ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 9, March 2018

AUTOMATIC OIL AND GAS LEAKAGE MONITORING AND DETECTING SYSTEM USING ZIGBEE

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***Abstract*— In case of the industries there is a need to monitor the oil and gas pipelines continuously to avoid any issues. The leakage cause immense amount of oil and gas lost and also cause serious environmental and health hazards. For this reason accurate detection and localization is focused. Generally there will be monitoring stations after a particular distance to check for leakages. It can collect the data of monitoring sites wirelessly and sent to the computer to update values in the location software. Subsequently, it can give a continuous analyst of the potential hazard region, gather the information of a hole mischance. However the previous frameworks can not respond in time, even can't acquire information from a mischance and find precisely. But this does not provide a proper checking. Thus the need of continuous monitoring of the pipeline arises. Our project emerges out with a solution for continuous monitoring of the pipelines. The gas sensor is used for a continuous monitoring. A continuous monitoring is provided over the pipeline the exact location of the defect can be identified and any accidents could be prevented.**

Keywords—Continuous monitoring. Localization, Leak detection,

I. INTRODUCTION

The environmental impact of leakages in oil and gas pipeline is considered to be one of the most serious issues. Since most of the industries use huge pipelines to carry oil and gas to a larger distance care must be taken to deliver them safely. There are many emerging techniques to solve this crisis. Checking of oil and gas pipelines represents a test regarding affectability of the liquid progression and also auspicious conveyance of basic data [1]. Different methods exist for discovery and limitation of spillage in light of pressure. A few of these procedures have been outlined in under wavelet and change examination. Unified approach for spillage discovery in WSN has much higher information rate and hub thickness when contrasted with supervisory control and information procurement notwithstanding having lower usage cost [3]. Disseminated processing for spillage location offers heartiness, expanded execution, furthermore, operational productivity since it diminishes per-hub and arrange asset necessities. Significant advances incorporate ongoing basic information catch, preparing, and dispersal. Because of a high liquid weight, the spillage causes constriction in the transient flag accordingly causing a NPW. Moderate and littler spillages demonstrate all the more difficult due to little weight distinction amongst ordinary and peculiarity case [4]. System lifetime is characterized as the era until the point that all dynamic sensor hubs neglect to give availability or are depleted. Observing of oil and gas pipeline like scaffolds and passages not just demonstrates testing due to broad direct traverse yet in addition because of basic liquid condition detecting prerequisites The situation of aggravation demonstrates the landing time of release reflected signs that can be utilized to gauge the ideal opportunity for transient flag to movement from its source by separating the pipeline into zones. Adjoining sensor hubs are assembled to frame hub groups which gain highlights of NPW and transmit to group head (gateway) [5]. The main contribution of this paper is to providing a continuous monitoring over the pipeline for any leakage and to detect and identify the exact location of the leakage.

II. MASTER NODE DESIGN

Microcontroller is the master node which is connected with a two flow sensors, GPS module, GSM module, motor drive, display and power supply. Master node plays a main role for detecting and intimating the information about the pipeline. Master node is shown in the figure 1.

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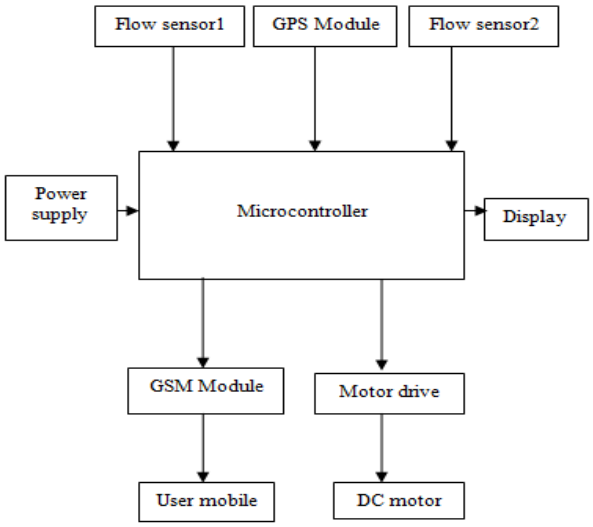

Figure. 1. Master node

A. ARDUINO MEGA 2560

Arduino mega 2560 is a master node. Arduino mega 2560 is a microcontroller which has 54 digital input/output pins in that 14 can be used as PWM outputs, 16 analog inputs, 4 UARTs, 16MHz crystal oscillator, USB connection, a power jack, an ICSP header and reset button. The operating voltage of the microcontroller in 5V. Microcontroller can be powered with an external power supply. The power source is selected automatically. Depending upon the pin value given in the program each and every components are connected to it. VIN- The information voltage to the Arduino board when it's utilizing an outside power source (instead of 5 volts from the USB association or other controlled power source). You can supply voltage through this stick, or, if providing voltage by means of the power jack, get to it through this stick. 5V- The directed power supply used to control the microcontroller and different segments on the board. This can come either from VIN by means of an on-board controller, or be provided by USB or another managed 5V supply. Arduino mega 2560 is in figure 2.

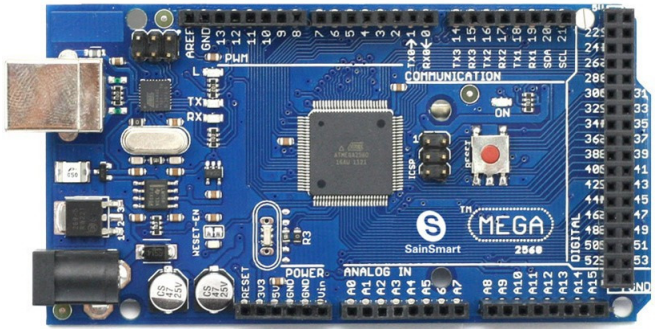

Figure. 2. Arduino mega 2560

B. GPS MODULE

The GPS module (GY-NEO6MV2) is used to find the exact location of the defect in the pipeline structures, the proper location would be done with the help of the GPS module. The excellent navigation is provided in the case of the GPS GY-NEO6MV2. GPS module connected with the microcontroller. GPS module is shown in the figure 3.

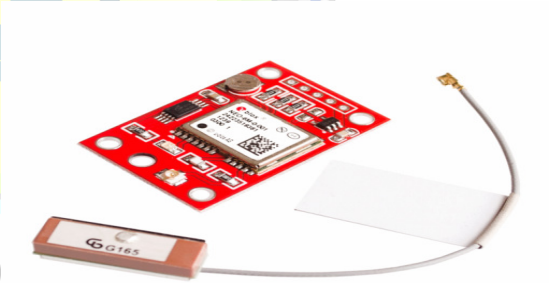

Figure.3. GPS module

C. GSM MODULE

GSM module sim 900 works on the frequency of 850/900/1800/1900 MHz and it can be used not only to access the internet, but also for communication, the module is managed by AMR926EJ-S processor, which controls phone communication, data communication and the communication with the circuit interfaced with the cell phone itself. The processor also in charge of a SIM card which needs to be attached to the outer wall of the module. GSM module sim900 is used generally to communicate with the user mobile. The location of the defect present in the pipeline would be given as AT command to the GSM and it would be sent as a message to the person in charge. In the message the latitude and the longitude position would be mentioned. GSM module is shown in the figure 4.

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Figure.4. GSM module

D. MOTOR DRIVE

The motor driver is integrated chip, usually used to control the motors. The motor driver act as an interface between arduino and DC motors. L293D motor driver allows a DC motor to drive on either direction. Motor driver works on the concept of H-bridge. H-bridge allows the voltage to flow in either direction, voltage change its direction for being able to rotate the motor in clockwise or anticlockwise direction.

E. DISPLAY

LCD(Liquid Crystal Display) screen is an electronic show module. 16*2 LCD show is fundamental module and it is normally utilized as a part of different gadgets. These modules are preferred over seven segments and multi segment LEDs. LCDs are easily programmable and no limitation of displaying characters. 16*2 LCD implies it can show 16 characters for every line and there are 2 such lines. LCD characters is displayed in 5*7 pixel matrix. The 16*2 LCD display is generally used to notify about the leakage identification and the location of the defect present. LCD displays the latitude and longitude of the leakage which is detected by the GPS module.

III. PIPELINE MODEL

A pipeline is a string of interconnected pipes used for the transport of matter nowadays only oil or gas. In order to provide a continuous monitoring over the pipeline, a gas sensor is used to detect the leakage which is movable over the pipeline. The gas sensor is connected with the master node. The two flow sensor is connected in the pipeline. One flow sensor is in the inlet of the pipeline and another is in the outlet side of the pipeline. The belt holds the gas sensor which is movable over the pipeline. In order to indicate the leakage in the prototype of our project, a separate pipe structure is used. The schematic pipeline model is shown in the figure 7.

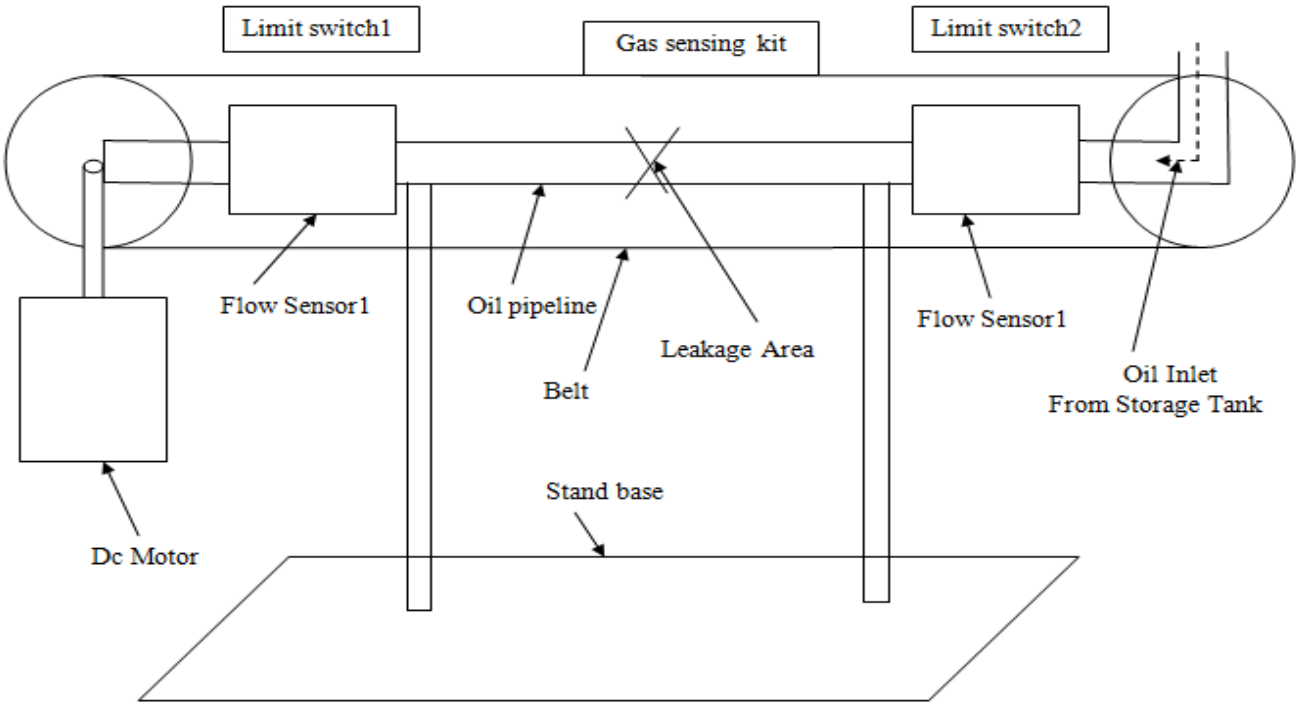

Figure.7 Schematic pipeline model

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A. GAS SENSOR.

The gas sensor which is movable in nature is generally present over the pipeline structures. They are generally driven with the help of the DC motor driver arrival. Mq2 gas sensor use a small heater inside with an electro-chemical sensor.Mq2 gas sensor is valuable for gas identifying spillage in home and industry. It can distinguish LPG, I-butane, propane, methane, liquor and smoke. due to its fast responses time , as soon as the leakage is detected it starts to move over the pipeline and stops at the defect area. Belt is used to hold the gas sensor over the pipeline. Gas sensor is shown in the figure 8.

B. LIMIT SWITCH

The limit switch is a electromechanical device. Two limit switch is used in the pipeline. which are used for a break of gas sensor. The limit switch generally consists of an actuator. When the device comes in contact with the limit switch, the device operates the context to make a break and electrical connection. Limit switch is connected in two sides of the pipeline for break the gas sensor in both side.

C. FLOW SENSOR

There will be a regular flow of water/oil ad gas in the pipelines. The rate of flow is generally measured in case of the monitoring over the pipelines. The flow sensor which is used generally has the water rotor inside it. The speed of the water rotor would generally changes with the different rate of the flow. The sensor which is used is the YFS201 hall effect effect sensor whose output will be given as the corresponding pulse signal. The sensor sits in line with the water line and continuous a pinwheel sensor to measure how much water has moved through . the sensor comes with three wires they are red for 5-24 VDC power, black for ground, and yellow for hall effect pulse output. By counting the pulses from the output of the sensor, easily measure the flow rate. Each pulse is approximately 2.25 milliliters. Two flow sensor is connected in the pipeline one is in the inlet side and another is in the outlet side of the pipeline.

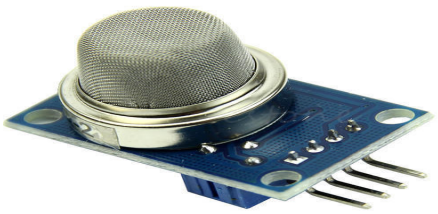

Figure.8 gas sensor

IV HARDWARE PROTOTYPE MODEL

The prototype of this paper is given in the figure.9 and figure 10. Prototype gives the master node connection and pipeline connection. Microcontroller is the Master node which connects with the GSM module, GPS module, motor driver, display and pipeline.

The prototype for the master node is shown in the figure 9. Gas sensor is used to detect the leakage over the pipeline which is movable over the pipeline with a help of DC motor. Belt is used to hold the gas sensor over the pipeline. When the oil and gas leakage is detected the gas sensor starts to move over the pipeline and stops in the defect area and sends the information to the mobile as an SMS. The leakage is detected the SMS is received as “leakage detected” to the in charger mobile with exact latitude and longitude. The received message is shown in the figure 11. Gas sensor detects the leakage by sensing the hazards which is coming out from the defect area. Gas sensor monitors the pipeline continuously. A master node is connected with a pipeline. Master node is a main reason for providing a continuous monitoring over the pipeline and detect the exact location of the leakage in the pipeline and it is displayed in the display and also sent the information through the SMS for the in charge.

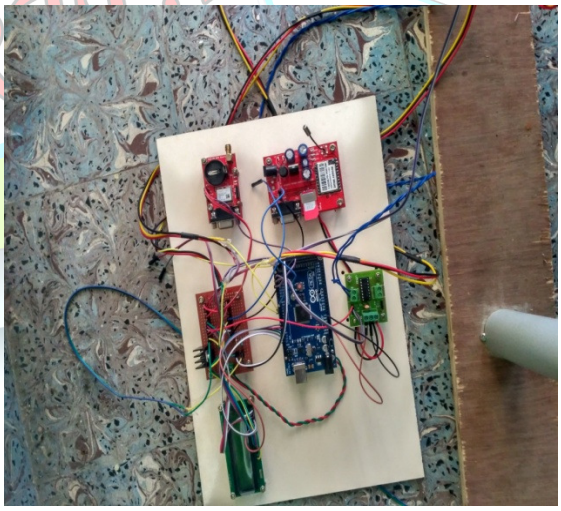

Figure.9. Prototype for master node.

The prototype for pipeline model is shown in the figure 10. It shows that the oil or gas is sends from the storage tank the inlet flow sensor measures the transmitter side flow rate and in the outlet flow sensor measures the receiver side flow rate almost the flow rate of inlet side and

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outlet side is equal. If there is any leakage occurs in the pipeline the flow rate of transmitter and receiver varies.

Figure.10. prototype of pipeline model

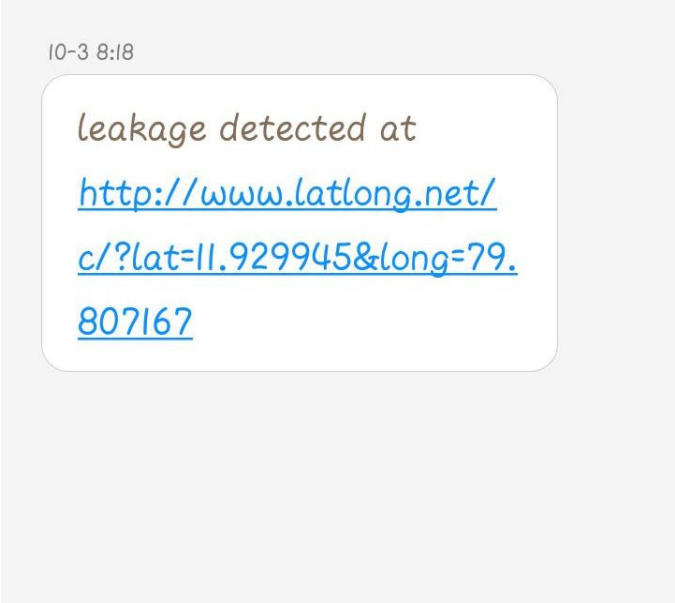

Figure.11. Result

V CONCLUSION

There were several topologies consider earlier for the oil and gas pipeline industries but it does not provide any proper information about the defect present in the pipelines to overcome those issues which existed earlier out project emerges the solution for monitoring the pipelines continuously and in case of any defect exact location is focused. This ensures safety of the workers and any disaster could be prevented . the proposed algorithm is considered to be more efficient than the previous methods. Instead of using different gas sensors separately for different gases only a single gas sensor is used to monitor any gas leakage in the pipeline system. The proper location of the defect is also obtained which gives us the latitude and longitude position of the defect present.

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