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AN IOT BASED SMART-HOME AUTOMATION WITH MISSING DATA MONITORING THROUGH COMPUTER VISION

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ABSTRACT

Home monitoring and automation are employed for the purpose to assist in the maintenance of comfortable living conditions within a residence. Comfort levels for humans in their houses can be classified into numerous categories. The visual comfort category, which is related to colours and light, and the hygienic comfort category, which is tied to air quality. A system can be configured to monitor these parameters for the purpose to assist in keeping them within acceptable limits. A further benefit of making the house smart is that it will enable for the intelligent automatic execution of many commands after analysing the data that has been collected. Automating processes can be performed through the usage of Internet of Things . In this way, the inhabitant gains access to some data stored in the house, also the capacity to change specific parameters from a distance. Presented in this paper is a detailed design of an Internet of Things-based sensing and monitoring system for smart home automation. In addition, the proposed design includes a tool for gathering and analyzing monitored data and feature for identifying the missing objects. The platform that has been chosen is extremely adaptable and user-friendly. It is feasible to sense and process data from various variables in the house using the NodeMCU-ESP32 microcontroller board, which allows for real-time data sensing, processing, and visualisation.

Keywords: Internet Of Things, Smart Home Automation System, Sensors Nodes, Computer Vision, Smart Home.

I. INTRODUCTION

Developing energy efficiency and renewable energy technologies is becoming a top concern for many countries throughout the world, and there is growing interest in these technologies. Universities have been active in this technology progress through student competitions, which are intended to increase student understanding of the issues. In the US and also in other nations across the world, one of these competitions is the Solar Decathlon, which has been taking place since 2007. With its submission into the SDME 2018 competition, Qatar University has been able to assemble a multidisciplinary group of students who will cooperate on the design and construction of a green, smart, portable, and inexpensive solar house. It is an easy to build an energy-efficient dwelling that is completely monitored and automated with the help of internet of things technology. particular degree of comfort, according to the company. home automation systems based on the Internet of Things are composed of three primary components. The first section is concerned with sensing and data gathering. This is accomplished by strategically placing sensors or devices, often known as objects, in various positions throughout the home to measure and collect required information such as temperature, humidity and light intensity. The rise in popularity of the Internet of Things has been rapidly diffused to simple in-home applications and everyday tasks. The Internet of Things is being used in homes to monitor and save energy while also achieving and maintaining a particular degree of comfort. home automation systems based on the Internet of Things are composed of three primary components. The first section is concerned with sensing and data gathering. This is accomplished by strategically placing sensors or devices, often known as objects, in various positions throughout the home in order to measure and collect required information such as temperature, humidity, or light intensity. The data processing component of the system is a second component. Sensors deliver data in an unprocessed format. These data are transferred to the processor via a mode of transmission, which is either a wired or wireless link. Afterwards, the processor converts the data into values. These values are forwarded to a device that will be controlled automatically. Internet is the final component of Internet of Things automation. The majority of systems transfer data to a server after processing,

it can be viewed by the person. The internet also makes it feasible to monitor data and manually control devices from a distance . Automation systems can assist in saving time, improving the overall quality of life in houses, and conserving energy by automatically executing a number of different orders. The device is also capable of tracking down and identifying any objects that have gone missing from the surveillance area. This paper describes and examines the architecture of an Internet of Things (IoT)-based smart solar house electrical system, which employs one or more options from among a variety of accessible approaches, in detail. It is divided into five sections: section 2 provides a brief review of the literature on Internet of Things systems used for home automation; section 3 covers the design approach; section 4 gives the testing and results; and section 5 closes the study.

II. LITERATURE REVIEW

This section discusses the standard configuration of a smart home automation system that makes use of an Internet of Things platform. Fig.1 shows a diagram of the human body and another one depicts such a platform, which is primarily composed of data sensing and acquisition, processing, transmission, and display components. usually, the term "Big Data" is related with the Internet of things and refers to the vast amount of data acquired from a big number of sensors and devices that must be processed, as it is the case in this instance. As effect depending on the number of sensors and the measurement-sampling rate, a considerable amount of data may be generated and transferred to the cloud server through the internet, which should be effective of handling such a big volume of data communication and archiving.

1) Data Transmission

Data transmission between devices and controllers is accomplished through the use of one or more communication technologies. Bluetooth, ZigBee, Wi-Fi, Ethernet, and GSM are examples of wireless technologies. Bluetooth and ZigBee are two wireless technologies that are extensively used for data transmission and control in the home, and they serve as a link between the sensors and the central processing unit. Low power consumption and ease of implementation are two reasons why these data transfer technologies are so popular. furthermore, the Internet of Things requires the use of either Wi-fi or Ethernet. The high data rate of an Ethernet connection is not required for home automation applications, despite the fact that it is far faster than a wireless connection. Furthermore, because Wi-fi is mobile, it is more widely used in most systems than other types of networking. Wi-fi technology consumes far more energy than competing technologies such as Bluetooth and ZigBee. The frequency at which data is uploaded can be lowered in order to reduce power usage.

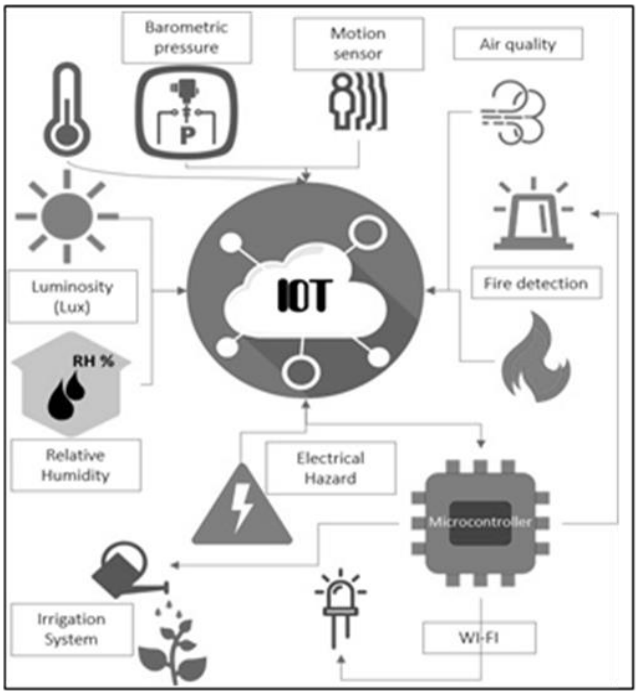

Figure 1. Typical configuration of a home automation system using the IoT platform

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2) Data Transmission

The data collected by a home automation system is typically processed and handled by a microcontroller, such as the Arduino, Raspberry Pi, or NodeMCU, among other devices. Raspberry Pi is a compact computer with a single microcontroller, which is called a microcontroller. It can do more sophisticated jobs than other controllers since it has a larger amount of RAM (256MB or 512MB, depending on the model), and it is primarily utilised as a central processing unit for many devices. The majority of recent Raspberry Pi models come equipped with USB and Ethernet connectors, making it simple to upload data to the internet.

Arduino, on the other hand, is a single-board microcontroller that can be easily programmed to perform many tasks. Arduino is available in a number of different configurations, with onboard flash memory ranging from 32kB to 512kB and a RAM of generally 2kB. Evidently, this controller has a lower processing power than the Raspberry Pi has. Nonetheless, the majority of Arduino devices are less expensive, easier to use, and powerful enough to handle most home automation applications.

Another alternative is to make advantage of the NodeMCU. It is based on the Arduino microcontroller, but it has the addition of the ESP8266 Wi-Fi chipset for wireless communication. There is 128kB of flash memory and a 4MB storage on this microcontroller. A single Internet of Things application or to eliminate the requirement for a central processing unit are the most common uses for this technology. Because each component of the system can upload data to the server on its own, the complexity of the coding and the connection chain is reduced as well. For the NodeMCU, one of its most significant advantages over its competitors is in the substantially lower price it commands for a controller that can connect to the internet directly over Wi-Fi, without the need for any additional peripherals or modules. One limitation of the NodeMCU board is that it only has one analogue input, which restricts its uses to being used as a single data monitoring system alone. It is possible to overcome this limitation by employing the ASD115, which is an analogue to digital converter with four analogue input pins and a conversion resolution of 16 bits, and which can be substituted for the ASD115.

3) Data Display & User Interface

There are various different methods in which the user and the system might engage with one another. One alternative is to make use of a software application. The creation of a mobile or web-based application to show data can be accomplished with minimal programming experience using a variety of basic methods. Another method of controlling the microcontroller is by mobile GSM, in which the user can send commands to the microcontroller in the form of codes via SMS. This control approach necessitates the addition of a particular GSM module to the circuit. This strategy can also be used in conjunction with emails

III. PROPOSED SYSTEM DESIGN

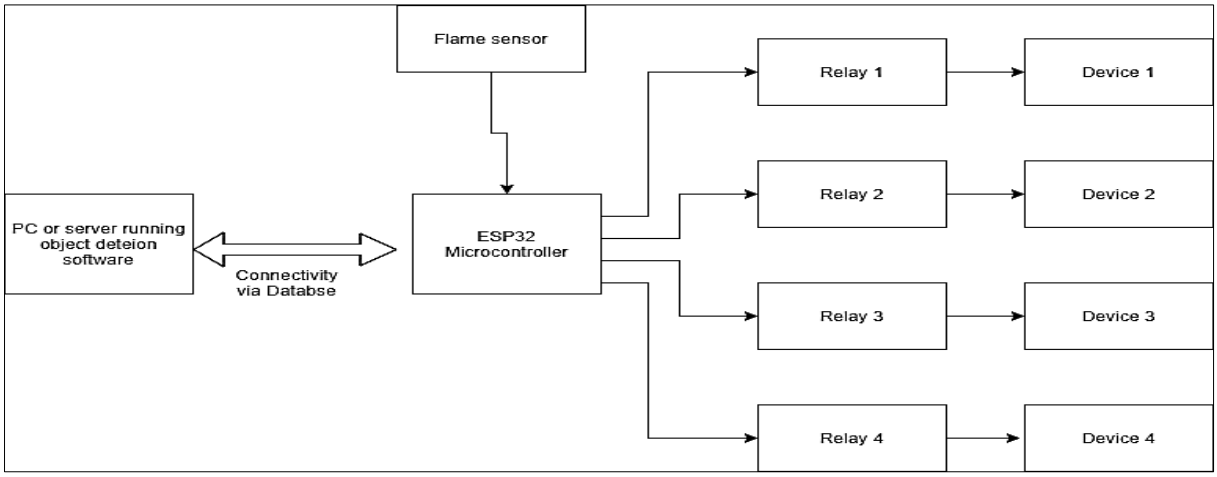

Figure 2. Schematic of proposed home automation system using IoT

1) Sensors

The design is implemented with the temperature as well as humidity sensors. LM35 temperature sensor is used for temperature sensing and HIH4000 for humidity sensing. The reason behind these selections was their smaller sizes compared with the other sensors such as DHT22 and the price is also low.

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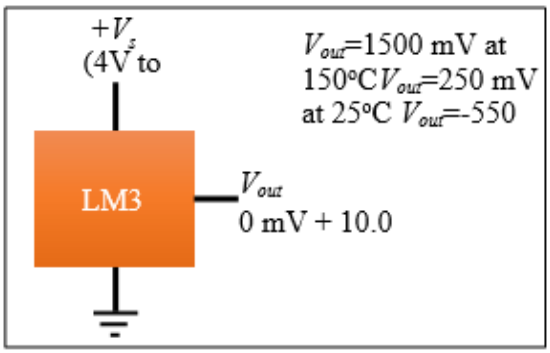

Figure 3. Basic connection of centigrade LM35 temperature sensor (+2oC to +150oC)

A circuit was designed to include all the mentioned sensors, as shown in Fig.3 All sensors were enclosed into a specially designed enclosure. The enclosure is used as the weather station hub and includes also the NodeMCU, the LM35 and Relays, and a backup battery.

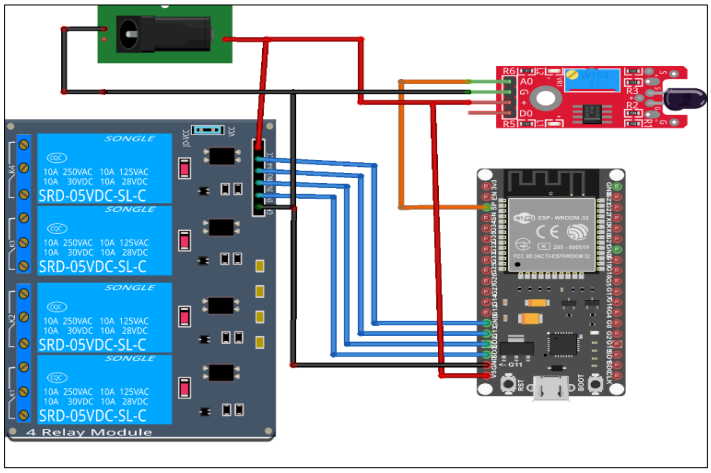

Figure 4. Circuit design of the weather monitoring hub

2) IoT

The NodeMCU is responsible for acquiring data from each node in the network. Every sensor's data is continuously uploaded to and saved on the Firebase platform, which serves as a central repository. In the Internet of Things, the Firebase is a cloud server that is used to log data, with the ability to show it through dashboards that can be easily constructed and customised to meet the demands of the user. It is an open-source server that is compatible with a number of pre-configured hardware modules, such as the emonPi and emonTx, as well as the ability to connect any other nodes or sensors to it in order to submit data. This is accomplished through the use of a personal API key that has been provided to the controller's code. This platform was chosen since it was determined to be the most appropriate for this particular project. An application is also developed to retrieve and show the monitored parameters from the server, as well as to apply the necessary control to the devices. It is really utilised as a means to display chosen monitored data for consumers on their mobile phones and tablets through the use of Blynk. Blynk is an application for Internet of Things. Programming is straightforward, requiring only simple codes, and the interface may be customised within the app itself. The YOLO concept is used in the detection of missing objects. YOLO (You Only Look Once) is an object detection technique that makes use of a single convolution neural network to recognise objects in a scene. The technique, in contrast to previous object detection algorithms that shift the image bit by bit, takes the entire image into account. A single image is taken into consideration before the input image is divided into a s x s grid by means of a feature map. Each row and column of the grid will anticipate the existence of N possible "bounding boxes." When predicting each bounding box, our algorithm makes advantage of features from the entire image. It also predicts all of the bounding boxes for a picture across all of its classes at the same time. Then, for each of the bounding boxes, it will forecast the level of certainty (or probability) associated with it. The Yolo method then proceeds to eliminate the bounding boxes that have a probability of occurrence that is less than a specific threshold. The remaining boxes will be used for object detection in the following stages. These boxes will be

processed using the Yolo algorithm, which will delete the boxes that are identical to one another. Following that, it will lead to the detection of missing objects.

IV. IMPLEMENTATION, TESTING AND RESULTS

The implementation of the smart home automation system is used for controlling the house energy efficient while maintaining the minimum required comfort of living conditions is implemented as shown in Fig.5. the sensors are placed inside and outside of the house. It gathers data, the information should be accessible at all times and uploaded every few minutes to the cloud server for display, processing, and archiving. A test was made to ensure that the data is uploaded to the IoT Firebase server, and it is plotted over a desired period of time.

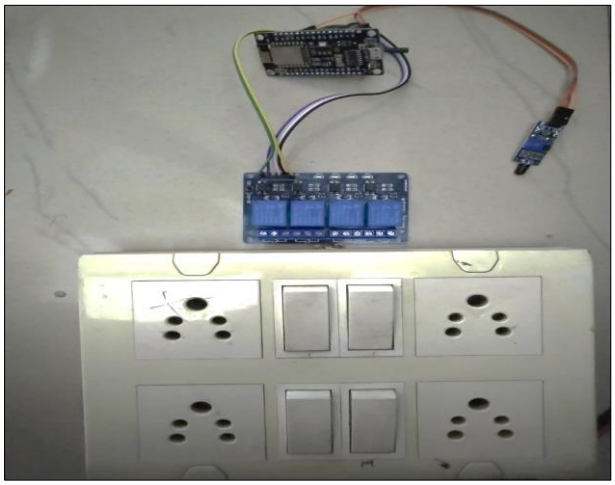

Figure 5. Implemented Monitoring Circuit

The Internet of Things (IoT)-based control system was also developed and tested. The NodeMCU controller receives a one-digit command value from one of the Firebase nodes on a periodic basis and reads it. Because of this, the NodeMCU sends an instruction to the motor controller to either open or close the panel cover based on the acquired value (0 or 1). In reality, a zero value indicates that the panel cover must be closed, but a unity value indicates the inverse of this.

Figure 6. Interface for Missing object Detection

A unique ID for each of the first detections is created by taking an input set of bounding box coordinates and establishing a unique ID for each of the initial detections. After that, following each of the input items as they move around the frames in a video while keeping their unique IDs is performed. Place the camera anywhere in the city where you want to hunt down the objects you want to track down. With the help of a camera, we may record numerous frames from a video. The photos will be fed into the Yolo algorithm after that. In order to track the object, we must first determine the centroid of each bounding box. Then it will assign a unique id to each object in each video frame and classify each object according to its classification. We can trace the images across numerous video frames by using the unique identifiers assigned to each object. The identified and tracked photos are saved in the computer's local storage, which is accessible over a network connection. Because the Internet of Things system is constantly in need of internet connectivity in order to access and view data, it is recommended that copies of uploaded data be saved to local memory storage in the future (e.g. SD Card). This can enable for the physical access to data in the event of an emergency or other instances where it is

required. Aside from attempting to make the House even smarter, one can consider enabling it to learn, develop, and evolve in tandem with the people who live there. This can be accomplished through the implementation of advanced artificial intelligence that can learn to adapt to the behaviour of certain members of the family.

V. CONCLUSION

This research proposed a straightforward and adaptable design for solar-powered house monitoring and control. The Firebase platform was chosen because it makes use of a cloud server to collect data from sensor nodes in accordance with the Internet of Things principle. The information gathered can be displayed, archived, or processed, and the results can be utilised to operate devices throughout the house. It was decided to employ the NodeMCU and the ESP32 as the primary processing unit, which collects and analyses data from the sensors before sending it to the Firebase server. Aside from controlling switching devices, the NodeMCU can also read information and orders from the same server. This consists of a complete smart-home monitoring and automation system that is based on Internet of Things technology (IoT). The proposed design for the smart home is quite adaptable, and it can be readily scaled up and adapted to larger structures by increasing the number of sensors, measured parameters, and control devices in the system, among other things. More functionality and smartness might also be added to the existing system, allowing the house automation system to grow, adapt, and evolve on its own as a result of the application of modern artificial intelligence technology.

VI. REFERENCES

[1] Hayat Lamina and Hafedh Abid, “Remote control of domestic equipment from an Android application based on Raspberry Pi card”, IEEE transaction 15th international conference on Sciences and Techniques of Automatic control & computer engineering - STA'2014, Ham Mamet, Tunisia, December 2014.

[2] Vaishnavi S. Gunge and Pratibha S. yalagi, “Smart Home Automation: A Literature Review”, National Seminar on Recent Trends in Data Mining (RTDM) 2016.

[3] M. B. W. Fincher, "Standards of Human Comfort: Relative and Absolute," The University of Texas at Austin, Austin, 2009.

[4] Archana N. Shewale and Jyoti P.Bari, “Renewable Energy Based Home Automation System Using ZigBee”, IJCTEE Volume 5, Issue 3, June 2015.

[5] Ali Mohammed Al-Kuwari, Cesar Ortega-Sanchez, Atif Sharif and Vidyasagar Potdar, “User-Friendly Smart Home Infrastructure: Bee House”, IEEE 5th International Conference on Digital Ecosystems and Technologies, 2011, Daejeon, Korea.

[6] Lamir Shkurti, Xhevahir Bajrami, Ercan Canhasi, Besim Limani, Samedin Krrabaj and Astrit Hulaj, “Development of Ambient Environmental Monitoring System Through Wireless Sensor Network Using NodeMCU and WSN Monitoring”, 6th MEDITERRANEAN CONFERENCE ON EMBEDDED COMPUTING (MECO), JUNE 2017, BAR, MONTENEGRO.

[7] International Electrotechnical Commission, Internet of Things: “Wireless Sensor Networks” Geneva, Switzerland: International Electrotechnical Commission, 2014.

[8] Grégory Nain, Francois Fouquet, Brice Morin, Olivier Barais, Jean- Marc Jézéquel, “Integrating IoT with Component Based approach”, 36th EUROMICRO Conference on Software Engineering and Advanced Applications, 2010

[9] S. Jaffe, "DESIGN OF INEXPENSIVE AND EASY TO USE DIY INTERNET OF THINGS PLATFORM," Faculty of California Polytechnic State University, 2016.

[10] F. Touati, M. Al-Hitmi, and H. Bouchech, “Towards understanding the effects of climatic and environmental factors on solar PV performance in arid desert regions (Qatar) for various PV technologies,” 2012 First International Conference on Renewable Energies and Vehicular Technology, 2012.

[11] Karpathy and L Fei-Fei, “Deep visual-semantic alignments for generating image descriptions,” 2015 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2015.