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Monitoring of Industrial Machine Parameters in an Internet of Things Platform

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ABSTRACT

In this paper an advanced low power system for monitoring and controlling various industrial parameters using credit card sized computer called raspberry pi is proposed. The multi parameter monitoring system designed by MAX232, ZigBee and Microcontroller. The system having raspberry pi as a master and a slave with a wireless mode of communication to master. Monitoring and controlling parameters are voltage, humidity, temperature, light and water level. When the threshold level of the sensors are increases in system then certain control actions are performed by the microcontroller. The measured parameters are collected and graphically represented at receiver section. The received values are stored in cloud with log time and can be monitored by web page.

Keywords: raspberry pi, wireless, industrial, internet of things

I. INTRODUCTION

The objective of this method is to decrease the manpower in industry. Presently in industry 24*7 people are working hard to monitorthe machines for their functionalities.So, to cut the manpower we are keeping sensors to check the machines are functioning properly. So for implementing this an experimental project to monitor the sensors in the industry and take control actions for predefined cases.

A design is proposed with the connection of different sensors to microcontroller. The microcontroller will compile and communicate to raspberry pi for sharing the information to cloud. The raspberry pi can perform multiple operations at single time. In this design all the sensors are connected to one slave. The data from the slave transferred to master by using ZigBee communication. Here master board is Raspberry Pi and slave board is designed using AT89S52 Microcontroller.

The ZigBee module present in master and slave boards uses serial communication and as of every computers are having USB so no need of any special hardware only USB to Serial cable is required. The serial communication link to microcontroller will established by MAX232. The baud rate of the both devices will be 9600 for transmission.

[1] Baosheng Yang, Jianxin Li, Qian Zhang described in the paper named Language based designe virtual experimental platform for communication with measurement and control, In order to explore more convenient ways to design the measure and control platform, and enhance the intelligent level of instrumentto realize the kind virtual panel, and put the intelligent part of the equipment to process by computer. The paper designed the virtual test platform for communication with measurement and control.

[2] Arkadiusz Jestratjew and Andrzej Kwiecie described in the paper named Performance of HTTP protocol in the networked control systems, Integration of Networked Control Systems is always an engineering challenge. Heterogeneous hardware and software environments combined with long lifetime

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of control systems makes this job particularly troublesome. Modern concepts of integration of automation systems are related to Service Oriented Architecture (SOA). While its suitability is proven in IT systems.

[3] Md. Nasimuzzaman Chowdhury, Md. Shiblee Nooman, Srijon Sarker described in the paper about the present age of Internet of things has entered a golden era of the rapid growth. The IOT is a concept that aims to extend the benefits of the regular internet constant connectivity, remote control abilityand data sharing.Everyday things are getting connected with the internet. This concept can be used to manage the security concerned issues in a cost effective way. In ths paper work a system is being developed to connect any door with the internet, so that the access control system can be controlled from any where in the world. In a case that one is not at home and a vistor is at his door steps then the authorized person will be notified about the visitor via twitter and the person can see the visitor from the web through the camera from any where and the system will take a picture of the visitor and keep a record by sending an attachment through Email or tweet in twitter. If the authorized person wants to give a message the visitor it can be sent easily through the internet and it will appear in a screen on the front face of the door.

II. DESCRIPTION OF THE MODULE

The entire system design using slave and master with wireless communication. The master raspberry pi will communicate with slave for getting data. The raspberry pi will connect to PC with LAN cable to display the values. The values are uploaded into the cloud.

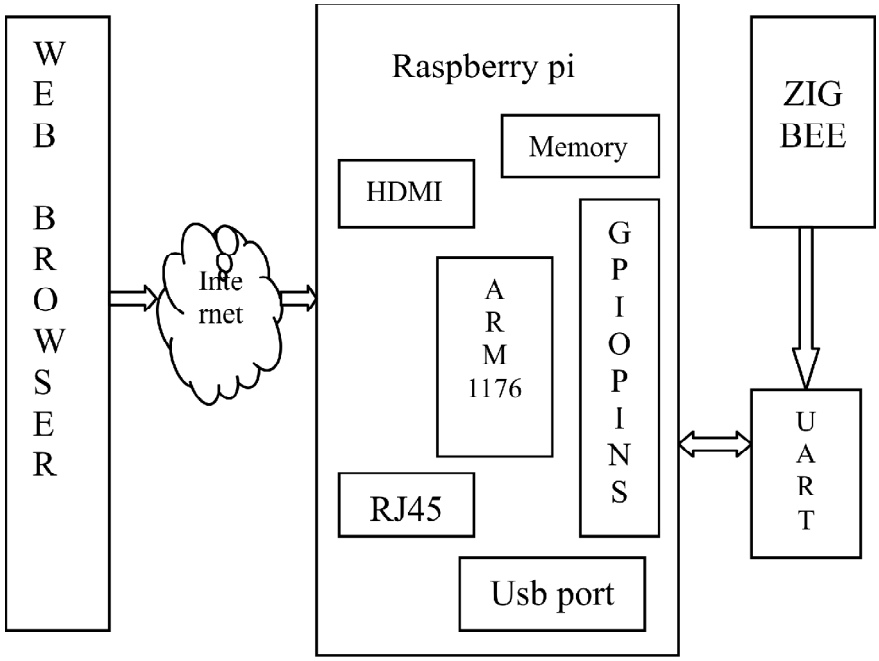


Figure 1: Block diagram of master module

(A) Master module

The figure 1 shows the components of master module, data acquires from the slave is received to the master by ZigBee. From Zigbee to raspberry pi the data is transmitted using serial communication with UART. After data received to raspberry pi the values are displayed in the window with graphical representation.

The rapberry pi is having Tx and Rx pins inbuilt so we connect the ZigBee Tx and Rx pins directly to raspberry pi. Raspberry will operate in 3.3V so we can give voltage supply to ZigBee directly from the power and gnd pins present on the board.

(B) Receiver Module

The figure 2 shows interfacing of the parameters like Water, Voltage, Light intensity, Humidity and Temperature. Data received from each sensor will be sent to the master through ZigBee module. The alarm is also connected to the microcontroller because if any sensor cross the threshold value then the alarm will be on. The microcontroller keep on checking the values of the all the sensors if any sensor value increases then the control actions are to be taken by the microcontroller.

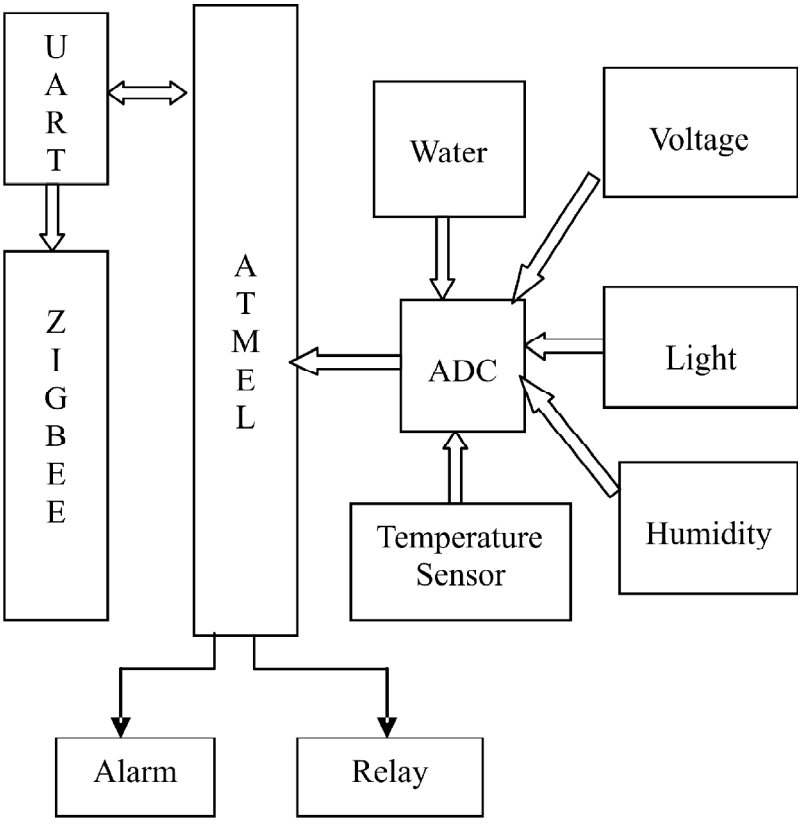


Figure 2: Block diagram of slave module

III. SOFTWARE SPECIFICATION

Keil Uversion 4

The Keil Uversion IDE is used to test, verify and optimize application code. The debugger includes features like simple and complex breakpoint and execution controllers for full visibility to device peripherals. Software application uses pre-build software components and software packages.

RASPBIAN OPERATING SYSTEM

Raspbian is a free operating system based on Debian optimized for Raspberry pi hardware. It comes with over 35000 packages and pre-compiled software bundled for easy installation.[4][5][6]

IV. HARDWARE DESCRIPTION

Master Module

Master module have in built Tx and Rx pins so, ZigBee is connected using these pins. The data received by the ZigBee from slave is transmitted by Tx pin to raspberry pi. Raspberry pi will transmit to computer by

LAN cable. Here we are using visual basic software to create a window for displaying the values and their graphical representation of the values. When the net is connected to the computer then the data is stored in the cloud. We can access this web page based cloud from any place where internet is available.

Slave Module

Slave module is designed by using ATMEL controller. The functionalities of the slave module are

1) Water Level Identifier: Water level is identified by the three wired unit connected to the port pins of the microcontroller. It will shows the low, medium, high levels of the water in the tank. When the water touched the low level the wire which we connected will be shorted and then the motor is turned on to fill the tank. For turning on the motor we are using the relay circuitry.
2) Voltage Measurement: Voltage level should be maintained constantly otherwise machines will be damaged for this reason we are measuring voltage. We will get the voltage output from the H-bridge which is connected to the supply. So voltage is monitored continually if the voltage increases then the alarm will turn on.
3) Light Intensity Measurement: Light Depended Resistor (LDR) is used to measure the light intensity. If the light is low in the place then the other light source is turned on for maintaining the light balance in the place. This is done by using the relay because microcontroller uses less voltage levels with that levels we cannot turn on the light. So, we are using relay to turn on the light.
4) Humidity Measurement: Humidity sensor is used to measure the humidity level of the particular area. The humidity values are displayed in the LCD placed in the slave module. If the humidity is more than the threshold level then buzzer will be turn on.
5) Temperature Measurement: We are using LM35 to measure the temperature output is proportional to the temperature in degrees. When the temperature value increases then the fan is turned on by the micro controller to decrease the temperature level.

III. IMPLEMENTATION

Hardware implementation

The hardware implementation of this prototype consists of the transmitter section and receiver section. In the slave section which does consists of the microcontroller AT89S52. Which is interfaced with different sensors where the sensor values are measured in the real time then the measured values are transmitted to the controller.

This is actually determined and send information to the zigbee which is wireless tranreceiver which transmits the data to master section.

The slave section of the system is interfaced with the ZigBee module which transmit the data to the master device. The received data is displayed as shown window. This data should be sent to the server where this information is stored and can be reviewed when necessary. This is accessible by using the link provided. To send the data from the receiver end to the computer we use RS232 which is USB to serial connection which sends the data from raspberry pi to the computer and then this data is updated into the server with internet connection.

IV. RESULTS AND DISCUSSIONS

Hardware result

The figure 5 and figure 6 shows us the actual hardware results which indicates both the transmitter section and receiver section. Where the transmitter section sends information to the receiver section and this send

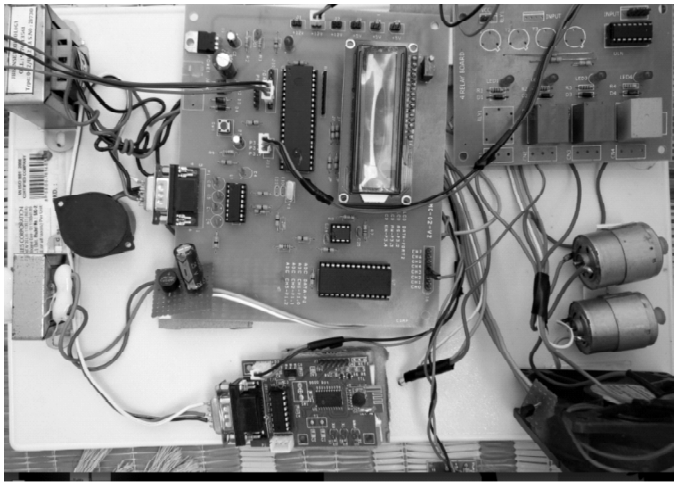


Figure 3: The Slave section

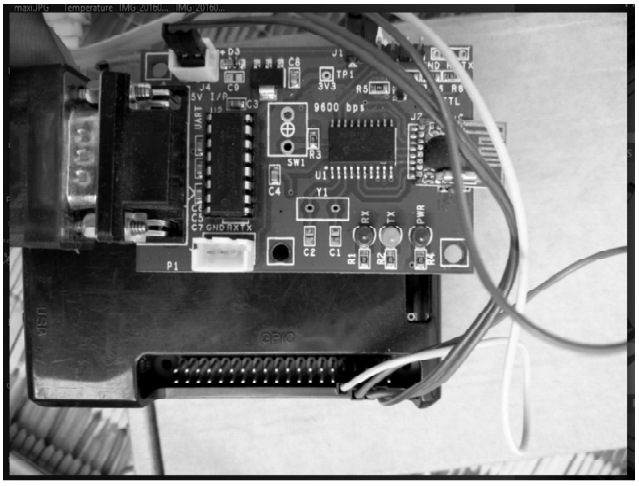
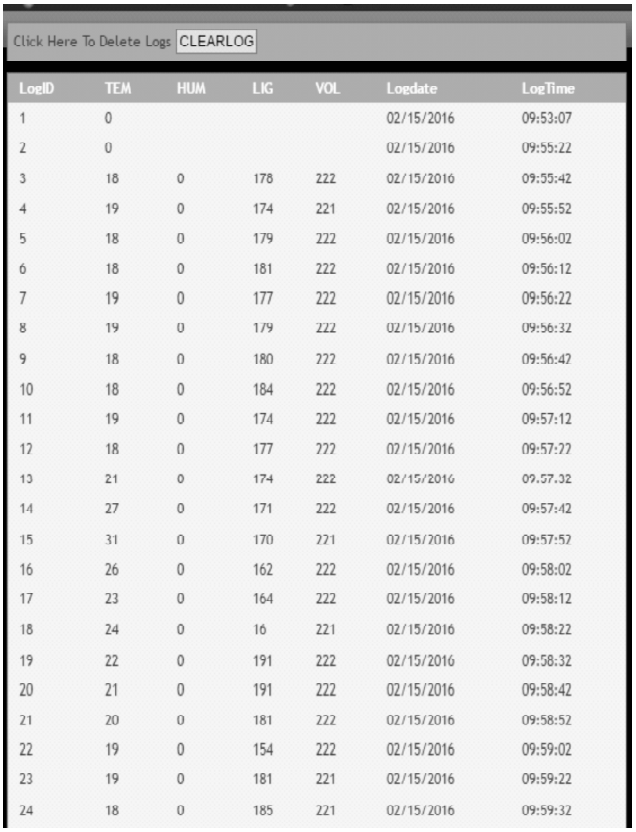


Figure 4: The Maser section

Figure 5: Data received at master section



LogID	TEM	HUM	LIG	VOL	Logdate	LogTime
1	0				02/15/2016	09:53:07
2	0				02/15/2016	09:55:22
3	18	0	178	222	02/15/2016	09:55:42
4	19	0	174	221	02/15/2016	09:55:52
5	18	0	179	222	02/15/2016	09:56:02
6	18	0	181	222	02/15/2016	09:56:12
7	19	0	177	222	02/15/2016	09:56:22
8	19	0	179	222	02/15/2016	09:56:32
9	18	0	180	222	02/15/2016	09:56:42
10	18	0	184	222	02/15/2016	09:56:52
11	19	0	174	222	02/15/2016	09:57:12
12	18	0	177	222	02/15/2016	09:57:27
13	21	0	174	222	02/15/2016	09:57:32
14	27	0	171	222	02/15/2016	09:57:42
15	31	0	170	221	02/15/2016	09:57:52
16	26	0	162	222	02/15/2016	09:58:02
17	23	0	164	222	02/15/2016	09:58:12
18	24	0	16	221	02/15/2016	09:58:22
19	22	0	191	222	02/15/2016	09:58:32
20	21	0	191	222	02/15/2016	09:58:42
21	20	0	181	222	02/15/2016	09:58:52
22	19	0	154	222	02/15/2016	09:59:02
23	19	0	181	221	02/15/2016	09:59:22
24	18	0	185	221	02/15/2016	09:59:32

Figure 6: Uploaded data stored in Cloud server

to the computer and the data is uploaded to the cloud server. The data stored in cloud server is shown in figure 6. In the slave section when the sensors value increases the threshold level then controller will take control actions for predefined cases.

V. CONCLUSION

With the aid of proposed design the various industrial parameters are measured and transmitted in real time. We developed the transmitter section with the sensors attached to the ADC. The microcontroller produces the result in the LCD and passes the message to Zigbee. The receiver section ZigBee will receive

the data and send to Raspberr pi. From the raspberry pi the data is uploaded to the cloud server in real time when the internet connection is established.

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