© 2017 IJSRST | Volume 3 | Issue 4 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Industrial Automation Control Using Raspberry Pi and Zigbee

Vivek N. Chavan, M. D. Jakhete
Digital Electronics, G.H. Raisoni Institute of Engineering and Management, Jalgaon, Maharashtra, India

ABSTRACT

In this paper we can survey on industrial automation control using Raspberry Pi module and Zigbee for the monitoring of the system. It is propose for the continuous monitoring of various industrial parameters. This task is accomplished by conjunction of Zigbee module with Raspberry Pi module. The system comprises of a single master and multiple slave with wireless mode of communication and a raspberry pi system that can either operate on windows or linux operating system. The parameters that can be tracked are temperature, light intensity and water level. The hardware design is done with the surface mount devices on a double layered printed circuit board to reduce the size and improve the power efficiency.

Keywords: Raspberry Pi, Zigbee, Windows, Linux, PCB

I. INTRODUCTION

This system proposes 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 RS232 and 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 or linux operating system. The parameters that can be tracked are current, voltage, temperature, light intensity and water level. The hardware design is done with the surface mount devices (SMD) on a double layer printed circuit board (PCB) to reduced the size and improve the power efficiency. The various interesting features are field device communication via USB-OTG enabled Android devices, on field firm ware update without any specific hardware and remote monitoring and control.

The entire system is designed with the double layer SMD based embedded board with different sensors and a raspberry pi that can compile and communicate the data received from the sensors. The raspberry pi when operated on the Linux operating system can perform multi-tasking. The design of the embed board includes the interfacing of different sensors to two slave boars and connecting those slave to a master board through RF tra nsmission. The master and slave boards use PIC 18F4550 Microcontroller, Encoder and Decoder ICs (HD12E & HD12D), LM35 & LDR Sensors, Water level sensor(IC CD4066) and RF Transceivers.

II. METHODS AND MATERIAL

A. Raspberry Pi

The Raspberry Pi is of a credit card-size, single-board computer launched in the United Kingdom by the raspberry pi foundation. The main objective of this is to encourage basic computer teaching in institutes. The Raspberry Pi has a broadcom BCM2835 system on chip, which comprises of an advanced RISC Machine 76JZF-S 700 MHz processor, video core IV GPU, and was originally distributed with 256 megabytes of RAM, later it is improved (Model B & Model B+) to 512 MB. It does not contain any built in hard disk or solid-state drive, but it uses an SD card for booting and persistent storage, with the Model B+ using a Micro SD. Figure show the Raspberry Pi Model B+ that used in this project.

In order to use Raspberry Pi device it's required to start by installing an operating system onto an SD card. The Raspberry Pi operates on a LUNIX based open source operating system called Raspbian OS. This allows more

control and flexibility in the software therefore making it easy to program the Pi. The Raspberry Pi communicates with the attached devices and sensors through C/C++ codes with addition library to control their functions.

The model A, A+ and Pi Zero have no Ethernet circuitry and are commonly connected to a network using at external user supplied USB Ethernet or Wi-Fi adaptor. On the model B and B+ the Ethernet port is provided by a build-in USB Ethernet adaptor using the SMSC LAN9514 chip. The raspberry Pi 3 is equipped with 2.4 GHz Wi-Fi and Bluetooth in addition with Ethernet port. The raspberry Pi may be operated with any generic USB computer keyboard and mouse.

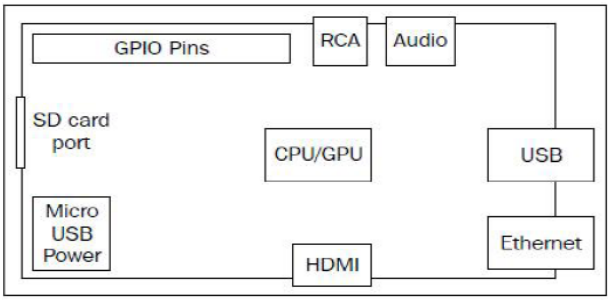

Figure 1: Raspberry Pi Architecture

B. **ZigBee**

ZigBee style networks began to be conceived around 1998, when many installers realized that both Wi-Fi and Bluetooth were going to be unsuitable for many applications. In particular, many engineers saw a need for self-organizing ad-hoc digital radio networks.

The IEEE 802.15.4-2003 standard was completed in May 2003 and has been superseded by the publication of IEEE 802.15.4-2006. In the summer of 2003, Philips Semiconductors, a major mesh network supporter, ceased the investment. Philips Lighting has, however, continued Philips' participation, and Philips remains a promoter member on the ZigBee Alliance Board of Directors.

ZigBee is a low-cost, low-power, wireless mesh networking standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range.

Figure 2: ZigBee module

C. **Master module**

Master module is fully equipped with in built peripherals and there is no need of any bridging devices for communicating with raspberry pi or other platform. Module operates in 5 volt and 500mA of current and also circuit has reverse voltage protection for safe operation. 20 MHz of clock frequency is fed as oscillator input to microcontroller.

1) FT232R is a USB to serial UART interface with optional clock generator which has asynchronous and synchronous bit bang interface modes
2) MAX232 level converter is an IC that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits.
3) 3.3V to 5V voltage level shifter is used to connect with the master with raspberry pi as it can operate with a minimum of 3.3V. The hardware is made by double layer PCB that is fabricated in laboratory by using toner transfer method. The design is done using EDA CAD tool and SMD components are used to reduce the hardware size and power consumption.

D. **Slave Module**

Slave module uses the same microcontroller configuration as that of the master module. The slave address is manually set using the address switch and the address is also known to the master module by its program. The main functionality of the Slave module is temperature measurement, light intensity measurement, water level indicator, voltage measurement, current measurement etc.

III. RESULTS AND DISCUSSION

This system is very useful in all types of industries which acquire large area and having a large production.

The system includes very high degree of automation in it and also it is very cost effective. The system is also useful in green house automation, chemical industries, food industries and many more. 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.

IV. CONCLUSION

An industrial automation system was implemented using Raspberry Pi. The system was able to monitor and control all the parameters use in the industries and giving the accurate result of the system. The system can able to control various parameters of the industries like temperature, light intensity, liquid level of the any fluid etc. The system also provides monitoring of all the various parameters using the Zigbee module that can be act as transceivers and provides the monitoring over the large area of the industries.

V. REFERENCES

[1]. Sarthak Jain, Anant Vaibhav and Lovely Goyal, "Raspberry Pi based Interactive Home Automation System through E-mail", International Conference on Reliability, Optimization and Information Technology-ICROlT 2014, India, Feb6-8 2014.

[2]. G Vijaya Lakshmi, "SMS-Based Tracking, Navigation and Broadcasting System", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 8, August 2014.

[3]. Matt Richardson and Shawn Wallace, “Getting Started with Raspberry Pi.” United States of America: O'Reilly Media, 2013

[4]. Peter Membrey and David Hows, “Learn Raspberry Pi with Linux.” New York City: Apress, 2012, pp. 1-149.

[5]. Python Software FoundationUS], https://pypi.python.org/pypi