Pipe Inspection Robot using Labview

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***Abstract*— Pipeline transports oil and gases for far distances. Routine maintenance is necessary for these pipes which avoid any abnormality things such as crack, leakage or deposit. Although it's less common, corrosion also can occur on the inside surface of the pipe and reduces the strength of the pipe. If crack goes undetected and becomes severe, the pipe can leak and, in rare cases, fail catastrophically. Extensive efforts are made to mitigate corrosion. Hence it is important to maintain it safely and economically, therefore the robot becomes most useful product available for this purpose. To overcome this problem a robotic system equipped with an electronic eye with gas sensor that can crawl inside the pipeline which is controlled with LabVIEW networks.**

Keywords – Pipeline; Crack; Leakages; Corrosion

I. INTRODUCTION

Robotics is one of the fastest growing engineering fields of today. It designed to reduce the human factor labour intensive or potential risks and to work in inaccessible environment. Robots are more common now than ever before and it is not necessarily only using in the heavy production industries. Pipeline transports the oil, gases, and other for far distances. The routine maintenance is necessary for these pipes which avoid any abnormality things such as crack, leakage or deposit. That's why it was important to use safely and economically thing, therefore the robot becoming most attractive product available. The major companies supplying and maintaining the oil pipelines faces many problems and difficulties when people want to inspect or check the oil pipeline and spent huge money on this process. Moreover the Companies also incurred more maintenance cost also staff and labor costs. And more often they did not able to find any faults in pipeline so they lose money, time and human effort. Hence, it is proposed to design a simple pipeline inspection robot to inspect pipeline for any malfunctions and to perform maintenance work. This robot may solve the problems of companies facing for inspection and we can implement it. 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. In this approach a Robotic system that can crawl inside the pipe line is designed equipped with a wireless camera and provide an electronic eye advantage, gas sensors can sense toxic gases inside the pipe line and it can be controlled through wireless remote.

II. LITERATURE SURVEY

In this paper M B Kaushik [1], Designed a Wheel based pipe inspection robot for inspecting 200mm to 300mm diameter pipes which is mostly used in oil and gas field industries. Vertical crawling, independent multi elbow turning, and maintenance free and commercially economic model but wall surface may be damage due to high friction, complex mechanism of wheel. Atul [2],An in-pipe inspection robots are used to remove the labour force and to act in inaccessible environment which moves freely in straight line pipes and elbow and branches but worm wheel mechanism difficult to construct. Movement in T joint not possible. Gopichand G, Santhi H [3],The RFID module is interfaced to the robot to identify locations using cards. RFID cards are placed at different locations in the pipeline. An LDR sensor is placed which gives a pulse to the controller when the light is detected. this mechanism is simple, low power consumption, high expansion ranges of legs efficiency in moving in all directions but this cause large destruction and have great impact in eco systems. Vasudev Yadav [4] ,Review on the use of LPG Gas leakage detector along with the stepper motor instead of using other simple Gas leakage detector. Real time detection capability with the software, high localization accuracy of hardware based technique but it detects only small leaks and the leak locations. Anjali. M [5],Internal and external corrosion at construction joints, cracking, locations with imperfections, accidents or sabotage can lead to pipeline leakage causing explosions, health problems, fatalities, pollution and huge economic losses. Advantage is that presence of transients along the pipeline does not affect the system and hence is more prone to false alarms but work can be extended to varieties of configurations other than straight pipeline and detection of multiple leaks on the same network. Ajay More [6], To ensure protection and avoid disastrous failures, companies use pipeline integrity and environmental safety practices. With the right set of tools, companies can monitor pipeline, pipeline maintenance inspection, and flow behavior analysis of transported liquid hydrocarbons and gas. [7] Pipeline or mass transport line are the chief applications which are typically involved in the oil and gas industries. Hence, inspection and maintenance must be done frequently to ensure the pipeline can be used in an excellent working state. It has the abilities to man oeuvre or crawl in the pipe's interior of the pipe but robots reach only small distances. Rahul Nalawades [8], To implement a system which detects the gas leakage and generates alert to the authorized person using GSM technology and beeps alarm in mobile. It isused as alert and safety purpose in using gas but presence of obstacles within the pipeline is a difficult issue. Sami Salama Hussen [9], Pipeline or mass transport line are the chief applications which are typically involved in the oil and gas industries. Hence, inspection and maintenance must be

done frequently to ensure the pipeline can be used in an excellent working state. Real time, has the abilities to man oeuvre or crawl in the pipe's interior. inside the pipe but robots reach only small distances. Pooja [10], The purpose of the present study is to develop the in pipe inspection robot to remove human intervention fromclabor intensive and hazardous work environment. Use of tilted and guide wheels for traversing curves and bends in pipes. Use of lighter material for the links to reduce the weight but presence of obstacles within the pipeline is a difficult issue.

III. PROBLEM STATEMENT

Inspection of underground pipe is a chaotic job in industries, factories etc. Proactive monitoring and frequent inspections are critical to maintain pipeline health, as gas, oil, water pipelines have become an indispensable part of life. The main aim of the project is to design a robot that can crawl in to a metal pipeline check the gas.

Aim:

The main aim of the project is to design a robot that can crawl in to a pipeline check the temperature inside the pipe and to send the live streaming image inside the pipe.

Objectives:

- To traverse robot inside the pipe with forward and backward and the motion is controlled using LabVIEW.
- To take a live streaming image of an internal of a pipe line.
- To check the Temperature inside pipe.

IV. PROPOSED WORK

- All the instructions to the system is given by LabVIEW to NI USB-6001.
- As shown in Figure [1] NI USB-6001 is connected to ULN2803.

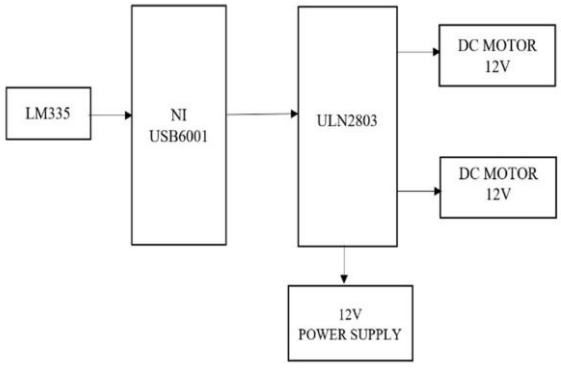

Figure 1: Block Diagram

- NI USB-6001 transfers the corresponding signal to the ULN2803 and the relays present in ULN2803 sends the information to the motors to rotate.
- If we click "forward" button on front panel window in LabVIEW screen the corresponding signal is sent to ULN2803 from NI USB-6001 and the motors connected to the relays of ULN2803 rotate clockwise which makes the robot to move forward.
- Similarly if we click "backward" button on front panel window in LabVIEW screen the motors rotate anticlockwise which makes the robot to move backward.
- If we click "stop" button the motors stop rotating which in-turn makes robot to stop.
- LM335 sensor is connected to NI USB-6001 which gives the information about temperature and the result can be viewed on LabVIEW screen.
- Camera connected to NI USB-6001 gives the clear picture of the interior of pipe.
- We can visualize the picture in LabVIEW screen.

mainly used as a relay driver with an ability to handle 8 relays at a time.

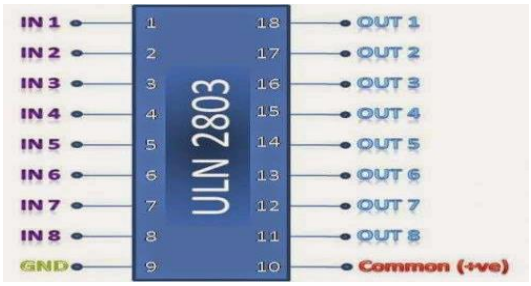

Figure 3: ULN 2803

C. 12v DC Motor:

A DC motor as shown in Figure [4] is any motor within a class of electrical machines whereby direct current electrical power is converted into mechanical power. A 12v DC motor is small and inexpensive, yet powerful enough to be used for many applications.

A. NI USB-6001:

The NI USB-6001 shown in Figure [2] is a full-speed USB device that provides eight single-ended analog input (AI) channels, which may also be configured as four differential channels. It also includes two analog output (AO) channels, 13 digital input/output (DIO) channels, and a 32-bit counter.

Figure 2:NI USB-6001

B. 8-Channel Relay (ULN2803):

Relay boards are computer boards with an array of relays and switches. They have input and output terminals to control the voltage supply. The ULN 2803 shown in Figure [3] is a highvoltage and high-current Darlington transistor array and is

Figure 4: DC motor

D. LM335 Temperature Sensor:

LM335 is a low cost temperature sensor and gives highly precised results. It operates as a two terminal zener diode. The Figure [5] shows that the temperature sensor is a 3 terminal device that has Adj pin, output pin, ground pin. It has low dynamic impedance less than 1 ohms. It has a large range for temperature i.e. -40 degree Celsius to 100 degree Celsius.

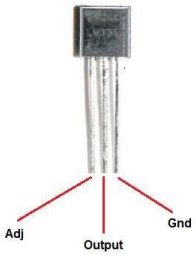

Figure 5: LM335 Temperature Sensor

E. 12v Power Supply:

12 Volt power supply is shown in Figure [6] 12 Volt Adapters are available with output power ranging from under 10 Watts to over 60 Watts.

Figure 6: 12v Power Supply

V. IMPLEMENTATION

A. SOFTWARE IMPLEMENTATION

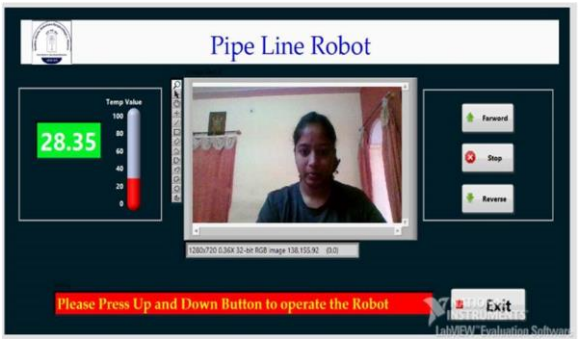

Figure 7. Front Panel Design

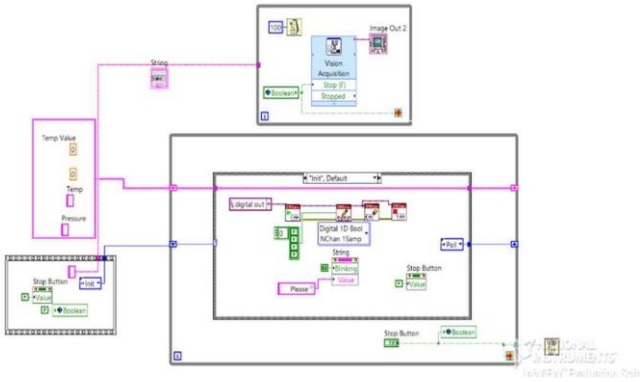

Figure 8: Block Diagram of Front Panel Design

This is the Front Panel design for the Robot movement control. In this panel the Temperature value is shown, live streaming is visualized through camera, forward and reverse for the robot movement. Figure [8] is the Block Diagram of the front panel design and we are using state machine architecture.

B. HARDWARE IMPLEMENTATION

Here the robots are substituted by the DC motors in this particular work.

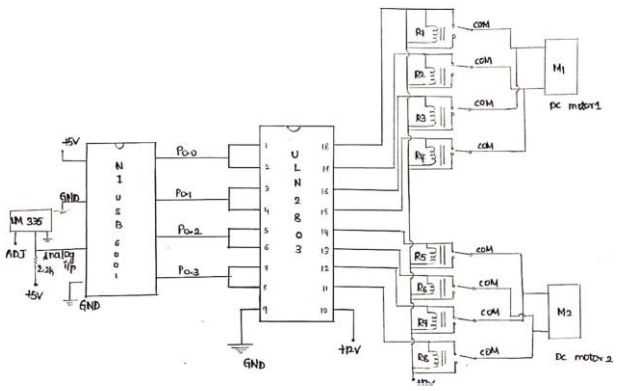

Figure 9: Circuit Diagram

VI. RESULT

- LM335 Temperature sensor detects the temperature inside the pipeline
- This system is a Robotic system that can crawl inside the pipe line.
- The wired camera transmitted the video feed through the USB Cable onto a Computer screen
- Robot system is controlled with LabVIEW Software.

VII. APPLICATIONS

Pipe inspection robots help mankind in many ways. Some of the applications are as below:

- Allow inspection of inaccessible hazardous work area and environment.
- Further improvement in robot will be helpful in borewell rescue operations.
- Provide information about the health and condition of critical plant components to facilitate decision.
- Reduce equipment / plant downtime and improve smaintenance and inspection procedure through better coverage and documentation.
- The robot has great application in accessing the regions of pipe where human cannot reach. It can be mounted with a camera which sends pictures of inside and help in inspection.
- It can be fitted with ultrasonic sensors and can pin point the location of a hole.

VIII. CONCLUSION

- A Robot has been developed which can travel easily through horizontal pipes and vertical pipes and check the corrosion and gas leakage inside the pipe.
- It is equipped with wireless camera to take live streaming image of internal pipe.
- It is traversed inside metal pipe with forward and backward motion and robot is controlled using LabVIEW.

IX. FUTURE SCOPE

The project is limited in several ways and can be worked upon to broaden its features and applications. A few of the improvements that can be implemented are mentioned below.

- Use of tilted and guide wheels for traversing curves and bends in pipes. Use of lighter material for the links to reduce the weight.
- Infrared/Ultrasonic inspection for better detection of defects. Implementation of long range sensors.
- Implementation as a bore well rescue robot. Alternate design without links to facilitate better motion

X. REFERENCES

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