IoT Based Fuel Monitoring System

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Abstract- *Fuel monitoring systems are necessary in tracking and understanding the changes in fuel level. Remote monitoring system are useful and effective tools to collect information from fuel storage tanks. A real-time remote fuel-level monitoring solution is an option for many who need to know exactly fuel losses are occurring. Earlier studies shows that fuel monitoring has been done using embedded systems, microcontrollers, GSM module architectures. But, these systems are costly. This paper presents the implementation of monitoring system based on internet of things technology. This system is a monitoring device built on the Raspberry-Pi computer, it takes information about tank's fuel level in real time through its sensor and live streaming of the site, uploading it directly on the cloud , where it can be read anytime and anywhere through web application. This system is cost effective and inexpensive as compared to existing fuel monitoring systems.*

Keywords- IoT,Arduino Mega, Raspberry-Pi,Ultrasonic Sensor, Fluid level Sensor,GUI.

I. INTRODUCTION

As fuel prices goes up, we people face many problems and many challenges in regard with generators for power supply.

In some part of our country up to 40% of the installed sites have no access to the power grid, those sites are usually powered by diesel or gasoline generators.Between 20% and 35% of the fuel intended for powering these generator sites are stolen.To avoid this, we have to implement such a system, though we have used Internet of things which has become a basic and necessary technology for monitoring of remote location via web or android application but for fuel monitoring system we havenot developed any system as of now.

The use of the Internet is growing in this day and age, so another area has developed to use the Internet, called Internet of Things (IoT). It facilitates the machines and objects to communicate, compute and coordinate with each other. It is an enabler for the intelligence affixed to several essential features of the modern world, such as homes, hospitals, buildings, transports and cities. The security and privacy are some of the critical issues related to the wide application of IoT.

A world where the real, digital and the virtual are converging to create smart environments that make energy, transport, cities and many other areas more intelligent. The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service.

II. IOT ARCHITECTURE

IoT architecture consists of different suite of technologies supporting it. It serves to illustrate how various technologies relate to each other and to communicate the scalability, modularity and configuration of IoT deployments in different scenarios. The functionality of each layer is described below:

- Perception Layer(Sensor Layer)

The lowest layer is made up of smart objects integrated with sensors. It is also known as a sensor layer. It works like people's eyes, ears and nose. It has the responsibility to identify things and collect the information from them. There are many types of sensors attached to objects to collect information such as RFID, 2-D barcode and sensors. The sensors are chosen according to the requirement of applications.

- Network Layer(Transmission Layer)

Network layer is also known as transmission layer. It acts like a link between perception layer and application layer. It carries and transmits the information together from the physical objects through sensors. The medium for the transmission can be wireless or wired. It also takes the accountability for linking the smart things, network devices and networks to each other. Therefore,it is vastly sensitive to attacks from the side of attackers. It has prominent security issues regarding integrity and authentication of information that is being transported in the network.

- Management Service Layer

The management service renders the processing of information possible through analytics, security controls, process modelling and management of devices. One of the important features of the management service layer is the business and process rule engines. Data management is the ability to manage data information flow. With data management in the management service layer, information can be accessed, integrated and controlled.

 Application Layer

Application layer defines all applications that use the IoT technology or in which IoT has deployed. The applications of IoT can be smart homes, smart cities, smart health, animal tracking, etc. It has the responsibility to provide the services to the applications.

HARDWARE

In this experiment, Arduino Mega Board, Raspberry Pi, Ultrasonic sensor ,Surveillance camera are used to estimate the data and distance of the subject.

i.Arduino Mega :

Arduino MEGA is used for data acquisition. The output from the ultrasonic sensor consists of AC and DC component. The AC component shows the ultrasonic waves and DC component shows the absorption of light by sensor. AC component plays the main role to estimate distance. The signal pin of the ultrasonic sensor is connected to an analog A0 pin of Arduino MEGA board to receive the ultrasonic signal.

ii. Raspberry Pi:

The Raspberry Pi 3 is used as a processor which is responsible to generate binary data respective to the analog signal. It is chosen because of its multitasking feature. It has serial peripheral interface (SPI) interface with 50 MHz serial clock (SCLK). The memory unit is required for the raspberry Pi to store files, data, etc.

iii.Ultrasonic Sensor (HC-SR04) :

Ultrasonic sensors work by transmitting a pulse of sound, this pulse travels away from the range finder in a conical shape at the speed of sound (340 m/s). The sound reflects off an object and back to the range finder. The sensor interprets this as an echo and calculates the time interval between sending the signal and receiving the echo.

SOFTWARE

The selection of IoT architecture is due to its vast uses and it describes as enabler that links seamless objects surrounding environment and performs some sort of message exchange among them of extensive graphical capabilities along with its availability.

Tools used:

- Arduino IDE 1.8.8
- Python tool 3.7
- Pyqt5 for GUI
- Notepad++ for R-Pi

III. METHODOLOGY

Fig. 1 shows the schematic diagram of the developed system :

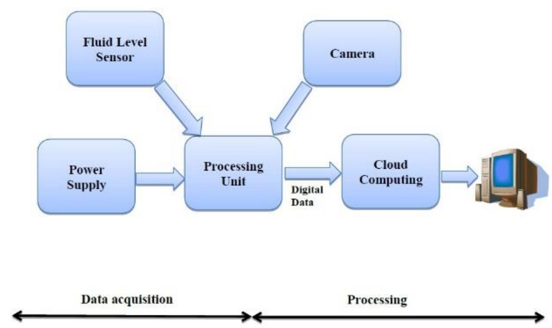

Fig.1 : Schematic Diagram of Patient monitoring system using Virtual Instrumentation

- Data acquisition
  - Sensing
  - Camera Surveillance
- Data Processing

A. Data acquisition:

- Sensing

The purpose of this part is to sense the level of fluid using ultrasonic sensor carefully chosen to achieve the best performance. The detected data should then be converted into digital formats corresponding to each of the measured values.. Digital sensors will give a digital output suitable for the R-Pi's (digital only) input, while analog sensors will need analog to digital conversion.

- Camera surveillance system

The Raspberry Pi and the connected camera module transfers data through an extremely fast Camera Serial Interface (CSI-2) bus directly to the Broadcom BCM2835 system-on-chip (SoC) processor. It is very likely to have a maximum video recording resolution of 1920 pixels × 1080 pixels at around 30 frames per second.

B. Data Processing:

The processing unit consists of two parts ADC and R-Pi.

a) Raspberry-Pi

This is the most important unit and the core of the system. It actsas processor and it controls all the functionality. It receives information from sensor, processes it, proceeds corresponding values, and generates the necessary controls to guide the data to the desired end point. The sensor will be connected to the R-Pi's GPIO pins in configuration. The main concept of the wiring is that digital sensors are connected directly to the raspberry pi's GPIO. The raspberry pi will handle the processing of data and upload it into cloud.

b) Software Design

Before writing the code for the system, several software dependencies must be installed for using Python on the R-Pi and making the process easier for user. To perform this we always requireinternet connection. In the execution part, the software life cycle management phases were employed for the web application.

1) Web application

The sensor collects the data of the fuel, transfers the value to processing unit which is R-pi. R-pi sends the value through point to point protocol to the internet. The website module retrieves the data from the internet and displays it to the users, using database for authentication.

This website is accountable of user operations, and includes:

- Add new user.
- See the current fuel status.
- See the fuel consumption rate.
- Watch the live streaming.

GUI

Fig. 2 & Fig. 3 shows the GUI designed for the system.

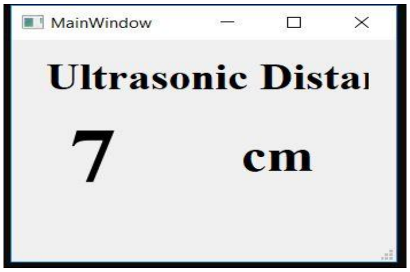

Fig. 2:GUI 1

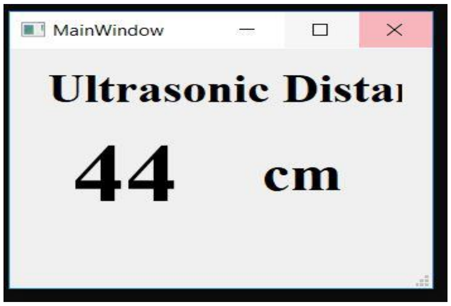

Fig. 3 :GUI 2

Using these GUIs, we can enter and save the fuel level information.

IV. IMPLEMENTATION

A)Software Implementation

The software Mobaxterm was used to communicate with the raspberry pi. The SSH protocol was used from MobaXterm software to communicate with the ip address of Ri-PI using internet. The use of Ri-Pi is due to the power that is consumed by the raspberry pi peripherals. By using this method, the raspberry pi's power limitations were reduced and thus makes system more reliable and efficient system. Several steps have been performed to construct the web application; the work mainly required of using ready-made libraries,development platform that was used is notepad++.

V. RESULTS

The implementations done in a number of steps in order to reduce the system intricacy and to restructure the system integration process. Three results taken during and after the implementation process of the system. Results were taken during the implementation purpose and after the implementation to safeguard that the system is working fine.

Hardware Results

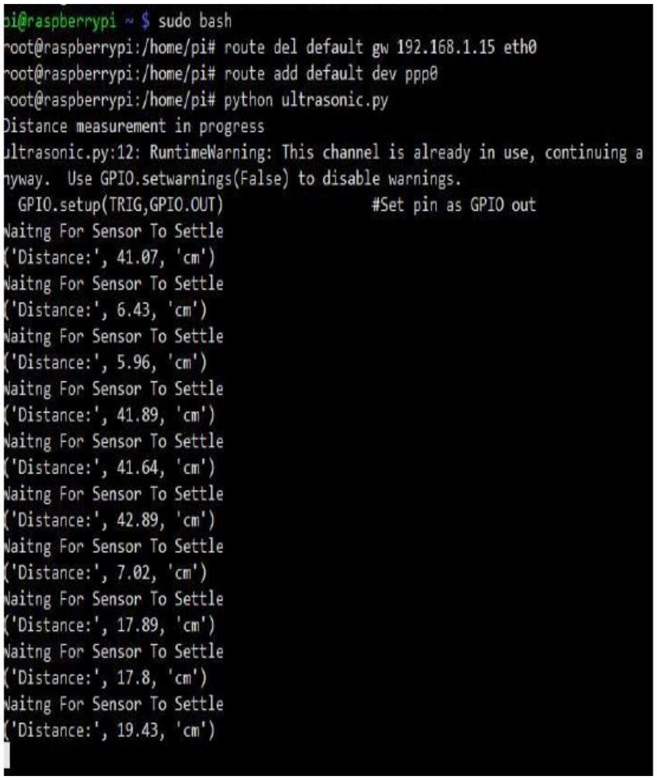

Fig. Hardware Result

Software Results

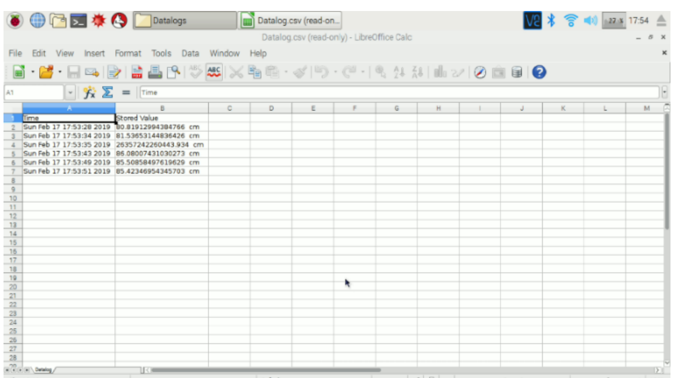

Fig. Software Result

VI. CONCLUSION

The system measures tank's fuel level which is displayed through web application and design of camera surveillance system for station. At the same time this management system can store the transaction information in the database**.** This system is more efficient, reliable and cheap compare to existing system.

REFERENCES

[1] Mr.Senthil kumar.R1,Ganapathi.M2, Arunkumar.D3, Goutham.G4,Karthick.M5, " Fuel Monitoring System For Fuel Management " in International Journal of Science, Engineering and Technology Research (IJSETR) Volume 6, Issue 4, April2017

[2] Shulong Wang, Yibin Hou, Fang Gao and Xinrong Ji "A Novel IoT Access Architecture for Vehicle Monitoring System" IEEE 3rd World Forum on Internet of Things (WF-IoT) pp. 1–11, Feb.2017.

[3] Oladayo Bello,Sherali Zeadally "Intelligent Device-to-Device Communication in the Internet of Things " in IEEE SYSTEMSJOURNAL,ieeexplore.ieee.Org,pp.1–11,Sept.2016

[4] Thinagaran Perumal1, 1Md Nasir Sulaiman, 2Leong.C.Y, " Internet of Things (IoT) Enabled Water Monitoring System " 2015 IEEE 4th Global Conference on Consumer Electronics (GCCE), Vol. 4 Issue 09,October-2015

[5] Nandini Hiremath,Mrunali Kumbhar,Aakriti Singh Pathania,VinodPatil , " Smart Fuel Theft Detection using Microcontroller ARM7 " in International Journal of Engineering Research & Technology (IJERT) ,Vol. 4 Issue 09,September-2015

[6] M. Abu-Elkheir, M. Hayajneh, and N. A. Ali, "Data management for the Internet of Things: Design primitives and solution," Sensors (Switzerland), vol. 13, no. 11, pp. 15582–15612, November2013.

[7] P SaiSushimitha, R Madhan, Detection of fuel theft and vehicle position with third party monitoring software. Int. J. Adv. Computational Eng. Networking 1(7), 37–39(2013)

[8] SS Aher, RD Kokate, "Fuel monitoring and vehicle tracking" International Journal Engineers Innovation Technology 1(3), 166–169(2012).

[9] GM Hemnandan, G Gajanan, R Anil, "Remote Monitoring of Fuel Level for Diesel Generator Set", in National Conference on Electronic Technologies (Ponda-Goa, India, 2011), pp.1–3

[10] D. Rountree and I. Castrillo, "The Basics of Cloud Computing," Basics Cloud Computing, pp. 123–149, 2014.

[11] P. F. OvidiuVermesan, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems.2013.

[12] D. Bandyopadhyay and J. Sen, "Internet of things: Applications and challenges in technology and standardization," Wireless Pers. Communication, vol. 58, no. 1, pp. 49–69, September2011.

[13] Raspberry Pi Foundation.http://www.raspberrypi.org/help/what-is-araspberry-pi/