion).

III. SYSTEM IMPLEMENTATION

The inspection robot is sent inside the pipeline that has to be inspected. The camera that is fitted on the robot takes video of the pipeline. It transmits the video through the AV transmitter to the AV receiver at the user's end. Since the robot is controlled by computer, the received video is sent through a tuner card and passed onto the user's computer screen. The movement of the robot can be given based on the section of the pipeline that has to be viewed.

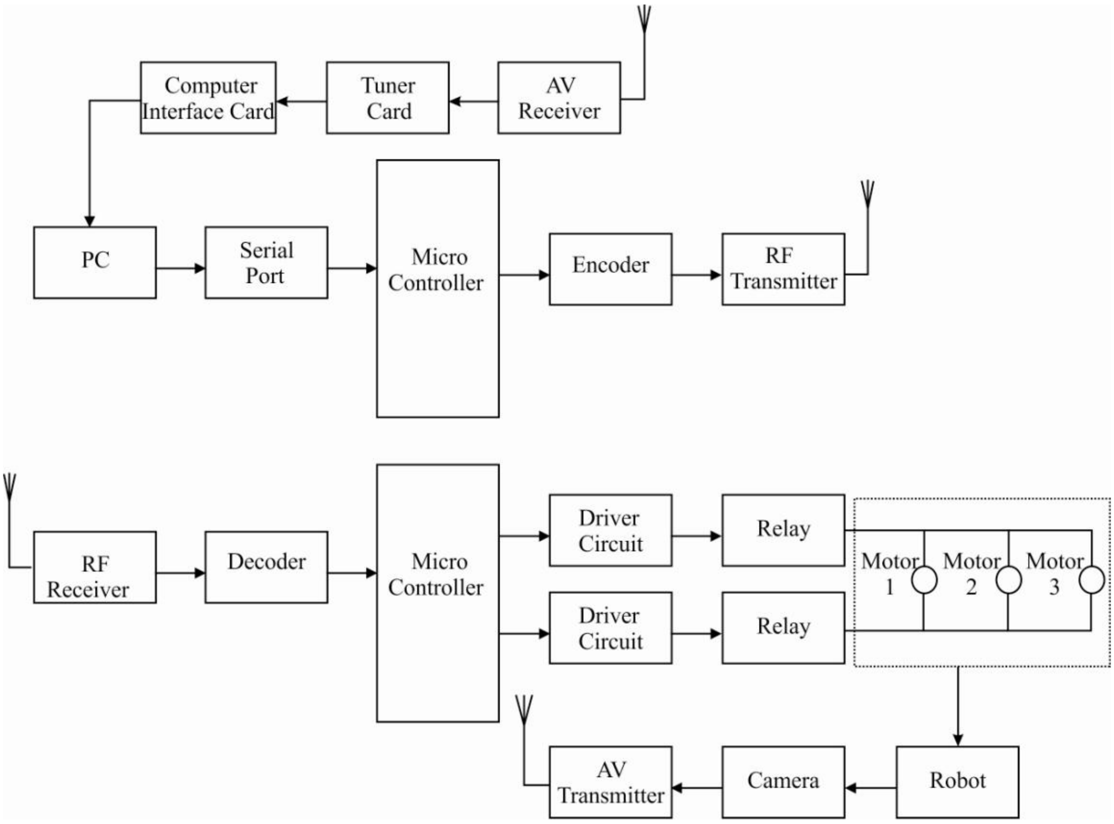

Fig.1 System block diagram

A visual basic application is developed for the purpose of switching the camera ON or OFF and giving the direction of robot movement. The input from the computer is transferred to the micro controller through the serial port and is encoded and transmitted through RF transmitter. The RF receiver at the robotic end decodes the data and transfers the data to micro controller. The micro controller signals the motor driver circuit of the motor to rotate accordingly.

IV. RESULTS AND DISCUSSION

The experimental results for the proposed model are presented below. Using the proteus simulation software an outline for the transmission of signal was designed using PIC micro controller. The transmission of forward and reverse control are transmitted across the virtual terminal (fig no2)

Hardware prototype for the model is designed and is inspected through the pipeline (fig no4)

A VB application form was developed. The RF transmission section is connected through the com port after specifying the com port no on the form (fig no 6). The control for the robot movement and given by clicking the corresponding buttons. The camera can also be switched ON or OFF when necessary using the control button on the form.

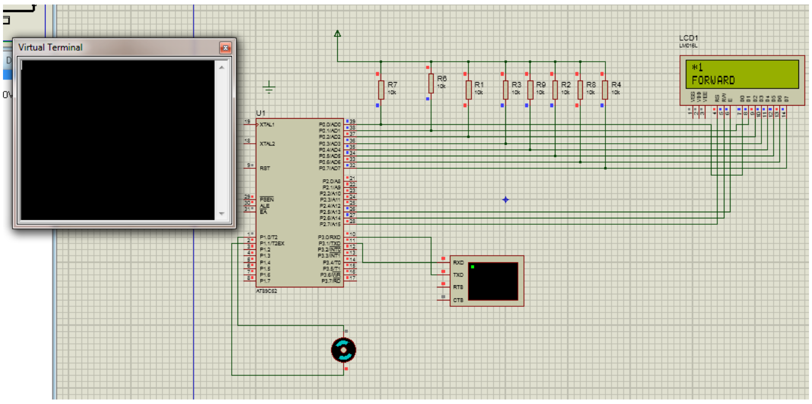

Fig 2 transmission of motor signal at the virtual terminal (forward)

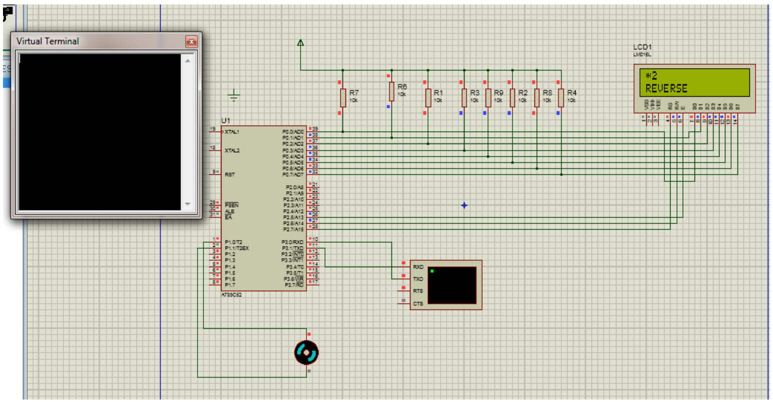

Fig 3 transmission of motor signal at the virtual terminal (reverse)

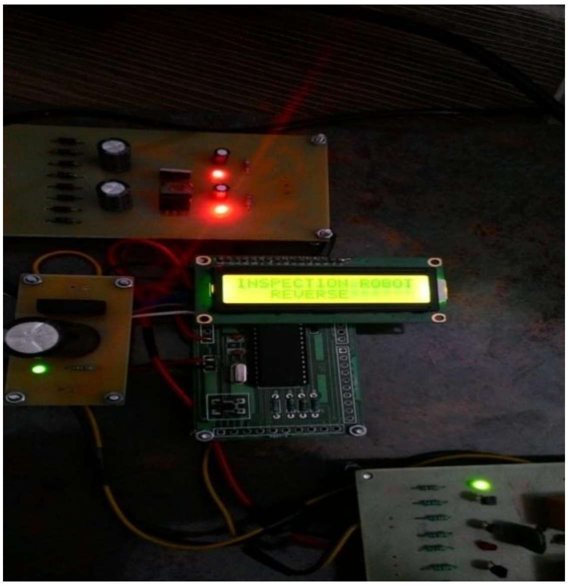

Fig 4 motor control signal transfer at the hardware

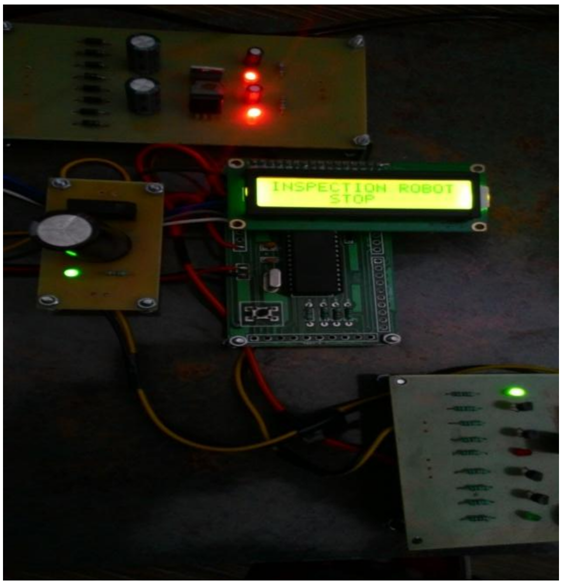

Fig 5 motor control signal transfer at the hardware

Fig 6 VB application

V. CONCLUSION

Most of losses are due to leakage in the water distribution systems; therefore, for an effective water management, it is of paramount importance to individuate and repair leaks and faults in water pipelines. As a result, constant research effort has been dedicated to enhance the techniques for leak detection and to investigate innovative methods that could make the leak detection surveys (and, hence, the consequent intervention and repair) more effective. As a matter of fact, the methods that are currently used for such surveys, despite being universally accepted, are very time-consuming (which also translates into high cost of personnel) and become unreliable when the measurements cannot be performed in specific operating conditions of the pipe. The robot is Capable of performing short and long-range inspections under various operating conditions and is ideal for water and wastewater applications. It is also Applicable to a variety of pipeline environments. There is no need for manned entry and no requirements to de-water.

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