Mohammed Anwaruddin* et al.
(IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH
Volume No.5, Issue No.1, December – January 2017, 5483-5486.

A Review On Raspberry Pi Based Industrial Process Monitoring And Control Using Modbus Protocol

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Abstract: **In recent research work the Wireless technologies are being more and more used in automation and also in the field of wireless communications are diverse. The advancement in wireless technology offers a good opportunity in the area of communication in perfect region. When the embedded devices are provided with internet access the demand will rise due to the remote accessing capability of these devices. Users can monitor & control remote systems by using embedded Easy IOT server. Wireless based industrial automation is a prime concern in our day-to-day life. The approach to Wireless Network for Industrial Applications standardized nowadays. Intelligent and low-cost automation of industrial processes are crucial in order to improve process efficiencies, deliver quality products, and ensure timeliness and accuracy of systems .Wireless is predicted to be one of the fastest growing technologies in the area of process automation sector This paper is focused on design & implementing a secured wireless communication system of ARM embedded IOT server based on Raspberry Pi. For effective designing & implementing a system we use wireless technology. This wireless technology along with router makes the system Accessible from anywhere in the world. Various Sensors are interfaced with microcontroller. Parameters like Temperature, gas, motion, distance, humidity are measured & real time sensed data is available on the remote pc as well as on the android Smartphone. Due to the use of wireless technology we can achieve super speed transmission of large amount of data in very less time. As the overall system is based on generating of dynamic IP address every time, we can say that the system is much secured than all the previous systems. Thus Proper use of wireless sensor networks (WSNs) lowers the rate of failures, overall cost of the system, & increases the productivity, efficiency of overall industrial operations.**

Keywords: **Easy IOT Server; Raspberry Pi; Real Time; Arduino Wireless Sensor Networks; Industrial;**

I. INTRODUCTION

In everyday operations or industrial processes, we come across situations where there is a need to control some device or a physical quantity such as time, temperature, sound, light and so on, to get the required result or output. For example, do you think an airplane would be useful to a pilot, if he cannot make it go where he wants it to go? Or would an air conditioner be useful, if the temperature in a room cannot be controlled? In both the examples, there is a need to control a process.

Electrical control can be defined as using electrical signals such as current or voltage to enable or disable or direct a certain process.

A Programmable Logic Controller (or PLC) is a specialized digital controller that can control machines and processes. It monitors inputs, makes decisions and controls outputs in order to automate machines and processes.

In this project we are turning our Raspberry Pi into a PLC Modbus master device for monitoring and controlling the Modbus slave device.

II. LITERATURE SURVEY

RASPBERRY PI BASED GLOBAL INDUSTRIAL PROCESS MONITORING THROUGH WIRELESS COMMUNICATION - Raguvaran. K, MR. J. Thiyagarajan, M.E., (PH.D)

This paper 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.

INDUSTRIAL PROCESS MONITORING AND CONTROL USING RASPBERRY PI.

Now-a-days the accidents in the coal mine industries have increased. Even if any explosion occurs it can't be easily known to the labourers and it may cause accidents. So in order to avoid this, a robot has been designed and this robot is allowed to

monitor the ambient situations inside the coal mine industry. Some of the environmental parameters such as methane leakage, temperature, oxygen are sensed by using the high end sensors and the sensed data are transmitted to the mobile phone through Wi-Fi. A static ip address is configured in the microprocessor for the Wi-Fi. The robot has a camera that transmits live video signal to mobile phone for monitoring the status of the coal mine and to control the robot movement. If the temperature exceeds a threshold, the cooling fan is automatically set to ON and if any gas leakage is detected the workers are given alert through a buzzer. Oxygen is supplied is there is suffocation for the labourers. The robot is designed using a Raspberry Pi 2 board. The Wi-Fi dongle and sensors are attached to the robot and this robot is tethered with the mobile phone and can be controlled from a web browser using navigation buttons. By this the human intervention can be avoided inside the industry and the accidents can be prevented.

III. EXISTING SYSTEM

Automation is the need of today's generation. Controlling the industrial process is very much essential. Control is said to be done manually when a user performs an action for the system to function. For example, the user might flip the switch of a manual starter to start and stop a motor. Control is said to be automatic when the action is performed automatically in response to a set of conditions. Machines can be controlled manually or automatically. Usually, there is a combination of manual and automatic control. For example, a process that is started manually may stop automatically when certain conditions are met. By using the Programmable Logic Controller (or PLC) we can control different set of process but the cost of controlling becomes high. There is a lot of research going on in this area.

IV. PROPOSED SYSTEM

The Raspberry Pi is a small computer about the size of a credit card and costs approximately £25. It was developed in the UK by the Raspberry Pi Foundation with the hope of inspiring a generation of learners. The device uses the ARM processor which does most of the hard work in order to run the Raspberry Pi. ARM processors can be thought of as the brain of the device.

These processors are mainly used in small devices such as mobile phones, hand held mobile gaming devices and other small digital devices. The reason for this is that ARM processors are extremely efficient and fast when used in small devices. This makes the ARM processor the obvious choice for the Raspberry Pi.

In this system we are going to turn our Raspberry Pi into a Programmable Logic Controller using Bermiz or OpenPLC. We can write the code for controlling a process which is conventionally done in a PLC in an editor and dump the code to Raspberry Pi. Now Raspberry Pi acts as a PLC, monitors and controls the industrial processes. We are using a communication protocol called Modbus which is a standard communication protocol through which we can communicate almost all the slaves which implement Modbus slave protocol.

Advantages:

1. This project is useful in monitoring industrial processes by reading the Modbus Memory Map.
2. Remote login through SSH into Raspberry Pi is a very good feature of this project.
3. SSH provides user and host authentication.
4. Cost of the system is reduced.
5. Easy to implement.
6. Control of industrial processes is possible by writing data to Modbus Memory Map.

Disadvantages:

1. It can connected to only one Modbus slave

Applications:

1. Cost effective solution for automation industry.
2. Small industries where one slave is present can use this project

Future Scope:

The present project uses a single serial (RS-232) cable for connecting with single Modbus slave. To further enhance the project we can use a RS-232 to RS-485 converter. Through this converter we can connect upto 247 Modbus slave devices. Each Modbus slave is assigned a slave address through which it is addressed. We can monitor the data through remote login of each and every Modbus slave and also controlling action can be performed.

Raspberry Pi

The Raspberry Pi is a small computer about the size of a credit card and costs approximately £25. It was developed in the UK by the Raspberry Pi Foundation with the hope of inspiring a generation of learners to be creative and to discover how computers are programmed and how they function.

Figure 3.1 Raspberry Pi Board

This small computer features amazing HD (high-definition) quality video playback, sports high quality audio and has the ability to play 3D games. The device uses the ARM processor which does most of the hard work in order to run the Raspberry Pi.

ARM processors can be thought of as the brain of the device.

Figure 3.2 ARM 11

These processors are mainly used in small devices such as mobile phones, hand held mobile gaming devices and other small digital devices. The reason for this is that ARM processors are extremely efficient and fast when used in small devices. This makes the ARM processor the obvious choice for the Raspberry Pi.

Even though the Raspberry Pi is a computer it does not have a hard drive like traditional computers, instead it relies on the SD card for the starting up and storing of information. For the Raspberry Pi the SD card does the same job as a hard drive does in a traditional computer.

Figure 3.3 SD Card

The SD card must contain the operating system, programs and the data needed to run the Raspberry Pi. The operating system tells the Raspberry Pi how to function, how to handle any input from the user and how to manage programs when they are running.

Basics of Raspberry Pi

System on Chip (SoC)

1. What is System on Chip?

– A complex IC that integrates the major functional elements into a single chip or chipset.

• Programmable processor

• On chip memory

• Accelerating function hardware (e.g. GPU)

• Both hardware and software

• Analog components

2. Benefits of SoC

– Reduce overall system cost

– Increase performance

– Lower power consumption

– Reduce size

SoC in Raspberry Pi:

Broadcom BCM2835 SoC

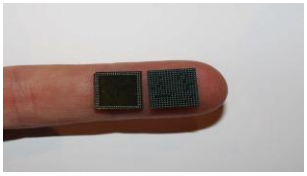

Figure 3.4 BCM2835 SoC (right) and Samsung K4P2G324ED Mobile DRAM (left)

Features of Raspberry Pi 3

Processor	Broadcom BCM2387 chipset.

1.2GHz Quad-Core ARM Cortex-A53 802.11 b/g/n Wireless LAN and Bluetooth 4.1 (Bluetooth Classic and LE) GPU Dual Core Video Core IV® Multimedia Co-Processor. Provides Open GL

ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode.

Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure

Memory	1GB LPDDR2
Operating System	Boots from Micro SD card, running a version of the Linux operating system or Windows 10 IoT
Dimensions	85 x 56 x 17mm
Power	Micro USB socket 5V1, 2.5A

Hardware

Hardware is a physical device that can be touched or held, like a hard drive or a mobile phone. Software can be thought of as a program or a collection of programs that instruct a computer on what to do and how to do it. Below is an image of the Raspberry Pi which describes some of the components that make up the hardware.

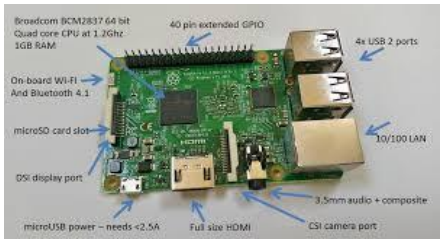

Figure 3.5 Raspberry Pi Labelling

Micro USB power port

The micro USB power port is used to power the Raspberry Pi device.

HDMI port

The HDMI output is used to plug into a modern television or monitor.

Ethernet port

The Ethernet port is used to connect the Raspberry Pi to the internet or a local network.

USB ports

USB 2.0 ports are used to plug in a keyboard, mouse, web cam, external hubs etc.

Audio output

The audio output can be used to plug into an external amplifier or an audio docking station.

GPIO headers

The GPIO headers are used to connect the Raspberry Pi to other hardware devices. For example, they can be used to connect to LEDs, motors and other electronic components.

RCA video output

The video output is used to connect to an older type television.

ARM processor

The ARM processor can be thought of as the brain of the Raspberry Pi.

V. CONCLUSION

The paper "**RASPBERRY PI BASED INDUSTRIAL PROCESS MONITORING AND CONTROL USING MODBUS PROTOCOL**" has been successfully designed and tested. It has been developed by integrating features of all hardware and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working unit. Using an advanced ARM board and implementing industrial standard Modbus protocol, the project is implemented

VI. REFERENCES

[1]. Raspberry PI Based Liquid Flow Monitoring and Control N.Suresh, E.Balaji, K.Jeffry Anto, J.Jenith

[2]. Raspberry PI Based Global Industrial Process Monitoring Through Wireless Communication Raguvaran. K, Mr. J. Thiyagarajan, M.E., (Ph.D)

[3]. Industrial Process Monitoring and Control using RASPBERRY PI

[4]. Darshini B. and E. Esakki Vigneswaran

[5]. A RASPBERRY PI based Global Industrial Process Monitoring through Wireless Communication - Priyanka S Lonare1, Dr. Mahesh Kolte

[6]. An effective Wireless Solution for Industrial Automation by using RASPBERRY PI - Amol A. Dharmapurikar, R.B. Waghmare

[7]. Angry IP – A Product Analysis and User Tutorial page 1 of 32 IDCP Internet Security Class – Marist College William F. Slater, III, PMP, CISSP, SSCP July 16, 2007

[8]. Quickstart Guide ABB PLC and drives integration using Modbus RTU

WEBSITES

https://www.raspberrypi.org/downloads/raspbian/

http://win32-disk-imager.en.uptodown.com/windows

http://www.openplcproject.com/getting-started-modbus-io

http://www.openplcproject.com/getting-started-rpi

http://www.putty.org/

https://www.youtube.com/watch?v=rHDUYWhCiRI

BIOGRAPHY

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