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Design of an Environmental Monitoring System with Cloud Connectivity Using Sensors on Linux Platform



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ABSTRACT:

A novel concept of an integrated spectrometric sensor platform is presented in this paper. The design and functioning of the proposed hardware and software for this instrument are discussed and its application prospects are investigated. It is designed to be a compact, portable and remotely operable sensing system, comprising of high resolution spectral and environmental sensors. In addition, it has the possibilities of internet connectivity and cloud based data access to users from far away operation sites. Thereby it is possible to perform measurements of environmental variables, real time online data visualization and storage of collected data with this system, which is a most unique feature of any such cloud based environmental sensing system developed until this time. With the open source and powerful data and spectrum analyzing software, this system is envisioned to be a highly potential and effective tool for monitoring of the environment- such as air quality, water pollutants, oil spills and many interdisciplinary fields.

Keywords:

Raspberry Pi processor, USB camera, temperature sensor, fire sensor, light sensor, AT89S52 controller.

I.INTRODUCTION:

The global environment is deteriorating day by day owing to contamination of the air, water and the soil of the earth.

The air we breathe, the water we drink and the food we eat are now so polluted that millions of people, wildlife and the entire ecosystem are subjected to rapidly degrading health and living conditions [2]. Scientists and technologists are therefore deeply involved with the design of environmental monitoring systems to understand the pollution agents and processes and numerous instrumental methods for laboratory analysis and theoretical interpretation have been developed [4]. However, managing the pollution scenario in real world is far more difficult because of the lack in resources for continuous, real time monitoring of environmental parameters and collecting the data with sufficient spatiotemporal coverage. To effectively address this situation, we need to design and construct smart sensing systems for pollution observations and also integrate them into networks to acquire sufficient amount of high resolution data on multiple environmental variables [1]. With the availability of varieties of modern, low cost and high performance environmental sensors and powerful computational facilities, we can conveniently design and deploy multiple such portable measurement units for environmental observations [3]. Further, by utilizing the capabilities of remote wireless access and the cloud computing concept, we will be able to make direct in situ studies on multiple environmental parameters, covering large areas and simultaneously make all the information available to a global research and user community through internet.

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II. RELATED WORK:

2.1 BLOCK DIAGRAM:

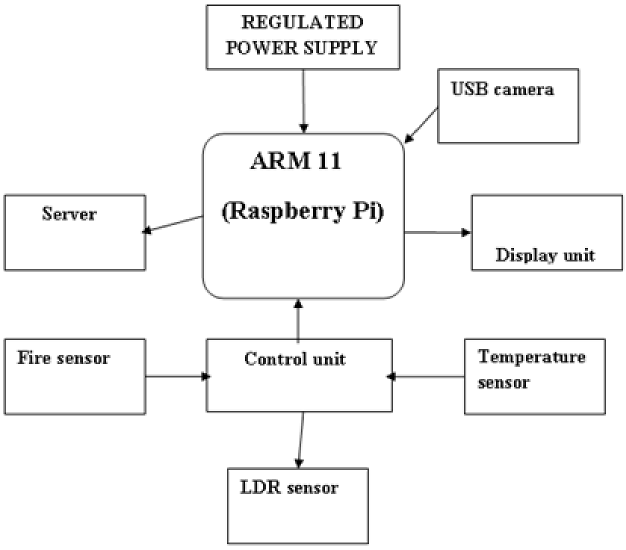

Figure-1: Block Diagram of project

2.2 EXISTING METHOD:

Many systems have already been developed based on the topics of remote monitoring and security either separately or jointly. But most of them lack implementation. Some lack low level implementation details. In some of them, implementations are done on workstation like embedded server with huge database backup.

2.3 PROPOSED METHOD:

But in proposed system we focus on a system which is open source hardware having small size with implementation details. The proposed method is used to overcome the drawbacks present in existing method. Here we are using 32-bit ARM Intelligent Monitoring Center which uses Samsung's processor as its main controller, the performance and frequency of which are suitable for real-time video image capture and processing applications. Embedded Linux operating system and embedded web server run on the main controller to manage various types of equipments including sensor networks, USB cameras and so on. We are connecting different sensors to monitor the conditions inside the area and we can control the devices present at different locations by using web technology. Generally monitoring conditions from web page with specific URL can be easily monitored by anybody if they know URL to overcome this disadvantage login credentials should be provided to access these web page. The block diagram of Proposed Method is shown below. This system makes use of ARM architecture, Webcam, Ethernet, PC, temperature sensor, fire sensor and LDR.

III. HARDWARE COMPONENTS:

3.1 RASPBERRY PI PROCESSOR:

Figure-2: 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 industry-standard 80C51 instruction set and pinout. 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

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

3.3. TEMPERATURE SENSOR:

In this project, in order to monitor the temperature continuously and compare this with the set temperature preprogrammed in the microcontroller, initially this temperature value has to be read and fed to the microcontroller. This temperature value has to be sensed. Thus a sensor has to be used and the sensor used in this project is LM35. It converts temperature value into electrical signals. LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. . The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

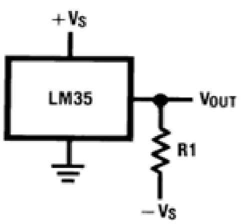

Figure-3: LM35 sensor

3.4 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.

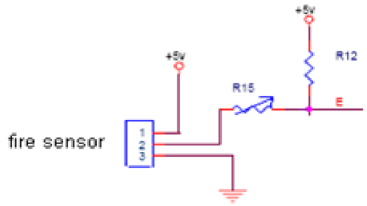

Figure-4: Fire Sensor

3.5 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. 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-5: LDR sensor

3.6. CAMERA MODULE:

A UVC (or Universal Video Class) driver is a USB-category driver. A driver enables a device, such as your webcam, to communicate with your computer's operating system. And USB (or Universal Serial Bus) is a common type of connection that allows for high-speed data transfer. Devices that are equipped with a UVC driver, such as the Logitech Quick Cam Pro 9000 for Business, are capable of streaming video. In other words, with a UVC driver, you can simply plug your webcam into your computer and it'll be ready to use. It is the UVC driver that enables the webcam to be plug and play. A webcam with a UVC driver does not need any additional software to work.

IV. RESULTS:

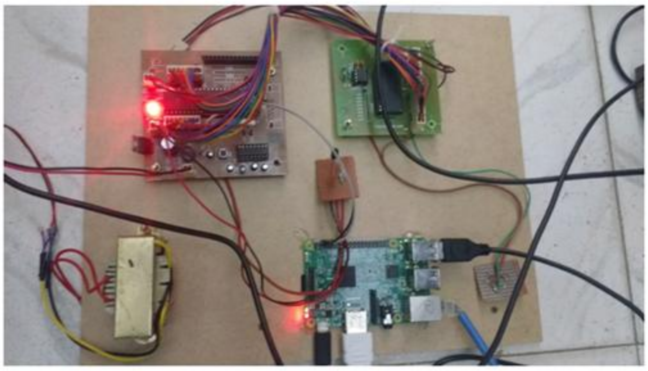

Figure-6: Hardware of the project

Figure-7: Output on monitor

V. CONCLUSION:

The project "Design of environmental monitoring system with cloud connectivity using sensors on linux platform" 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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