ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 20, March 2017

SAFETY PARAMETER MEASUREMENT USING ARDUINO AND WIRELESS BASED MOBILE ALERT SYSTEM USING GSM MODULE

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***Abstract*— Safety measurements are very crucial in industries and hence 24*7 monitoring is required.In many industries and factories the working process is watched manually.As the fuels are very dangerous and to avoid disasters, this project extends the scope of working automatically by sending message alert to a mobile if any variations happen in the sensor value by GSM module. Here Arduino is used because it is of Low Budget, Low Power consumption.The measured sensor value from fuel tanks are sent to the Arduino interfaced with network module. The generated UDP packets from arduino are stored in network for continuous monitoring ,and limit value of sensor is checked and if any variation occurs in the sensor values it sends message to the mobile number by GSM module with Sim 900A.The messages can be sent to any phone numbers based on the Arduino-GSM programming.**

***Keywords*— *Hydrogen sensor, Ethernet shield, Arduino with GSM(Global System for Mobile Communication),SMS(Short Message Service)*.**

I. INTRODUCTION

Wireless communication and embedded platform is rapidly growing, making it possible to design wireless network systems that can constantly collect, analyze, evaluate and validate our environment to get more control of the factors that influence it [1-2]. Arduino system is low-cost and highly scalable both in terms of the type of sensors and the number of sensor nodes, which makes it well suited for a wide variety of applications related to environmental monitoring. Unlike wired network designs, wireless network designs create more flexibility in handling these environmental issues. For this reason, a wireless sensor network system that is capable of handling this situation is implemented [3]. Hydrogen leakages are a common problem in industries and factories. If not detected and corrected at the right time, it can also be life threatening. Unlike a traditional gas leakage alarm system which only senses a leakage and sounds an alarm.The sensor values can be stored in network for future references [4]. In addition to this, a message is sent to an authorized person informing them about the leakage.For detecting dangerous & flammable gas leaks in storage tank, a gas sensor is used which detects gas [5-8]. GSM modem can be configured by standard GSM AT command set for sending and receiving SMS and getting modem status. Depending upon the gas sensor output, the microcontroller can send message to the authorized person.

II. EXISTING MODEL

In industries the safety measurements are done and watched manually. The measured values are established from Control room to any system by wired LAN.If any defect occurs in this technique it cannot be prevented immediately.

Objective:

- To find the leakage, change in temperature or pressure values in the tanks which contain fuels for industrial uses
- To send the sensor value to network using Ethernet shield for continuous monitoring and future data analysis.
- To send an alert message to mobile phone through GSM module if any variation occurs in the sensor value.

III. PROPOSED METHODOLOGY

The measured sensor values from fuel tanks are sent from Control room to the Arduino interfaced with network module.The generated UDP packets are stored in network and limit value of sensor is checked. It extends the scope to send message alert to a mobile if any variations happen in the sensor value.

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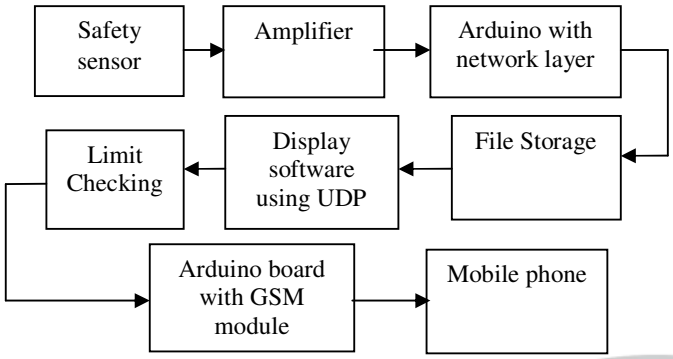
Methodology Diagram:



Working Principle:

The measured sensor values from tank which contain hydrogen fuels are sent to the Arduino which is interfaced with network module. The generated UDP packets from the Ethernet shield are sent to network. These datas are used for future verification and further analysis. The file storage and display of sensor values are generated and displayed as graph and then the limit value of sensor is checked sends an alert message to a mobile if any variations happen in the sensor value through GSM module.

1.Safety sensor:

Hydrogen safety covers the safe production, handling and use of hydrogen particularly hygroen gas fuel and liquid hydrogen. The main concern in working with hydrogen is flammability. It possesses the NFPA 704's highest rating of 4 on the flammability scale because it elemental form of H2 hydrogen gas flameable when mixed even in small amounts with ordinary air; hydrogen gas and normal air can ignite at as low as 4% air due to the oxygen in the air and the simplicity and chemical properties of the reaction.

Fig 3.1:Hydrogen sensor(MQ-8)

2.Arduino:

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. It is Inexpensive, Low power consumption and works on Cross-platform.

Fig 3.2:Arduino board with pin details

3.Arduino with network module:

Arduino Ethernet Shield allows an arduino board to connect to the internet.UDP is User Datagram Protocol which is a protocol in the transport layer of T CP/IP model.The server is creating a Datagram Socket and waits to get Datagram Packet.The Client creates an object which contains the File Event object.The File Event object contain the file content ,file metadata and destination folder.The datas are unicasted between two PC.This datas are used for further reference.During testing in industries these datas are continuously monitored.If we have W5100 IC inbuilted in ethernet shield the datas can be multicasted.

Fig 3.3:Arduino with network module.

4.Node.js software:

Node.js is a very powerful JavaScript-based framework/platform built on Google Chrome's JavaScript V8 Engine. It is used to develop I/O intensive web applications like video streaming sites, single-page applications, and other web applications.It is a Web based application and helps in

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creations of Web servers and networking tools using JavaScript.

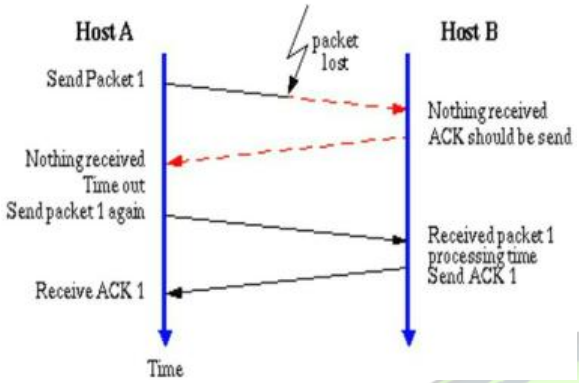

Fig 3.4:Transferring UDP packets between two host

Fig 3.5: GSM module with SIM 900

5.GSM module with SIM 900:

The Arduino GSM Shield 2 allows an Arduino board to connect to the internet, make/receive voice calls and send/receive SMS messages by using the GPRS wireless network. You can also make/receive voice calls using the on-board audio/mic jack and send/receive SMS messages.

The shield uses a radio modem M10 by Quectel.It is possible to communicate with the board using AT commands. The GSM library has a large number of methods for communication with the shield. The shield uses digital pins 2 and 3 for software serial communication with the M10. Pin 2 is connected to the M10's TX pin and pin 3 to its RX pin.The modem's PWRKEY pin is connected to Arduino pin 7. The M10 is a Quad-band GSM/GPRS modem that works at frequencies GSM850MHz, GSM900MHz, DCS1800MHz and PC1900MHz. It supports TCP/UDP and HTTP protocols through a GPRS connection. GPRS data downlink and uplink transfer speed maximum is 85.6 kbps. To interface with the cellular network, the board requires a SIM card provided by a network operator. [6] discussed about Positioning Of a Vehicle in a Combined Indoor-Outdoor Scenario, The development in technology has given us all sophistications but equal amounts of threats too. This has brought us an urge to bring a complete security system that monitors an object continuously.

IV. ALGORITHM(Software)

A. Arduino Programming:

Open source and extensible software- The Arduino software is published as open source tools. The language can be expanded through C++ libraries, and can make the leap from Arduino to the AVR C programming language.

B.Java Programming:

Node.js is a very powerful javaScript based platform and it a Web based application.It acts as a Server side platform and works on JavaScript runtime environment.Creations of Web servers and networking tools using JavaScript is used for display.

C.Engineering value calculation:
Hydrogen sensor:

- *Calibration : 0 – 50%*
- *Acceptable level: 0 – 4%*
- *Voltage level : 0.73 – 3.6V*
- *assign 0.73V as 0%*
- *assign 3.6V as 50%*
- *so, 0.965V is 4%*

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V. SIMULATION RESULTS

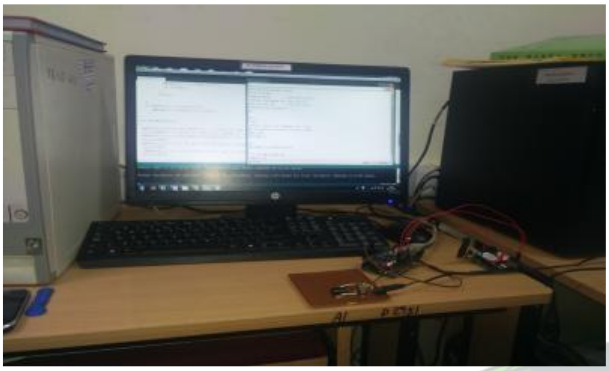

Fig 5.1:Whole Experimental Setup

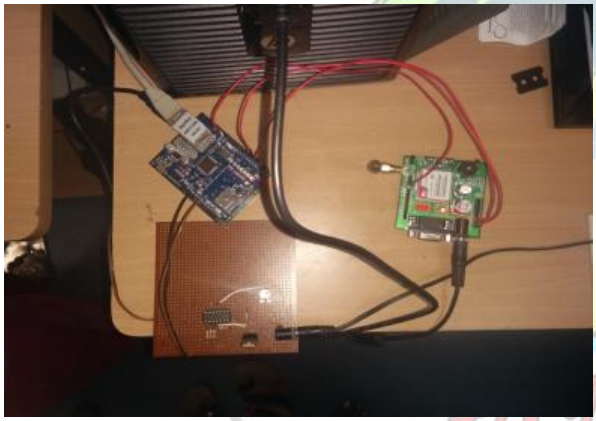

Fig 5.2:Amplifier circuit connected with Arduino interfaced with network module and connected to GSM

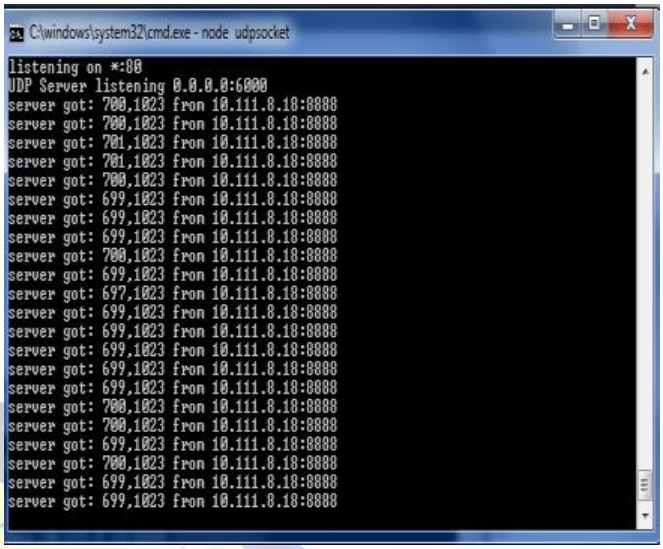

Fig 5.3:Data received as UDP packets

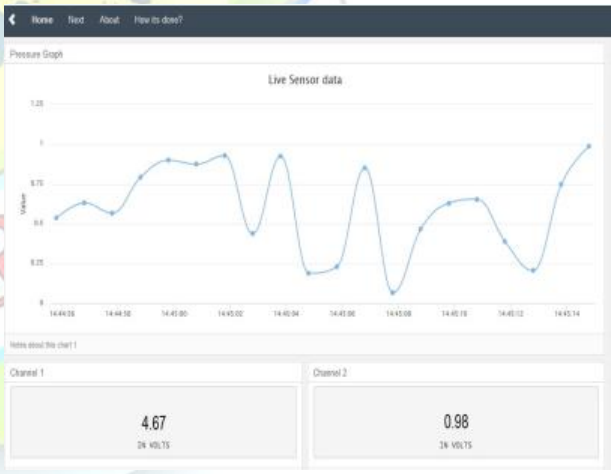

Fig 5.4:File storage and Display using node.js software

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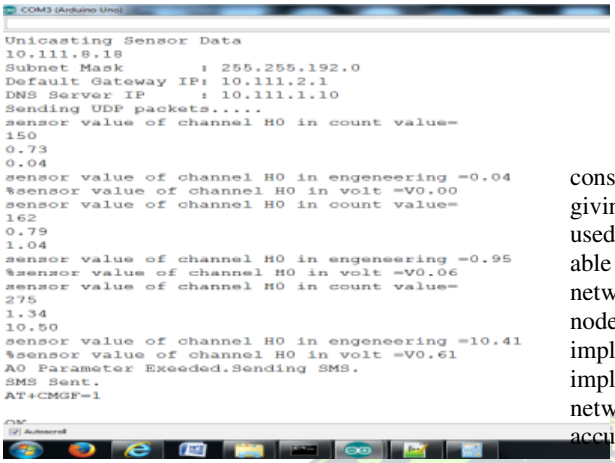


Fig 5.5.1: Results on varied sensor value and alerted gsm message

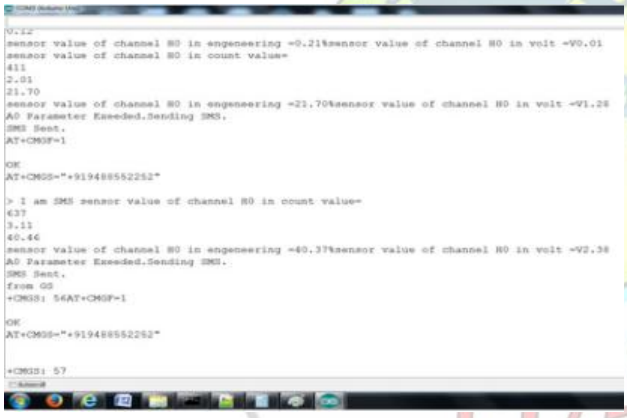
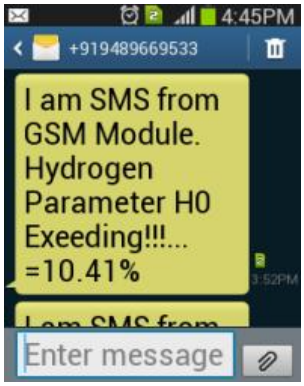


Fig 5.5.2: Results of varied sensor value and GSM alert message.



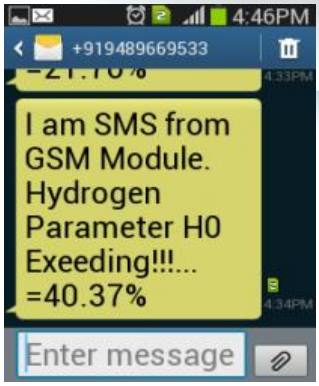


Fig 5.6:Message sent from GSM module

VI. CONCLUSION

As Arduino is of low cost and low power consumption the implementation in industries can be done by giving the sensor values to the analog pins.As 18 sensors are used 3 Arduino boards will be needed.All the nodes should be able to access the values so the engineering value is send to network.A display module can be implemented using the node.js software.The efficient monitoring method is implemented using GSM module. The proposed prototype was implemented and tested with single arduino interfaced with network module and alerted using single GSM and shows the accuracy of ≥98%.

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