ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

IOT-Based Smart Buildings Monitoring Techniques for Energy-Efficient Using Raspberry Pi

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ABSTRACT:
With the proliferation of Internet of Things (IoT) devices such as smart phones, sensors, cameras, and RFIDs, it is possible to collect massive amount of data for localization and tracking of people within commercial buildings. Enabled by such occupancy monitoring capabilities, there are extensive opportunities for improving the energy consumption of buildings via smart HVAC control. In this respect, the major challenges we envision are 1) to achieve occupancy monitoring in a minimally intrusive way, e.g., using the existing infrastructure in the buildings and not requiring installation of any apps in the users' smart devices, and 2) to develop effective data fusion techniques for improving occupancy monitoring accuracy using a multitude of sources. This paper surveys the existing works on occupancy monitoring and multi-modal data fusion techniques for smart commercial buildings. The goal is to lay down a framework for future research to exploit the spatio-temporal data obtained from one or more of various IoT devices such as temperature sensors, surveillance cameras, and RFID tags that may be already in use in the buildings. A comparative analysis of existing approaches and future predictions for research challenges are also provided.

Keywords:
Raspberry Pi processor, RFID module, fire sensor, Temperature sensor, alarm, IOT.

I.INTRODUCTION:
Smart buildings are becoming a reality with the integration of Building Management Systems (BMS) [1] with an underlying monitoring and communication infrastructure that consists of smart devices such as sensors, cameras, RFIDs, meters, and actuators. These smart devices, along with the communication infrastructure, are referred to as Internet of Things (IoT). The BMS manage various crucial components of the buildings such as heating, ventilating, and air conditioning (HVAC), gas, lighting, security system, and fire system, and it can communicate with the IoT devices. With the availability of IoTs in commercial buildings, building occupants and environment can be monitored in real time. In this way, we can have real-time access to occupancy counts in different zones of the building and even locate most of the users carrying a wireless device.This real-time occupancy status information can be used in a variety of applications controlled by the BMS.

For example, the smart building systems of the future can adjust their energy consumption by intelligently controlling the HVAC, and respond promptly to any potential issues that can put the building off its track to carbon neutrality [2], [3]. In addition to energy issues, real time occupancy tracking may also help rescuing survivors in case of emergency response applications [4]. The security or fire system can benefit from this information through the BMS. Finally, this information may also be used to improve building surveillance and security, and help in better deploying the wireless communication infrastructure for fulfilling ubiquitous throughput guarantees throughout the buildings.

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II. RELATED WORK:

2.1 BLOCK DIAGRAM:

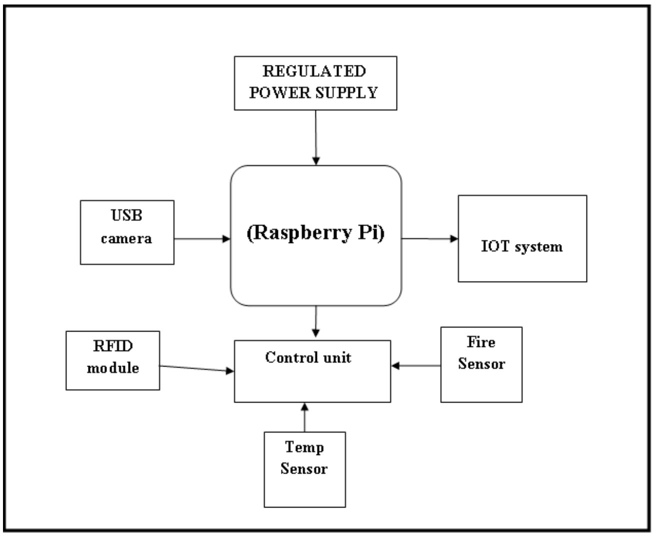

Figure-1: Block Diagram of project

2.2 EXISTING METHOD:

Presently, the home security system is major defect in our country. In homes or any industry security system is not available not only that security any other conditions like fire accidents or theft alert. To overcome the security problem our project is implemented with advanced technology.

2.3 PROPOSED METHOD:

This Paper deals with the design and implementation of building monitoring system using Raspberry pi, RFID technology, temperature sensor and video monitoring. It increases the usage RFID technology to provide essential security to our homes and for other control applications. Capable of motion & disturbance detection at entry points along with security alarm system having alerts containing picture, was implemented to allow real time monitoring of the building anywhere and anytime.

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. 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.

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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.

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.

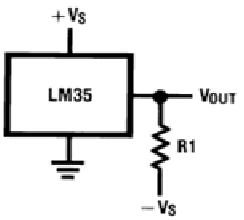

Figure-3: LM35 sensor

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.

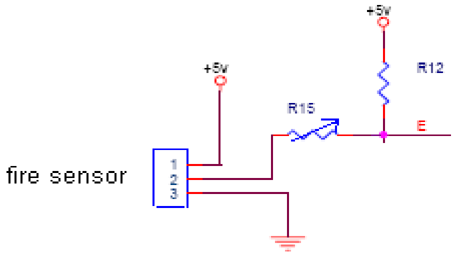

Figure-4: Fire Sensor

3.5. HTTP (HYPER TEXT TRANSFER PROTOCOL):

The WEB Internet (or The Web) is a massive distributed client/server information system as depicted in the following diagram.

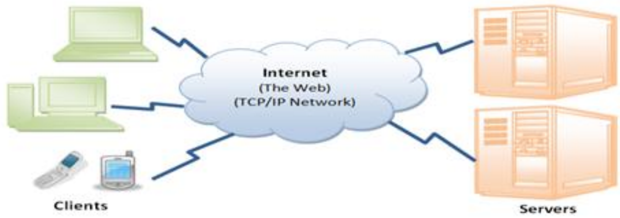

Figure-5: HTTP protocol

Many applications are running concurrently over the Web, such as web browsing/surfing, e-mail, file transfer, audio & video streaming, and so on. In order for proper communication to take place between the client and the server, these applications must agree on a specific application-level protocol such as HTTP, FTP, SMTP, POP, and etc.

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IV. RESULTS:

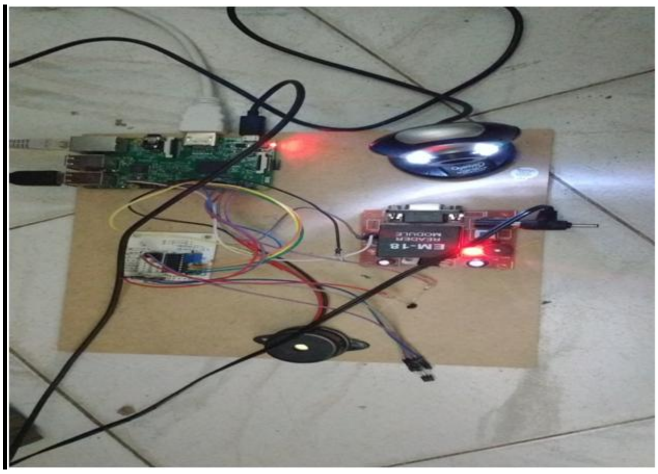

Figure-6: Hardware of the project

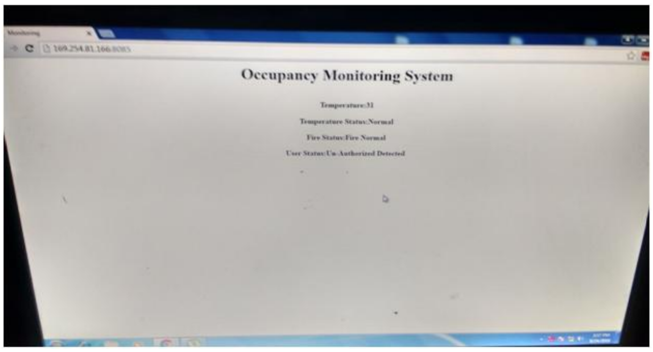

Figure-7: Output on web server

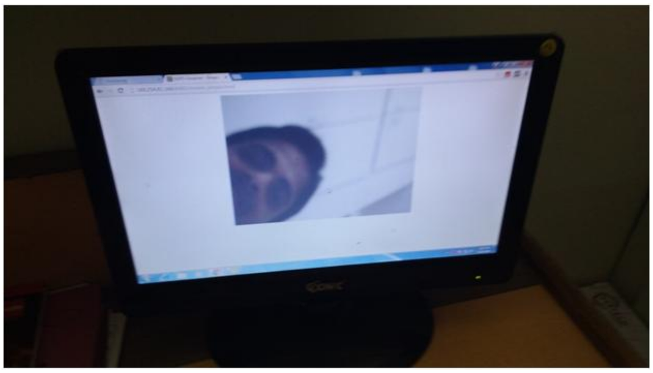

Figure-8: Video Monitoring system

V. CONCLUSION:

The project "IoT-based Smart Buildings Monitoring Techniques for Energy-Efficient using Raspberry Pi" 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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