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Analysis of IoT based Occupancy Monitoring Technique for Energy Efficient Smart Buildings

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ABSTRACT: Internet of things (IOT) is a vision towards Future internet the place "matters" are offered with sufficient intelligence to communicate with each other without the human intervention. With the proliferation of internet of things (IOT) devices such as smart phones, sensors, cameras, and RFID etc. In this admire, the main challenges we envision are 1) to acquire occupancy monitoring in a minimally intrusive means, e.g., utilising the present infrastructure within the buildings and not requiring set up of any apps in the users"smart instruments, and a couple of) to increase potent data fusion techniques for making improvements to occupancy monitoring accuracy using a mess of sources. This paper surveys the existing works on occupancy monitoring and multi-modal knowledge fusion tactics for clever industrial constructions. The purpose is to put down a frame work for future study to take advantage of the spatiotemporal data got from one or more of quite a lot of IoT devices equivalent to temperature sensors, surveillance cameras, and RFID tags that may be already in use in the buildings.

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

I. INTRODUCTION

Buildings are identified to be one of the biggest customers of electrical power; the United States division of power estimates that constructions consume 70% of the electricity in the US. Contemporary efforts have concerned with making structures more energy effective, together with research that target specified areas comparable to lights and managing IT power consumption within structures. Smart structures are fitting a fact with the integration of building management techniques (BMS) [1] with an underlying monitoring and communication infrastructure that contains smart instruments comparable to sensors, cameras, RFIDs, meters, and actuators. These smart contraptions, along with the communication infrastructure, are referred to as internet of things (IOT). These approaches have exact drawbacks with appreciate to accuracy, fee, intrusiveness, and privateness. Accuracy, price and intrusiveness are inter-related in the feel that with the multiplied pay, we could deploy extra contraptions (reminiscent of more than a few sensors, RFIDS, cameras) and expand the accuracy of the procedure at the same time at the equal time broaden the intrusiveness. As a consequence, anintelligent system to cut back cost is to rely on the existing infrastructure as so much as viable. This routinely addresses the intrusiveness dilemma due to the fact that there shall be no need to installation further contraptions inside the rooms, and additional functions on the users' devices. None the much less, this raises the query of accuracy which could also be severely affected. This paper provides an analysis of the present strategies and support handle as a result recounted issue through selling the use of multi-modal data fusion in order to be gathered from the prevailing IOT network. A data fusion approach might strengthen the accuracy of occupancy detection at the same time retaining a low intrusiveness. With the aid of exploiting the approach power among the to be had information, data fusion procedures can filter noisy measurements coming from IOT contraptions, and make predictions and inferences about occupancy status. Mainly, we first analyse the versions of the difficulty and the on hand IOT instruments after which survey the existing works with recognize to those assumptions. There are a number of variants once we check with Occupancy Monitoring difficulty. These are interrelated but relying on the purpose of the application, previously, quite a lot of forms of the concern are studied.

Occupancy Detection: This concern experiences whether or not an area is occupied or no longer at a given time. That is regularly within the type of binary solutions which does no longer tell what number of individuals exist if the

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distance is occupied. The areas viewed right here are usually workplaces or private spaces. Occupancy detection of the general public spaces (e.g., assembly rooms, passages, restaurants), on the other hand, is tougher. Normally, these public areas can either be monitored via different method (e.g., cameras) or through default regarded occupied for HVAC applications. -II.

Occupancy Counting: The goal of this problem is to determine the total number of people in a building at a given time. There are two versions of this problem: First, counting all the people in the whole building. Second, counting people based on some predefined zones.[2] [3] The zones can be defined, for example, using HVAC zones, offices, or Wi-Fi access point (AP) coverage areas. The granularity of the zones differs in most of the studies.

Occupancy Tracking: This problem can be considered as the superset of the all of the above problems. It not only detects people, but also counts, locates, and tracks them. The solutions to this problem can utilize the well-known user localization algorithms that run on the network side rather than the user devices.

Occupancy Event/Behaviour Recognition: This problem is mostly related with the activities of the users once they are detected at certain locations. The activities can be individual or collective. Through occupancy event/behaviour recognition, the behaviour analysis of the individuals can be done and used for intelligent HVAC control. When investigating these problems, researchers relied on several network and IOT devices. These can also be classified into the following categories in order to assess the cost and intrusiveness of the approaches [4].

II. RELATED WORK

Despite the fact that so much interest has been put into intelligent constructing applied sciences, the research area of utilising real-time understanding has not been totally exploited yet. With the intention to receive a correct simulation model, a unique illustration of the building constitution and the subsystems is required, despite the fact that it is the integration of all techniques that requires essentially the biggest effort. Initial solutions to energy efficiency in constructions have been in general considering non-deterministic units based on simulations. A number of simulation instruments are on hand with various capabilities. With the incessant growth of ICT and sensor networks, new purposes to bettering energy efficiency are continuously rising. For example, in workplace spaces, timers and movement sensors furnish priceless software to discover and reply to occupants at the same time providing them with suggestions information to encourage behavioural alterations. The options based on these approaches are aimed at supplying units founded on actual data sensor and contextual understanding. Smart monitoring programs, comparable to automated lighting fixtures systems, have limitations comparable to, wherein the time extend between the response of these automatic programs and the actions carried out can reduceenergy financial savings, even as an very quick response would produce inefficient changes. These monitoring programs, even as contributing toward energy effectively, require significant investment in intelligent infrastructure that mixes sensors and actuators to control and adjust the overall energyconsumption.

The cost and difficultyconcerned in deploying such networks mainly constrain their viability. Obviously, aninfrastructure-less method that uses present technological data would furnish a more cost effective substitute to constructing energymanagement. Then again, constructing energy administration need to face up the inaccuracy of sensors, the lack ofsufficient units for many approaches and the non-deterministic sides of human conduct. In this sense, there's a main study area that proposes to implement synthetic intelligence strategies to process all data associated with theconcern, and as a method of delivering wise building administration techniques fixing the above drawbacks. Thisprocess entails models centred on a combo of actual data and predictive patterns that represent the evolution of theparameters affecting the energy consumption of constructions.

An instance of such a procedure is somewhere the authorssuggest a clever system capable to manage the foremost improvementcontributions offered within the context of an intelligent building, i.e.,HVAC and lighting fixtures, while consumer preferences concerning alleviation stipulations are situated consistent with the occupants'locations. Nevertheless, the authors handiest authorize the inputs of temperature and lights with a purpose to

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make choices,whereas many more factors are really involved in energy consumption and must be incorporated to provide an most useful andextra entire technique to the situation of power efficiency in constructions. In addition, no automation platform isproposed as a part of the answer. Now intelligent power in buildings is a predominant research discipline of internet of things(IOT). Buildings as main components of the smart grids, their power effectively is significant for the atmosphere and internationalsustainability. Furthermore to hardware price, the inconvenience of deployment and the renovation issues make itunattractive for industrial constructing house owners to take a position on the deployment of sensible technologies for power-effectively purposes. Thus, there is a research trend recently toward the usage of present communication infrastructure, suchas the generally to be had Wi-Fi AP infrastructure in buildings. Using occupancy as a driver for smart manipulate ofHVAC and lights techniques has been explored previously. Prior study in HVAC manage techniques suggests that occupancy data can be utilized to drive an extra optimized HVAC [7] schedule. Nonetheless, due to the crisis inobtaining actual time correct occupancy data, many of those systems centre of attention on utilizing pre-decided schedules. Manytrendy constructions use passive infrared sensors (PIR) to force lighting; the PIR sensors are linked immediately to nearbylights and are hardly ever used for intelligent HVAC administration [8].

These PIR sensors are also simpleaction sensors and most commonly are not able to certainly verify if the room is occupied or not. Thus most use a timeout forshutting off the lights (half-hour is long-established) which can be sub-ultimate. Different ways for detecting occupancycomprise making use of sonar founded approaches or digital established techniques that carry up issues relating to price, deployment andprivacy issues. CO2-established occupancy detection has also been examined - the principal limitation of these systems is thatthey're very sluggish to detect activities similar to incoming persons. Many modern constructions already contain a confined quantityof wired sensors. An important barrier to more trendy deployment of sensors, nevertheless, is installation costs due to theneed for extra wiring for each and every sensor. The arrival of cheap wireless sensor networks has enabled widerdeployment possibilities of a huge quantity of connected sensors.

The time period “internet of things” (IOT) was first usedin1999 with the aid of British science pioneer Kevin Ashton to describe a system where objects in the physical world could beconnected to the internet via sensors. Ashton coined the term to illustrate the power of connecting Radio-FrequencyIdentification (RFID) tags [9] utilized in corporate deliver chains to the internet with the intention to rely and monitor goods without the necessity for human intervention. Today, the internet of things has turn out to be a general time period for describing eventualities inwhich internet connectivity and computing capability extend to a kind of objects, instruments, sensors, and day-to-daygadgets. While the time period “internet of things” is somewhat new [10][11]. The thought of mixing desktops andnetworks to watch and control gadgets has been around for many years.

III. PROPOSED SYSTEM

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.

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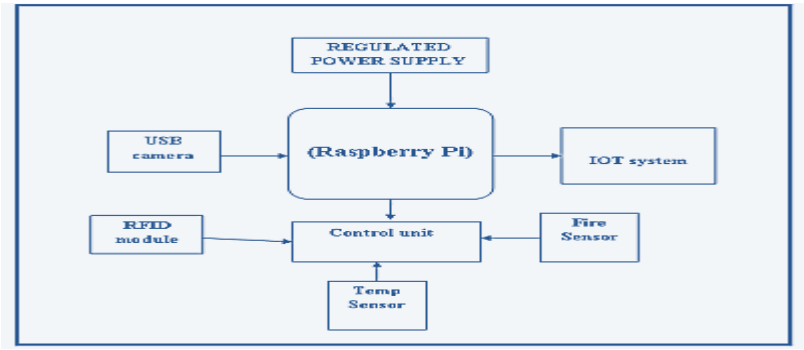

Figure-1: Block Diagram of project

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 an ordinary pc, requiring a keyboard for command entry, a show unit and a power give. considering that raspberry Pi board operates like pc it requires "mass storage", but a tough disk pressure of the varietyobserved in an ordinary pc is not relatively in maintaining with the miniature dimension of Raspberry Pi.

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 our 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.

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 low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with

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single power supplies, or with plus and minus supplies. As it draws only 60µA from its supply, it has very low selfheating, less than 0.1°C in still air.

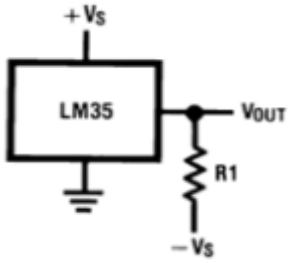

Figure-3: LM35 sensor

Fire sensor:

This fire sensor circuit exploits the hearth sensing property of a 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.

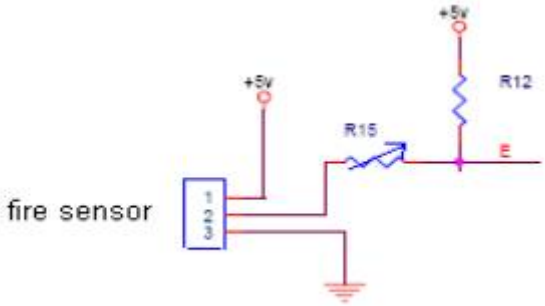

Figure-4: Fire Sensor

HTTP (hypertext transfer protocol)

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

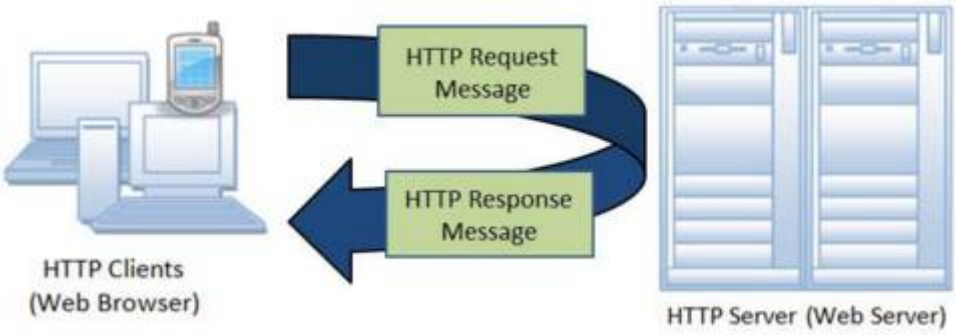

Figure-5: HTTP protocol

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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.

IV. CONCLUSION

The project "IoT-established shrewd structures Monitoring methods for power-efficient utilizing Raspberry Pi" has been effectively designed and demonstrated. It has been developed by means of integrating features of the entire hardware accessories and application used. Presence of every module has been reasoned out and positioned carefully for that reason contributing to the great working of the unit. Secondly, making use of totally developed ARM11 board and with the help of developing technology the challenge has been efficiently implemented.

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