IJCSE International Journal of Computer Sciences and Engineering Open Access
Technical Paper Volume-4, Issue-4 E-ISSN: 2347-2693

Raspberry pi based Energy Monitoring System in Chemical Industry

Giethu Kavanal[1], Rakhi ganesh[2], Shahana Sakkeer[3] and Sreelekshmi R[4]*

[1,2,3,4] Department of Information Technology,
Mahatma Gandhi University, India

Available online at: www.ijcseonline.org

Received: Apr/02/2016 Revised: Apr /10/2016 Accepted: Apr/22/2016 Published: Apr/30/2016

***Abstract* - The main purpose of implementing Chemical industry automation is to provide required temperature, air humidity and light levels independent from outer environmental conditions. By this way maximum control from unit area will be obtained so that industry will have been handled in most efficient way. Controller type and its peripherals must satisfy required customer expectations. Traditional systems owners look forward to user friendly interface, scalable input and output ports that are compatible with any type of industrial equipment's, faultless control system from such automation system. In addition to customer expectation, suitable software algorithm is to developed to save different mechanical conditions in single microprocessor. For related control system we should also clarify right sensors to measure present factory conditions.**

KEYWORDS- EMS, Remote Control, 2- Tier Architecture

I. INTRODUCTION

This paper presents an advanced system for process management via a credit card sized single board computer called raspberry pi based multi parameter monitoring hardware system designed using a microcontroller that measures and controls various global parameters. The system comprises of a single master and multiple slaves with wireless mode of communication and a raspberry pi system that can either operate on windows[1]. The parameters that can be tracked are current, voltage, temperature, light intensity and water level.

Chemical industry is an industry which faces the most hazardous situations. Sudden changes in environmental conditions will result in explosions, toxicity ,injury and death. The major reason for this is the inaccuracy in measurement of global parameters like temperature, humidity, light intensity etc. This energy monitoring system set a limit to each of the parameters and different sensors are used to notify the changes in value of parameters. The design of the embed board includes the interfacing of different sensors to two slave boars and connecting those slave to master board through RF transmission. The master and slave boards use PIC 18F4550 Microcontroller.

The main contribution of this paper is to implement an electronic card which can control, through the Internet under the android environment, the devices such as light, heater, springler. The application consists to develop programs that allow communication between a remote user using a smart phone, a web server and raspberry pi card that communicates with one or more interface cards to control the equipment in the chemical industry.
The Raspberry pi is a low cost credit card sized Linux computer which has the ability to interact with the outside world and has been used in a wide array of digital maker project.

II. REMOTE CONTROL EXAMPLE OF DOMESTIC EQUIPMENT FROM AN ANDROID APPLICATION :

We offer the example of a system for controlling a remote shutter, using a "Raspberry pi" card for receiving commands from an Android application on mobile phone[2]. Our electronic system is composed of a "Raspberry pi" card for receipt of commands sent by the user and according to the order nature, the card will raise or lower the electric shutter. The implementation of this system requires:

- The Programming of a Raspberry pi card capable of receiving commands (orders) sent by a remote user to raise or lower an electric shutter linked with this card.
- The development of a mobile application "Android "in order to control our system.

The solution that we present can also be adopted for other equipment such as lamps, air conditioners etc.

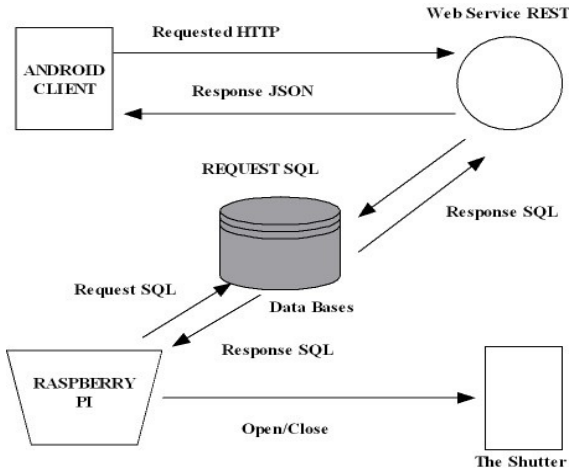

FIG. 1. COMPONENTS AND INTERACTIONS.

III.PROPOSED TECHNOLOGIES FOR THE PROGRAMMING PART :

1) Architecture at three levels (3-tiers)

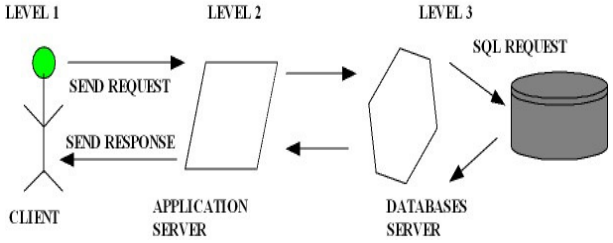

FIG. 2. ARCHITECTURE AT THREE LEVELS (3-TIERS)

The architecture we adopted for our application (side: Android application, web service and database) is the three-tier architecture, which is a stack of three levels: The presentation of data (Level 1), Treatment business data (Level 2) and access to persistent data (Level 3)[3].

2) Two-tier architecture (2-tier):

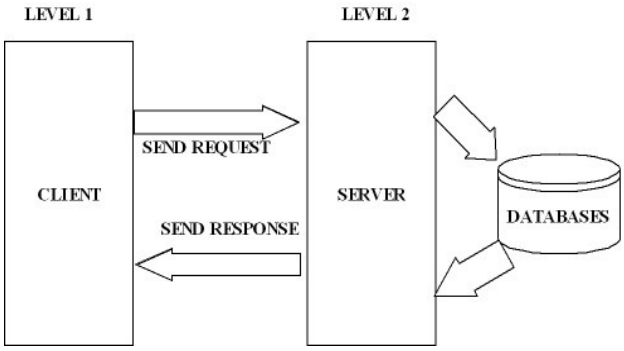

FIG. 3. TWO-TIER ARCHITECTURE (2-TIER)

IV. SYSEM ARCHITECTURE

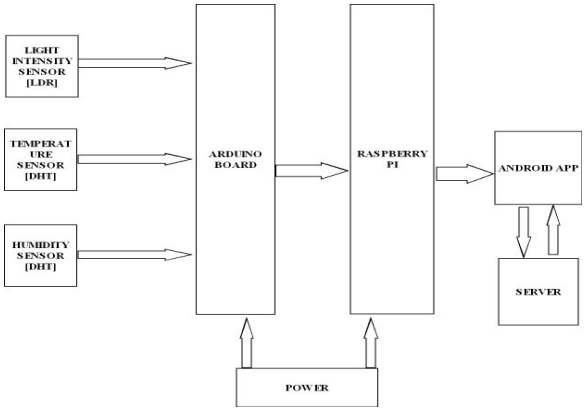

FIG 3: OVERALL SYSTEM ARCHITECTURE

V. MODULE DESCRIPTION

1.Hardware

The collection of factory environmental values and microclimate control is done by the hardware module. Therefore it needs some sensors and actuators for sensing and maintaining the climate. The sensors and actuators are controlled and coordinated using a microcontroller[4].

2. Server

The coordination of the entire system is done by the server module. It establishes the socket connectivity with client device[2]. The comparison of the environmental values and other operations are also done by this module.

3. Android

It provides the GUI facility to the user to know the status of the industrial conditions. The application is also very user friendly and it helps to the managers to control the industry efficently.

Hardware Module

- Collection of the environmental values
- Send the values to the coordination system

Server Module

- Socket Connectivity
- Value Comparison
- Insert conditional values into database
- Send values to the Android module
- Actuator control

Android Module

- Monitoring the greenhouse status
- Notifications to the user
- Actuator Control

INTERFACES

FIG 4: HOME INTERFACE

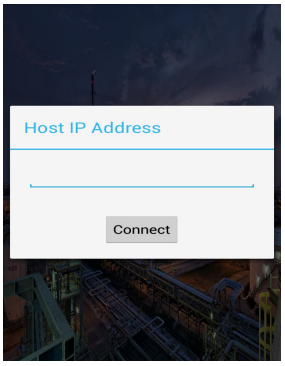

FIG 5: LOGIN INTERFACE

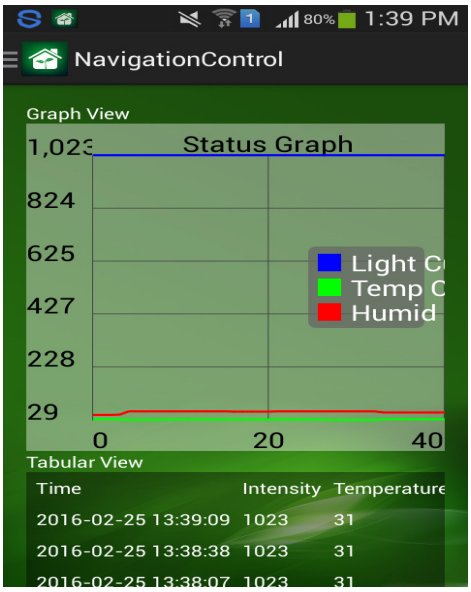

FIG 6:GRAPH VIEW AND TABULAR VIEW

HARDWARE

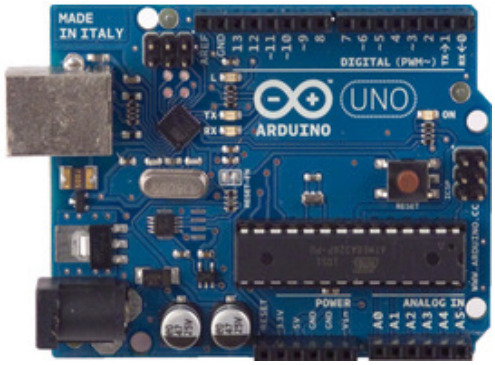

FIG 7: ARDUINO BOARD

FIG 8: RASPBERRY PI

CONCLUSION

Raspberry Pi based energy monitoring system is a system that alerts the users regarding the fluctuations in the readings of parameters such as temperature, light intensity and humidity within a chemical industry. The variations in these values are detected with the help of sensors like DTH and LDR respectively. Additional sensors can also be included within the system[5]. The readings given by the sensors are converted from analog to digital value by using arduino board which is fed as input to the raspberry pi[6]. The fluctuations in the above mentioned parameters can be obtained as a graphical representation along with the corresponding time in the android interface. It is also possible to manually control the devices such as fans, cooler, springler etc inorder to adjust the variations in the above mentioned parameters. The proposed system keeps the workers aware about the working conditions within the industry and also provides a safer working environment. More features can be embedded into the system[7]. This system can be integrated to run as a bigger application. This can also be modified to use in an IOS platform. This system has been proposed to overcome the hazardous situations that occur due to sudden change in global parameters within the chemical industry

.

FUTURE SCOPE

The system can be enhanced for wave form representation of data in an excel sheet using raspberry pi. The additional slaves can be added for measures various other parameters. Also controlling action can be set for some predefined cases in the master module which enables the automatic operation at certain cases. A dedicated video processor can be used in raspberry pi to display graphical and three dimensional view of the industry.

REFERENCES

[1] Alfredo Gardel Vicente, Ignacio Bravo Munoz Jose Luis Lazaro Galilea and Pedro A. Revenga del Toro, “Remote Automation Laboratory Using a Cluster of Virtual Machines,” IEEE Transactions on Industrial Electronics, vol. 57, no. 10, pp. 3276–3283, 2010.

[2] Amiya Ranjan Panda, Utpal Mandal and Hare Krishna Ratha, "Integrated Monitoring of Encoder Status Parameters and GUI based Remote Control Panel Using Lab view," IJCA., vol. 43, no. 3, pp. 21–26, 2012.

[3] Arkadiusz Jestratjew and Andrzej Kwiecien, "Performance of HTTP Protocol in Networked Control Systems," IEEE Transaction on Industrial Informatics, vol. 9, no. 1, pp. 271–276, 2013.

[4] Baosheng, Yanga, Jianxin Lia, and Qian Zhangb, "G Language Based Design of Virtual Experiment Platform for Communication with Measurement and Control," Elsevier-International Journal of Procedia Engineering, vol. 29, pp. 1549-1553, 2012.

[5] Eva Besada-Portas, Jose A. Lopez-Orozco, Luis de la Torre, and Jesus M. de la Cruz, "Remote Control Laboratory Using EJS Applets and TwinCAT Programmable Logic Controllers," IEEE Transaction on Education, vol. 56, no. 2, pp. 156–164, 2013.

[6] Md. Nasimuzzaman Chowdhury, Md. Shiblee Nooman and Srijon Sarker, "Access Control of Door and Home Security by Raspberry Pi through Internet," IJSER, vol. 4, issue. 11, pp. 550–558, 2013.

[7] Mukesh Kumar, Sanjeev Sharma, and Mansav Joshi, "Design of Real Time Data Acquisition with Multi Node Embedded Systems," IJCA., vol. 42, no. 11, pp. 6–12, 2012.

[8] Ahlam Ansari, Tahir Ansari, Faizan Hingora and Mudassir Ansari,"A Secure Cloud Server Using Raspberry Pi and Kerberos Authentication Protocol" IJCSE, Volume-3, Issue-3, E-ISSN: 2347-2693