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Inspection of Internal Parts in a Pipeline Using an Intelligent Fiberscope

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ABSTRACT

This paper describes a method and device for the inspection of internal parts in a pipeline using an intelligent fiberscope.Due to the continuous use of pipeline there are chances of corrosion or crack on the interior of the pipeline. To check the defects directly with eyes is not possible for human beings. The present paper discusses on using an intelligent fiberscope inspection technique

Keywords: Intelligent Fiberscope, Internet of Things, Pipeline,Control/Monitor, Corrosion, Crack, Camera module, Path Illuminating Module, Sensor Module, Electrical Signal, Fibre Signal Convertor

1. INTRODUCTION

The present invention relates to the field of Internet of things (IOT) in inspection of pipelines using intelligent fiberscope.

The goal of this research is to develop a smart method and a device for pipeline inspection. Pipeline management is key in oil, gas and water supplying industry. Pipeline management should ensure safety and security to the environment and the consumer as it poses risks if there are leaks and corrosion.

Our research team has developed an intelligent method and device that provides an interface to continuously monitor the inspection of the pipeline using an intelligent fiberscope as well as control the fiberscope when necessary to ensure effective and accurate inspection.

The system comprises the following advantages:

1. A fiberscope head comprising of lens camera module, path illuminating module, sensor module
2. A user interface that provides live inside view of the pipeline
3. An optical fiber line to connect the fiberscopic head with the user interface

The implementation and description of the novel method and device would be discussed in the preceding sections of this paper.

2. DESCRIPTION

The paper discusses in detail on the inspection of the internal parts of pipeline. More specifically on a device that provides an interface to the user allowing them to control/ monitor the intelligent fiberscope that is inside the pipeline.

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The intelligent fiberscope device is having an optical fibre, a user interface and a fiberscope head. The fiberscope head is further divided into camera module, path illuminating module, sensor module and electrical signal connected to fibre signal convertor.

Whenever the intelligent fiberscope is inserted into the pipeline it will detect any of the corrosions or cracks present inside the pipeline by using the different module present on the fiberscope head such as camera module, path illuminating module, sensor module and electrical to fibre signal convertor. Then the electrical signal is converted to optical signal by the convertor and sent to the user interface.

Fig.1 provides is a diagram of an intelligent fiberscopic device which is used for the inspection of the interior part of the pipeline.

As shown in the fig. 1 there is a user interface 106 present for the user to analyse the defect inside the pipeline that is captured by the lens camera module 101 present in the fiberscopic head 105. The fiberscopic head 105 further has path illumination module 102, sensor module 103 and signal convertor 107. The fiberscopic head is connected to the user interface with the help of an optical fibre 100.

To check the defects inside the pipeline only the fiberscopic head 105 will be inserted inside the pipeline. As shown in the fig. 1 the fiberscope head 105 is having three modules for easy detection of the defects inside the pipeline. The sensor module 103 present in the front end of the fiberscope head has two type of sensors such as ultrasonic and radiography.

The ultrasonic sensor module sends the ultrasonic signal to the walls of the pipeline to detect the defects. Whenever any defect is detected then another sensor module 103 radiography modules will send the radiography signal to confirm the position as well as the size of the defect.

Once the defect is detected inside the pipeline, it will inform to the user interface 106 with alarm system by indicating the distance of the defect from the fiberscope head 105. After receiving the signal from the sensor module the signal convertor converts the electrical signal to fibroptic signal and sends through the optical fibre 100 to the user interface and another signal convertor present on the receiving end to convert the optical signal to electrical signal before reaching to the user interface.

After finalising identification of defect the fiberscope head will move to the exact place of the defect with the actuator. The path illumination module 102 present on the fiberscope is LED lights which is capable of excellent illumination even in the dark environment. The image and real time video will be captured by camera module 101 which includes CCD video camera.

Then the information will be gathered regarding the defect and forwarded to the user interface by the intelligent fiberscope.

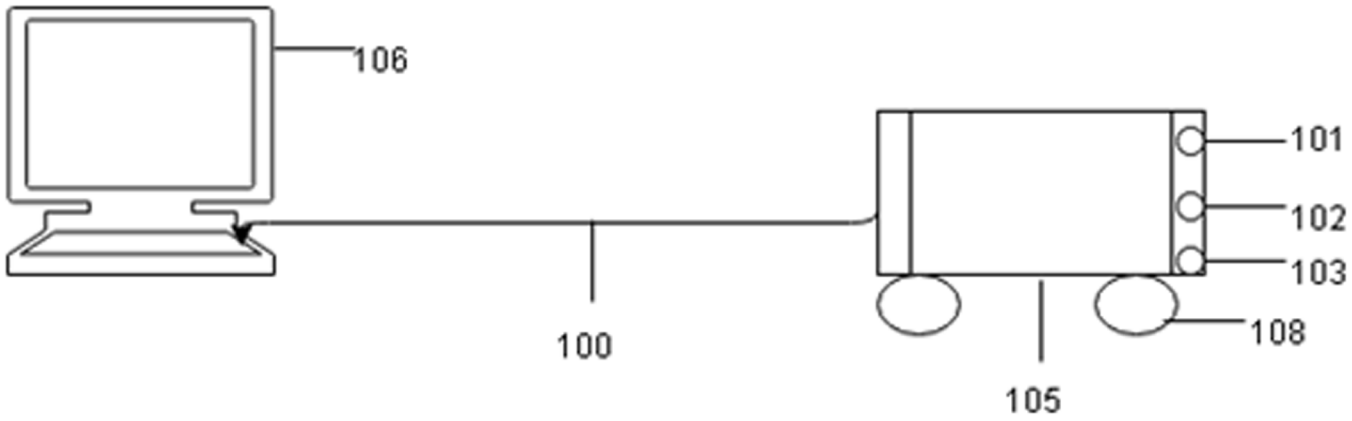

Figure 1: Intelligent Fiberscopic Device

3. IMPLEMENTATION

The present invention and its advantages can be implemented as described below. The system inspects the internal parts in a pipeline to detect the damages using an intelligent fiberscope.

The optical fiberscope device attached with output module detects any crack and defects on the internal surface of the pipeline. The system and device provides the monitoring and controlling of the intelligent fiberscope to inspect the internal parts of the pipeline The intelligent fiberscope device is having optical fibre, a user interface and a fiberscope head.

Whenever the intelligent fiberscope is inserted into the pipeline it will detect any of the corrosions or cracks present inside the pipeline by using the different module present on the fiberscopic head. Then the electrical signal is converted to optical signal by the convertor and sent to the user interface.

4. CONCLUSION

The present invention provides a robust system that incorporates a fiberscope with additional tools/ devices allowing the user at the end to easily detect the location of the defect inside the pipeline.

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