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Design and Implementation of Industrial Monitoring System through Wireless Sensor Networks

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ABSTRACT:

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 temperature, light intensity and gas sensor. 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.

Keywords:

Raspberry Pi processor, AT89S52 controller, Zigbee module, IR sensor, fire sensor, LDR sensor.

I.INTRODUCTION:

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 [20]. 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 transmission. 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. The RF transceivers present in slave and master boards uses the process of serial communication and as most of the computers have more than one serial port there is no need of any special hardware other than a cable. The effective baud rate is the main advantage of using RS232 and also the transmission is on both directions which mean the inverted logic is also handled with the same. RS232 uses MARK (negative voltage) and SPACE (positive voltage) as two voltage states. So the baud rate is identical to the maximum number of bits transmitted per second including the control bits. The transmission rate of this device is 9600 baud with the duration of start bit and each subsequent bit is about 0.104ms. The complete character frame of 11 bits is transmitted in 1.146ms. MAX 232 IC mounted on the master board converts the 0's and 1's to TTL logic.

II. RELATED WORK:

2.1 TRANSMITTER:

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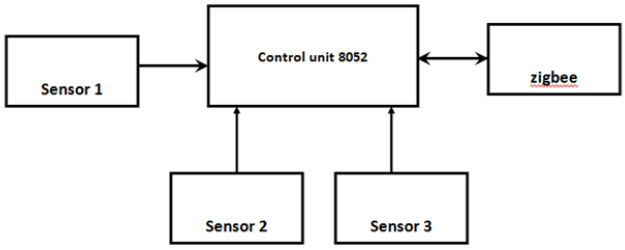

Figure-1: Block diagram of transmitter

2.2 RECIEVER SECTION:

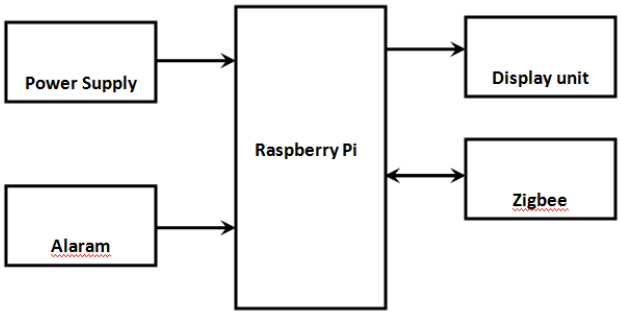

Figure-2: Block Diagram of receiver

2.3 EXISTING METHOD:

THE SMART GRID is an intelligent monitoring system, distribution, and control system. The proposed system is helpful in collection and analysis of real time data. emphasizing the importance of the communication infrastructures required to support data exchange between the various domains which comprises the smart grid. Our proposed scheme is implemented with a ZIGBEE protocol.

2.4 PROPOSED METHOD:

In proposed system we extend our data transmission to ZIGBEE so that the relevant parameters are monitored controlling through ZIGBEE. This is very useful in the case when the user is moving in industrial area. Along with the data monitoring devices is also controlled based on the values.

III. HARDWARE COMPONENTS:

3.1 RASPBERRY PI PROCESSOR:

Figure-3: Raspberry Pi diagram

The Raspberry Pi board involves a processor and snap shots chip, Random Access Memory (RAM) and more than a few interfaces and connectors for external devices. Some of these instruments are main others are optional. It operates in the identical method as a ordinary pc, requiring a keyboard for command entry, a show unit and a vigor give. considering that raspberry Pi board operates like pc it requires 'mass-storage', but a tough disk pressure of the variety observed in a ordinary pc is not relatively in maintaining with the miniature dimension of Raspberry Pi.

3.2 AT89S52 MICROCONTROLLER:

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the indus-try-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory pro-grammer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation

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down to zero frequency and supports two software selectable power saving modes.

3.3. ZIGBEE MODULE:

ZigBee is a low-cost, low-power, wireless mesh networking proprietary 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. The ZigBee Alliance, the standards body that defines ZigBee, also publishes application profiles that allow multiple OEM vendors to create interoperable products.

3.4 IR COMMUNICATIONS:

IR wireless is the use of wi-fi science in instruments or methods that deliver information via infrared (IR) radiation. Infrared is electromagnetic power at a wavelength or wavelengths quite longer than these of pink gentle. The shortest-wavelength IR borders noticeable crimson in the spectrum. The longest-wavelength IR borders radio waves. The name means below red, the Latin *infra* meaning "below". Red is the color of the greatest wavelengths of noticeable light. Infrared light has a longer wavelength than that of red light visible to humans, hence the literal meaning of below red.

WHAT IS INFRARED: Infrared energy is light that we cannot see, but our bodies can detect as heat. It is part of the electromagnetic spectrum that includes radio waves, X-rays and visible light. All of these forms of energy have a specific frequency, as represented in the chart below.

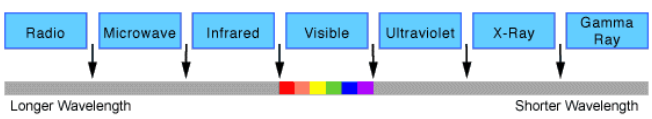

Figure-4: IR sensor Rays

Infrared vigor is made out of those frequencies that exist just below the purple end of the visible spectrum, and for cooking homes they've an awfully specified improvement - once they strike healthy molecules (reminiscent of any variety of food), they cause the molecules to vibrate, thereby growing warmness. Even though practically any kind of electromagnetic vigor can cause heating, for the motive of cooking, infrared vigor is the excellent choice.

3.5 FIRE SENSOR:

This fire sensor circuit exploits the hearth sensing property of an usual signal diode IN 34 to realize warmness from fire. On the moment it senses warmth, a loud alarm simulating that of fireside brigade will probably be produced. The circuit is too touchy and can detect a rise in hearth of 10 measures or extra in its vicinity. Usual sign diodes like IN 34 exhibits this property and the inner resistance of those instruments will cut down when fireplace rises.

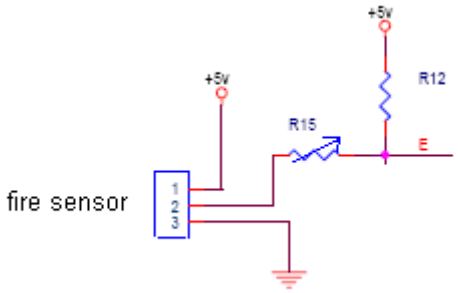

Figure-5: Fire Sensor

3.6 LIGHT DEPENDENT RESISTOR:

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1,000,000 ohms, but when they are illuminated with light, the resistance drops dramatically. Thus in this project, LDR plays an important role in controlling the electrical appliances based on the intensity of light i.e., if the intensity of light is more (during daytime) the loads will be in off condition.

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And if the intensity of light is less (during nights), the loads will be switch. LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically.

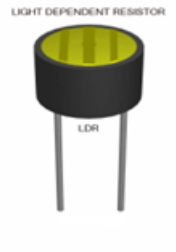

Figure-6: LDR sensor

IV. RESULTS:

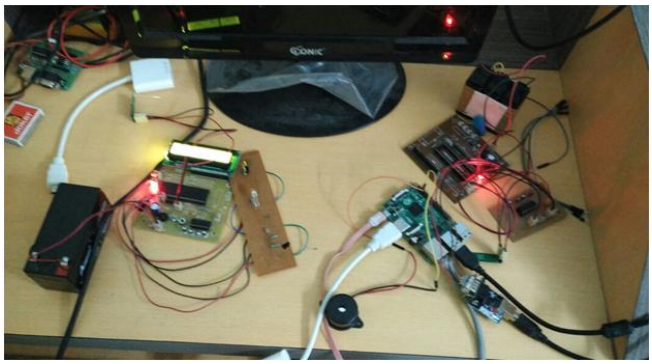

Figure-7: Hardware of the project

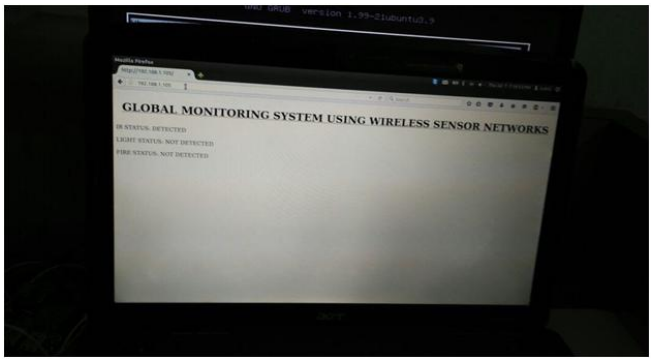

Figure-6: Output on web server

V. CONCLUSION:

The project **"DESIGN AND IMPLEMENTATION OF INDUSTRIAL MONITORING SYSTEM THROUGH WIRELESS SENSOR NETWORKS"** has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM11 board and with the help of growing technology the project has been successfully implemented.

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