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MONITORING AND CONTROLLING LEAKAGE IN WATER PIPELINE

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ABSTRACT

In this paper an approach to monitor and control leakage in water pipeline is presented. It is essential for many industries to continuously monitor the pipeline for detection of any leakages, which would cause large scale damages and create hazardous surrounding. Leaks in pipes can be as a result of severs elements which include the pipes age, unsuitable installation and herbal screw ups. Therefore a solution is needed to locate leakage in pipeline. Control action implemented in this case is ON-OFF control. There are ordinary methods which uses man power to switch on and off valves manually for mixing. Since ordinary method consumes time and man power, it is essential to jump into an automatic method which overcomes lags in conventional method The hardware includes flow sensor, solenoid valve, relay and arduino uno. The software includes LabVIEW, VIPM and arduino.

Keywords: LabVIEW, solenoid valve, flow sensor, relay

1. INTRODUCTION

Water is an essential element for every organism, the needs for providing a good water distribution system is a must. Sometimes, the condition in certain location does not allow us to create a good water distribution system on the ground and the development of constructions causes the current water distribution system to residential, offices, and industry premises through pipes under the ground.

Liquid flow sensor is one of the sensors that are used for this monitoring complete process. This sensor makes use of Hall Effect sensor inner it to measure the water go with the flow price and is placed on a pipe that has a diameter identical to the diameter of the sensor. The sensor will retrieve water waft information with the aid of analysing rotation matter of the wheel. A microcontroller is needed to technique this records to be able to know how the fee of water flows via. Then the data will be sent by the microcontroller to the end node. Data value is compared with threshold value that is given as a feedback to controller which decides the operation of solenoid valve operated automatically.

Commonly, water distribution is accomplished via underground pipes, where the water pipeline will become lots tough to manipulate than in the open space. This scenario will purpose a everlasting loss if there may be a disturbance within the pipeline which include leakage. Leaks in pipes can be caused by numerous factors, which include the age of the pipeline, flawed installation, and the condition of the surroundings. Therefore, an efficient solution is required to detect and to locate the damage in pipeline system. The objectives are to achieve early detection and control of leakage that occurs in the pipeline using controller and also to develop LabVIEW based monitoring for leakages in pipeline.

LabVIEW stands for laboratory virtual instrumentation workbench which provides the user with a graphical interface. LabVIEW is a state of software programming language which provides a service from simulation to real time measurement and control

2. METHODOLOGY

2.1Block diagram

2.1.1Arduino UNO

The Arduino UNO is a widely used open supply microcontroller board primarily based at the ATmega328P microcontroller. The board is ready with sets of virtual and analog enter/output pins that can be interfaced to various growth forums and different circuits. The board capabilities 14 virtual pins and 6 analogy pins.

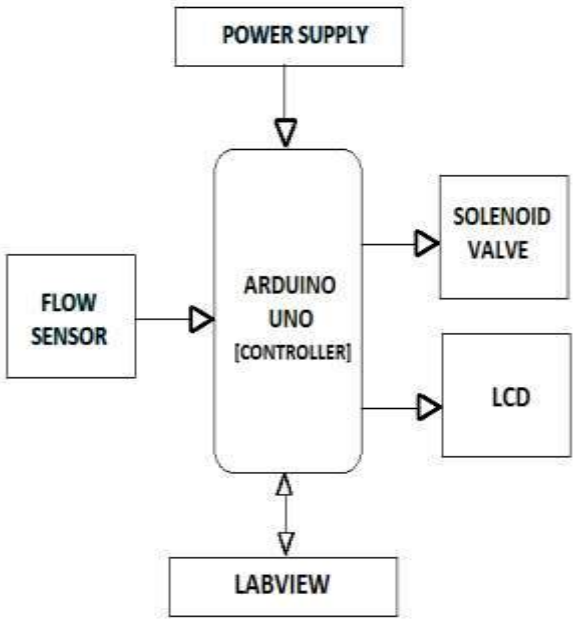

Fig 1: Block diagram

It is programmable with arduino IDE via USB cable. It can be powered by a USB cable or with the useful resource of an outside 9 volt battery, even though it accepts voltages among 7 and 20 volts. It is likewise just like the arduino nano and Leonardo. UNO method one in Italian and have become selected to mark the release of arduino software. The ATmega328 at the arduino uno comes with a boot loader that allows uploading that allows importing new code to it without the usage of an outside hardware programmer.

2.1.2 Flow sensor

Liquid flow sensor of a plastic valve frame, a water rotor, and a Hall Effect sensor. When water flows via the rotor, rotor rolls. Its velocity numerous as fee of float modifications. The Hall Effect sensor outputs the corresponding pulse signal. This one is suitable to stumble upon go together with the waft in water dispenser. Specifications

- Mini. working voltage: 4.5V DC
- Max. working current: 15Ma
- Working voltage: 5V - 24V DC
- Flow rate range: 1 - 30L/min

2.1.3Solenoid valve

A solenoid valve is an electromechanical tool win which the solenoid makes use of an electric present day to generate a magnetic area and thereby function a mechanism which regulates the outlet of fluid flow in a valve. A way valve has ports. If the valve is open, then the two ports are related and fluid may glide between the ports. If the valve is closed, then ports are isolated. If the valve is open while the solenoid valve is not energised, then the valve is called as commonly open. Similarly, if the valve is closed while the solenoid is closed, then the valve is termed as commonly closed.

2.1.4Liquid-crystal display (LCD)

A liquid crystal display is a flat panel show device that uses the mild modulating properties of liquid crystal. Liquid crystals do no longer emit moderate right now, as an opportunity the usage of a backlight to produce snap shots in monochrome. LCDs show arbitrary pictures which may be displayed or hidden, which include preset phrases and digits.

2.1.5LABVIEW

LABVIEW is used for Graphical User Interface.

3. ALGORITHM AND FLOWCHART

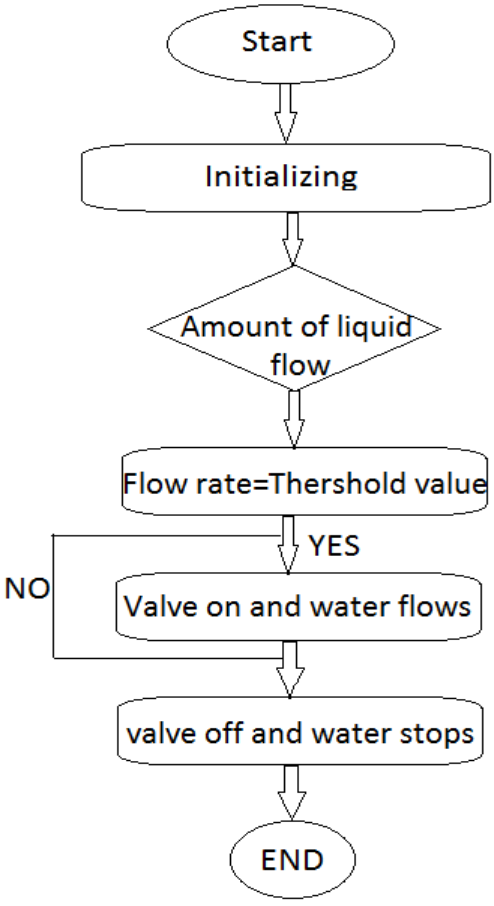

Fig 2: Flow chart

1.Interfacing LABVIEW with arduino and checking the compatibility of flow sensor and valve.
2.Flow sensor measures the flow rate of liquid.
3.The valve is set on until the flow rate is equal and less than to threshold value
4.Valve is automatically switched off once the flow rate increases than threshold value.
5.Process stop indicating leak in pipeline

4. RESULT AND CONCLUSION

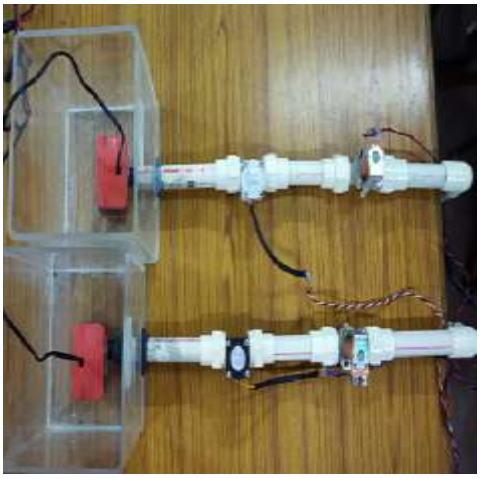

Fig 3: Hardware implementation

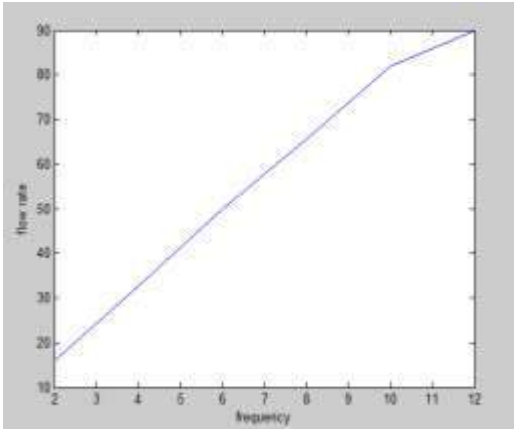

Fig 4: Frequency verses Flow Rate

As pressure of water increases the pin wheel inside the sensor starts rotating. The rotation is counted and converted into pulses. The pulse in turn gives the frequency and hence flow rate can be calculated using the formula as given below

Frequency = 7.5 * flow rate

Flow rate = frequency / 7.5

For different values of frequencies corresponding values of flow rate is tabulated and plotted as in the fig 4.Threshold value given which is compared with water flow rate in pipeline 1 and pipeline 2 when the flow is less then threshold value valve is in OFF condition indicating leakage in respective pipeline, water flow stops. In case flow rate is equal to threshold valve the valve is ON water flows without any leak

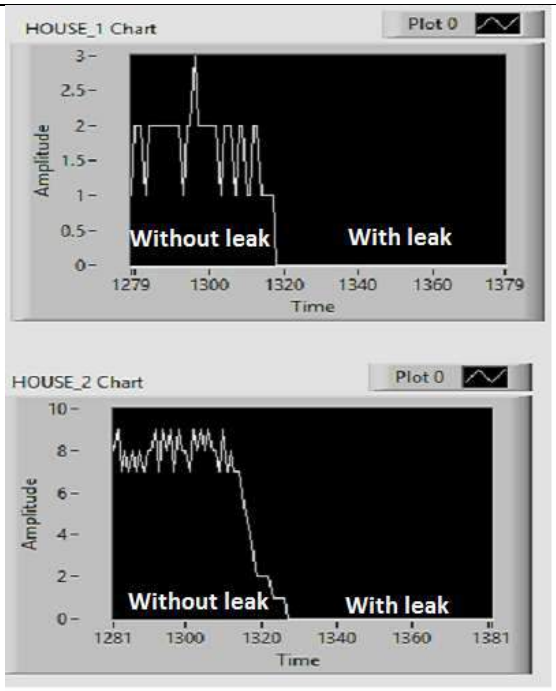

Fig 5 : water flow in pipeline 1 and 2

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5. CONCLUSION

Automatic leak detection in pipeline system and controlling of valve is built successfully. The code has been built in LabVIEW and Arduino UNO as a controller. The ON-OFF control algorithm is successfully applied which is operated automatically using solenoid valve.

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