IOT Based Smart Home Automation and Security System

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Abstract— The current home automation system ensures safety and a happy life at home. As a result, the use of home automation technologies is becoming increasingly widespread. Our article recommended using the internet of things (IOT) to develop and implement home automation, garage monitoring, and home security. It's difficult to keep an eye on security in our busy life, but with a smart home system, it's much easier. If someone breaks in, this technology can instantly send out message. Our technology focuses on the home to create a smart home wireless protection scheme that sends to the homeowner an electronic mail with a photo if a stranger enters the home without a password, and we can even monitor the garage remotely. It only takes a few seconds for our system to refresh data. As a result, a concerned individual can quickly take the proper steps. From anywhere in the world, our system can operate and monitor temperature of the house, humidity, flame status, and all home devices. Our proposed solution is low-cost, has a user-friendly interface, and is easy to set up in a home. Through effective monitoring and control, the user can reduce electrical power waste using IoT technology.

Keywords: Smart Home; IOT; Automation; Raspberry pi-4

I. INTRODUCTION

Smart home applications are fast growing as the Internet of Things develops. Many manufacturers have begun to create smart home-related equipment and commodities, such as smart gates, smart light controls, smart TVs, smart audio systems, and a variety of other devices that make our lives easier, safer, and more comfortable. Smart appliances, on the other hand, are out of reach for most households, limiting the adoption of new technologies. As a result, this research presents a smart house control system. system to easily integrate IoT technologies. A home equipped with lighting, warming and electronic devices that can be monitored and controlled remotely by computer or smartphone.

Intrusion recognition systems and OTP are utilized in the study [1] to provide security to the house's locking system. The issue with this technique is that OTPs may be delayed as a result of network issues. Guests can also see using other technology such as smartphones and cameras. The mechanism of smartphone-to-door signal transmitting was employed in the paper [2, but it was confined to a small range. The use of the GPRS system to control operations from any location is a future project in this article. The study [3] proposes sending the malicious user's recorded photographs to the owner's mobile device. However, the device does not use an alarm to unlock the doors at a certain time.

Various control systems, including as Bluetooth, GSM, the Internet, and speaking-controlled wireless communicating home automation systems, have been employed in various research on home automation systems. [4], It was introduced as a machine-to-machine system that uses a global mobile communication system. [5], [6] have proposed a speech-controlled automation system. The Bluetooth concept is ideal for controlling home appliances. These systems, however, do not work remotely. In [7], a low-cost Java-based house automation approach is detailed. In[19],[8] a ZigBee-based system is described in detail. An internet-based home automation system [9] is the most popular home automation system on the international market. Wireless-based home automation and monitoring systems reduce installation costs while increasing system flexibility [10]. The internet of things can monitor, lead, and manage the home's situations based on the homeowner's lifestyle [11].The established system has three main parts that are monitoring, security and control. The devices in the home can be monitored and controlled by a variety of methods. The automation system may send and receive data from remote users via the internet, both online and offline. The operator can regulate and monitor their homes on/off status of devices.

If an intruder enters the house gate and enters the incorrect password, the camera automatically snaps a picture and transmits it to the homeowner through email.

A. *The Advantages of Our System*

When compared to CCTV or other approaches, the technology is both cost-effective and versatile. Our technology only takes a few seconds to update data on the server. We can use the internet to control it from anywhere in the world. It's Wi-Fi, so it'll keep your home safe, comfortable, and luxurious.

Our paper work is well-arranged in the following sequences. Section 2 explains the suggested system. Section 3 explains how to design a system. Section 4 explains how to set up the implementation. A summary of the work is provided.

II. OUR PROPOSED METHOD

There are no customers who do not want to expand the capabilities of the current system, which is supple and works with a limited number of general applications, similar to a smartphone. Our method is designed to prevent the faults that exist in the current system. The newly developed approach provides more security, comfort, and flexibility. Our technique's goal is to design and build a low-cost, open-source home automation system that can control and maintain the popular of the house. The proposed approach adds versatility by connecting multiple modules to the home automation system's server using wireless, dependable technology. This system will lower the expense of growth and increase advancement elasticity. Figure 1 shows the block diagram of our proposed method.

A. *Garage Monitoring System*

In this application, the owner of the house gets a notification about vehicle presence status in the garage, which is either inside or outside of the house. Authorized users will get notifications when a car, motorcycle, or any vehicle exists or does not exist in this garage.

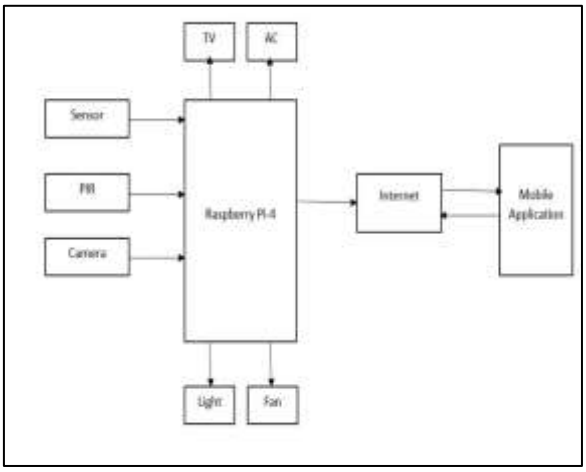

Fig. 1: Block diagram of the proposed system

B. Smart Home Security Systems

In this system, the doors of the house automatically close at a specified time. It is useful when by mistake the owner of the house gets the closing of the door forgotten, as it reduces the human effort as the doors close manually [16].

The Smart Home Security System is configured through the use of Python software with its GUI platform. The whole system comprises a portable panel that has push buttons, a camera, and a connected LCD. After the model starts, we have to enter the password that we had set up earlier. If the password entered is correct, then the Python interface sends a message to the Arduino Uno through a USB cable. Then the door will open and the smart home automation system will be switched on. But in a case when the entered password is wrong, the camera is triggered and it snaps a picture of the person and sends it to the admin via e-mail, in this case, the door will not open [15].

III. System Design

A. Raspberry pi

A Raspberry-pi is a cheap way to deposit the card-shaped sole board computer that was invented by the Pi foundation. It's like a brain. Its primary advantage is its processing power and higher-level processing capability. The main part of the home automation system is the Raspberry Pi. A Raspberry-pi four model B is used by us.

It is a general-purpose computing unit that analyses data collected by sensors and keeps the database up-to-date. [10] The resulting changes are redirected to the database and displayed on the front end. The Raspberry Pi unit analyses data from the sensors and sends it over the internet to a database through Ethernet connections. The data that the sensors direct is analog. [11] That raw analog data is converted into a digital layout by the Raspberry Pi unit.

To improve students' programming skills and hardware understanding, the Raspberry Pi is very helpful.

B. Sensor Interfacing

The ultrasonic sensors are used to detect the vehicle's presence. Ultrasonic sensors detect the presence of something in immediate proximity. Because these sensors detect the presence of a somatic object without communicating with it, their lifespan is longer [12]. We employ the HC-SR04 ultrasonic distance calculating sensor in this recommended system, which is capable of sensing an item at distances ranging from 2 cm to 60 cm. An ultrasonic sensor consists of a transmitter, receiver, and regulator unit with trigger, echo, and I/O ports. The data collected by the sensors are put together [13], [14].

For motion detection the Passive Infrared sensor module is employed. For ease of use, a PIR sensor is used. A PIR sensor detects the presence of a human within 10 meters of the sensor. The LM35 basic temperature sensor is utilized in this experiment. The LM35 sensor measures the temperature in the room. Cameras are installed at the gate for security purposes, and they snap photographs and send them to the homeowner's email address over the internet.

C. The structural design of our proposed IoT

The suggested IOT architectural method implicates of a network and transport layer, a data link layer, an application and presentation layer, and a physical layer. The IoT gateway router, device administration, and a variety of contact protocols are all part of the data link layer. All of the controlling devices are found in the physical layer section. A web portal is developed as a web page for controlling various devices at the application and display levels. A smart phone app can also be used to control the devices. The web portal and mobile app are both useful. similar work. The proposed system IoT layer is shown in Figure 2.

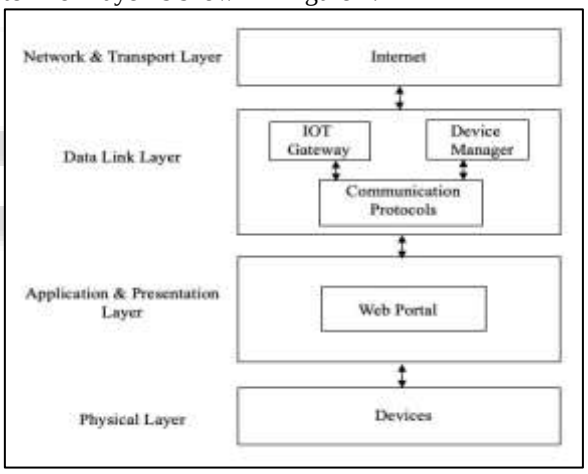

Fig. 2: Proposed IoT layer

IV. Implementation

A Prototype It has been created and is being tested in our laboratory to analyze the architecture of our suggested technique. The implementation phase is split into two sections. The first is the hardware, and the second is the software. Garage monitoring, which contains a software component describes the implementation sections.

A. Hardware and Software Implementation

The major components of the hardware parts are a Raspberry Pi 4, a camera, a PIR sensor, an LM35 sensor, a flame sensor, a humidity sensor, and a relay bank. Many sensors are interfaced with Raspberry-pi through the Python programming language, and the output is seen on the Web and in Android Apps. In Figures 3 and 4, the garage monitoring system circuit diagram is shown.

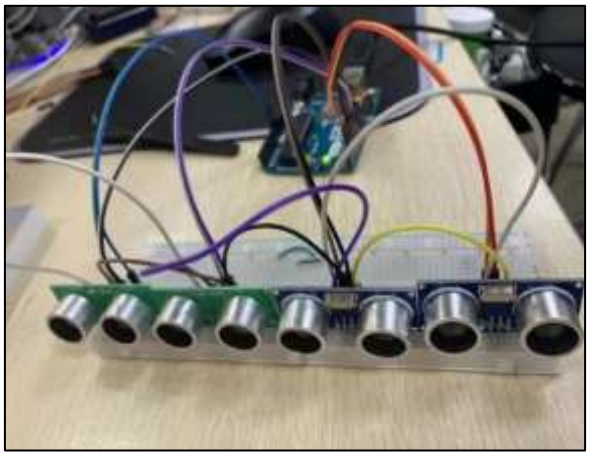

Fig. 3: Circuit Diagram

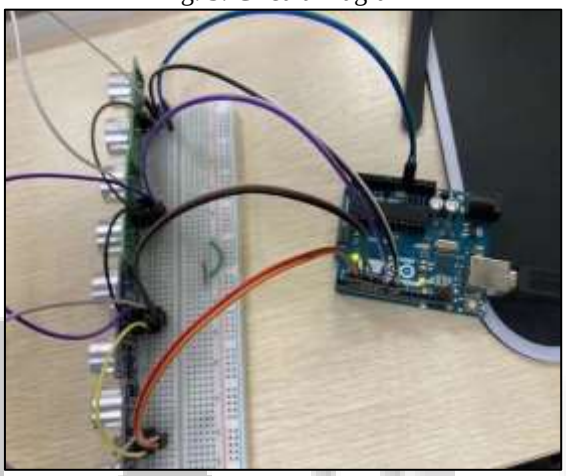

Fig. 4: Circuit Diagram

The snapshots for the automated garage monitoring System as shown in Figure 5.

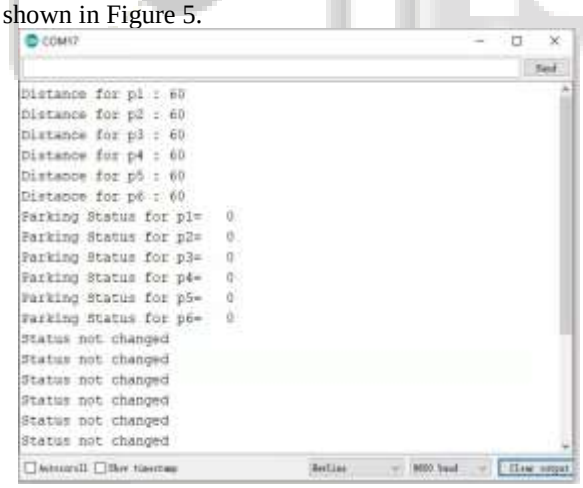

Fig. 5: Vehicle status

The screenshot above shows a serialized monitor display that is utilized in the Arduino integrated Raspberry Pi4 utility. The serialized monitor displays the vehicle's supreme distance from parking sensors when it is parked in its allotted parking place. For parking slots p1, p2, p3, p4, p5, and p6 the maximum distance that parking sensors can detect is 60cm, as seen in the screenshot [18]. The parking status for parking slots P1, P2, P3, P4, P5, and P6 are shown in this screenshot. Depending on whether or not a car exists or not, Figure 6, This Screenshot Displays the Distance of Cars from the Sensors of Vehicles that Exist in Parking Slot Number P1.

Therefore, it displays Parking Status = 1 for Parking Slot P1. Meanwhile, there are no vehicles in Slots P2, P3, P4, P5, and P6. Set up our Raspberry Pi. Then, using the Python programming language, we create a program to monitor garage and operate lights, fans, televisions, refrigerators, and other household equipment remotely.

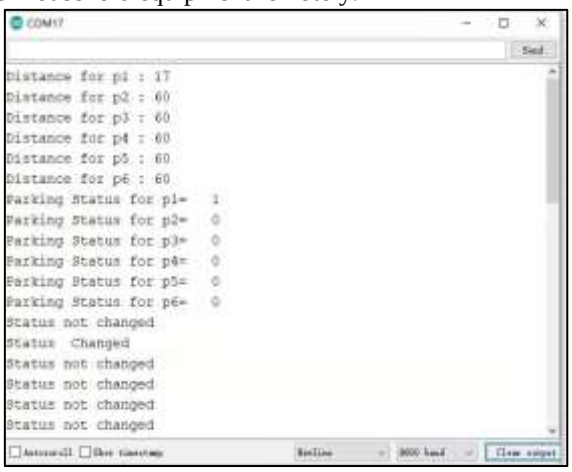

Fig. 6: Raspberry Pi integrated Arduino monitor display

We have used a third-party server like Adafruit for this prototype, but we will use our own server for business needs. The code of Raspberry Pi, Arduino and the third-party live server is connected. Few sensors, including as ultrasonic sensors, flame sensors, LM35 sensors, humidity sensors, and PIR sensors, are interfaced with the Raspberry-pi. After a few seconds, these sensors send data to the server through the internet on a continuous basis. The user has the ability to alter this at any time. We used Android Studio to create an Android app for controlling and monitoring home appliances. When the user touches the visual button in this android app, the program connects to the server and sends data to the server via the internet from the user's mobile phone. The Raspberry Pi receives the data from the server and then runs this command. Additionally, the android mobile app receives real-time JSON data from the live server and shows it on the mobile screen. For safety, we use OpenCV and SMTP modules to connect the Raspberry Pi to a camera that detects humans and sends messages to the owner.

B. Securities

We established a user id and password system to secure our home automation system devices, and we employed ultrasonic sensors and cameras to check that our vehicle is present or not in the garage without the door opening and without physically presence. Through the internet, by getting notification, the owner can know their vehicle's status.

V. CONCLUSION

The existing method has done a lot of work in terms of home automation and security. However, when compared to existing methods in terms of cost, security, and long-term viability, our solution stands out. Our recommended system provides data updates every few seconds, permitting for speedy decision-making in the time of a threat. Our method can be managed in a variety of ways. The internet, the World Wide Web, and smart phones are all terms that are used interchangeably. Our method can declare security and

convenience for all users using IOT technology. The homeowner can be alerted and take the required precautions for his family's safety by receiving notification, which is not probable with CCTV. Through correct scheduling and checking of the devices, this system can be used to reduce electrical power waste. Our designed method can be utilized in a variety of locations, including banks, labs, and workplaces, to significantly reduce the risk of unlawful entrance. Our method's reaction is outstanding, and it can be relied on for long-term results.

VI. FUTURE WORK

Home automation technologies have the potential to make homes even smarter in the future. This system can be used in a variety of applications, including industrial automation, hospital automation, and agricultural automation for farmers. Different sensors, such as motion sensors, light sensors, flame sensors, temperature sensors, and so on, can be interfaced with this system to give safety and control benefits [17]. Device toggling that is automated in response to a certain condition can also be established.

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