Global Industrial Process Monitoring Using Raspberry PI through WC

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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 predicated multi parameter monitoring hardware system designed utilizing RS232 and microcontroller that measures and controls sundry ecumenical 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 dehydrogenate monoxide level. The hardware design is done with the surface mount contrivances (SMD) on a double layer printed circuit board (PCB) to reduced the size and amend the potency efficiency. The sundry intriguing features are field contrivance communication via USB-OTG enabled Android contrivances, on field firm ware update without any categorical Hardware and remote monitoring and control.

Keywords: - raspberry pi 2, tethering, high end sensors, robots, static ip.

1. INTRODUCTION

In the hazardous working environment, humansafety is an important concern. Coal mines is a place inwhich human lives are more dangerous and many workersare injured due to explosions and leakage of toxic gases.Fire accidents can also happen. At the same time if anyperson is absent in an important place for monitoring, itmay also cause serious hazards. At present many systemsare implemented in industrial areas but still thoseaccidents are occurring.The new method is to design a robot and thatrobot is allowed to enter into the coal mine area. The robotwill be equipped with some sensors like temperature andgas for detecting the toxic gases and the ambienttemperature. The robot used must be a flame-proof so thateven if any disaster occurs it will transmit the informationto the receiver without fail. Also, it must be designed towork in the high temperature situations. A camera is alsointerfaced with the robot which will give a live video ofthe environment and this video is transmitted to the mobilephone to the user who is controlling the robot by means ofWi-Fi technology. If any serious situation occurs means analert given to the nearby workers.Wireless communication is also an importantissue inside the industry. Usage of wired technologies arenot worthy as the cables will get damaged after a certainperiod of time or due to some environmental factors. Sothe wireless transmission technology is preferred. Theindustrial monitoring protocol should be designed suchthat the system must have a reliable end to end datadelivery. The data which is collected from the robotshould be transmitted without any delay and loss of data.Some of the techniques like zigbee, Bluetooth have a smallrange and the data rate is minimum when compared to WiFi.So using Wi-Fi the data can be transmitted to a widerange with a high data rate of 54Mbps.

2. IMPLEMENTATION

Software

The raspbianos is used in the raspberry pi board. It is a free operating system that is based on Debian which is particularly optimized for the Raspberry Pi hardware. It comes with over 35,000 packages and pre-compiled software bundled in a simple format for easy installation in the Raspberry Pi. The coding for all the sensors and the robot movement are done using the python coding. Python is preferred since it is a simple and a minimalistic language. It is also free and open source software. This can be used in many platforms such as Linux, VxWorks, and PocketPC etc. Also, it supports procedure-oriented programming as well as OOPS. The web browser is created by using HTML. The static IP address should be configured in the raspberry pi for the Wi-Fi dongle. This assigned static ip address is for connecting with the Wi-Fi of the mobile phone for the live video transmission. Since a normal usb camera is used it must be initially installed in the raspberry pi 2 board using the linux commands.

Raspberry pi

The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.Raspberrypi block function v01.svgThis block diagram depicts Models A, B, A+, and B+. Model A, A+ and the Pi Zero lack the Ethernet and USB hub components. The Ethernet adapter is internally connected to an additional USB port. In Model A, A+, and the PI Zero, the USB port is connected directly to the system on a chip (SoC). On the Pi 1 Model B+ and later models the USB/Ethernet chip contains a five-point USB hub, of which four ports are available, while the Pi 1 Model B only provides two. On the Pi Zero, the USB port is also connected directly to the SoC, but it uses a micro USB (OTG) port.The Broadcom BCM2835 SoC used in the first generation Raspberry Pi is somewhat equivalent to the chip used in first generation smartphones (its CPU is an older ARMv6 architecture),which includes a 700 MHz ARM1176JZF-S processor, VideoCore IV graphics processing unit (GPU),and RAM. It has a level 1 (L1) cache of 16 KB and a level 2 (L2) caches of 128 KB. The level 2 cache is used primarily by the GPU. The SoC is stacked underneath the glued to RAM chip, so only its edge is visible.The Raspberry Pi 2 uses a Broadcom BCM2836 SoC with a 900 MHz 32-bit quad-core ARM Cortex-A7 processor (as do many current smartphones), with 256 KB shared L2 cache. The Raspberry Pi 3 uses a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache.

3. PROPOSED WORK

A robot is designed using the raspberry pi board. The raspberry pi board is given a power supply of about 5V. The sensors which are connected are given power through the GPIO pins. An usb camera is fixed in the robot. The camera will capture the industrial environment and it will transmit the live video to the mobile phone and displayed in the created web browser. In the web browser three navigation buttons are formed for the up, left and right movement of the robot. An ALERT button is placed at the centre for giving alert to the workers in case of any emergency. The Wi-Fi dongle in the robot must be tethered with our mobile phone using the username and password. After tethering, a web browser should be opened and the static IP address must be given and the user name and the password of the raspberry pi are typed. After authenticating, the created web browser will be opened automatically and the robot is operated using the navigation buttons in the browser page. The robot wheels are given 12V from a separate rechargeable battery. The movement of the robot depends on the python coding inside the raspbion os. The wheels are connected through a relay. The relay which here used is a 4-channel relay. When the robot is kept stationary, the GPIO pin which is connected to that particular relay is given HIGH. During movement they are set to LOW. When the temperature sensor senses the temperature above 35ºC, the GPIO pin which is connected with the cooling fan through the relay is set to LOW which will operate the cooling fan. Also,

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when any gas is sensed, the GPIO pin of the buzzer is kept LOW and thus the buzzer will be ON. If there is more suffocation inside the mining area, the carbon dioxide emission will be more. When this CO2 is sensed, the oxygen supply cylinder will be opened by setting the GPIO pin of that particular relay to LOW. The robot movement operations are given using the python coding and saved in the SD card in the microprocessor. These movement functions are called from the web browser navigation buttons using webiop macro function. When any navigation button is pressed it will call the particular function from the main program and the particular operation will takes place. For giving alert the audio file is saved inside and if any emergency situation occurs the ALERT button is pressed and thus the sound will be produced. The sensed data will be displayed in the corner of the web browser.

4. EXPERIMENTAL RESULTS

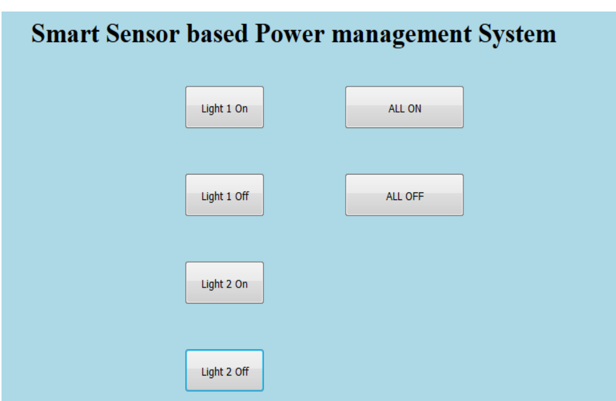

Fig:-1 Smart Sensor

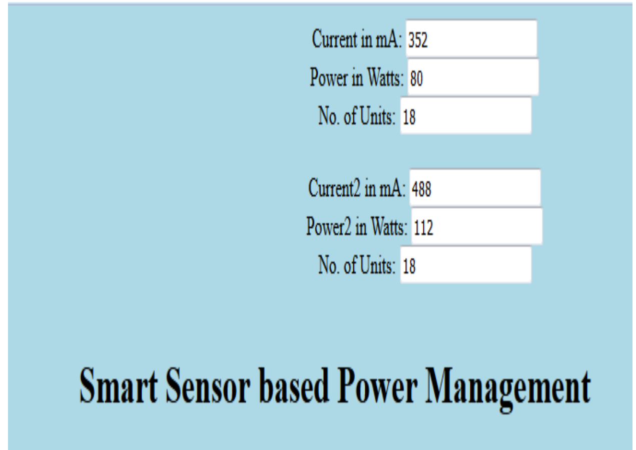

Fig:-2 Power Management

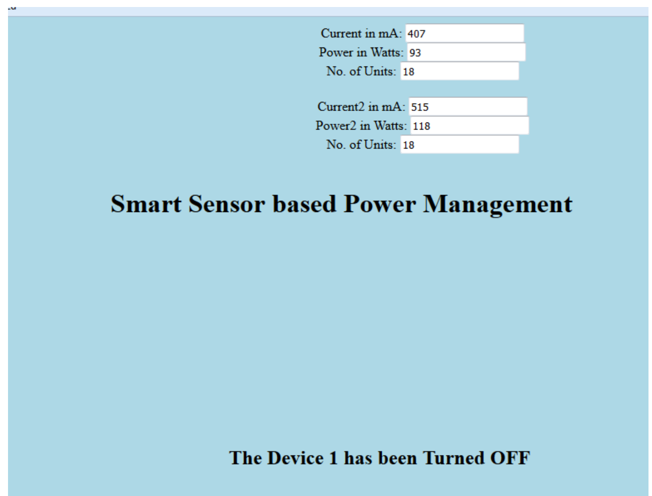

Fig:-3 Running Status

Fig:-4 Result

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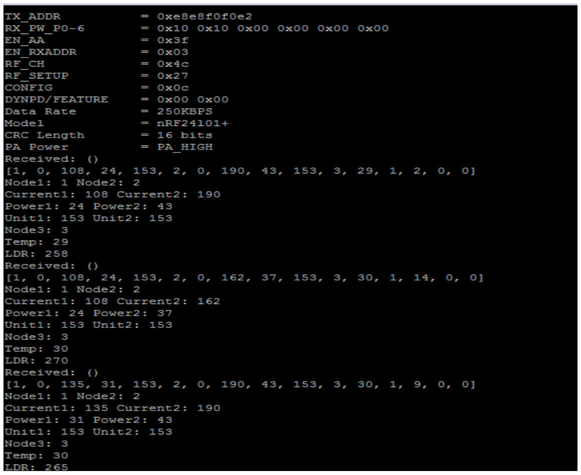

Fig:-5 Result Values

5. CONCLUSION

An automated system is developed to take data from the different sensor nodes. Obtained data can be used to control various actions. A proper database is maintained for data obtained from the sensor nodes. This data can be accessed by any authorized used from any lactation. The obtained data can be stored in various format and can be represented in graphical format to increase the readability of data. In this way we can use automation in home, medical care as well as desired industrial selectors. Future work focuses on implanting this concept in all sectors.

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