

Review of Home Automation Systems

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Abstract: With the availability of the internet everywhere, there is a rapid advancement in the field of IoT based technology. With global positioning of IoT and increase for widespread accessibility of the internet, web based technologies and component design and manufacture companies like Arduino have gained widespread importance. With the unleashing of 5G after a lot of trials, considering its flexibility of use in almost all kinds of devices and bringing them into a web network. Apart from the use of IoT in industries, the Home automation sector has a lot of use cases. In this paper, we have brought together all kinds of research work that have been proposed in the field of IOT in home automation and tried to bring to light different components that are used, what are its advantages and disadvantages.

Keywords: Automation, IOT, NodeMCU, Google Assistant ESP8266, wifi integration technology, sensors, voice control.

I. INTRODUCTION

Home automation refers to a network of hardware, communication, and electronic interfaces that intersects everyday devices via the Internet. Since they all have sensors and WiFi connectivity, users could regulate every device from your mobile device or tablet irrespective of whether you're at home or thousands of miles away. You can use this to switch on the light sources, lock the front door, or even turn down the heat no matter where you are.

II. COMPONENTS OF THE HOME AUTOMATION SYSTEM

Sensors, controllers, and actuators are the three major components of a smart home automation system.

- Sensors can detect changes in temperature, sunlight, or motion. Home automation systems can then change those settings and more based on your preferences.
- Controllers are the devices that send and receive messages about the status of your home's automated features. They can be personal computers, tablets, or smartphones.
- Actuators are devices that control a home automation system's actual mechanism or function. Light switches, motors, and motorised valves are examples. They are programmed to be activated by a remote command from a controller.

Arduino IDE: The Arduino Integrated Development Environment (IDE) - is a development environment which is written in C language. The environment contains a lot of libraries and example code which can be used for basic and advanced arduino projects.

IFTTT: If This Then That is a private commercial company that runs services that allows it to program and automate different tasks based on varied inputs from any kind of devices and triggers. IFTTT has a lot of service providing platforms to run the input and output automation programs, like youtube, alarms, date and time, messaging, dropbox and 700+ other platforms.

Webhook: webhook is a one-way data sharing platform triggered by input events. it enables applications to share and network with data in a much broader manner.

III. LITERATURE REVIEW

Manish Prakash Gupta et al.[1] has done a model and system of automation systems controlled by IFTTT, Blynk and Google assistant. They made a system comprising ULN 2803 IC to control relays and NodeMCU. It solved the problem for the elderly people that they can now efficiently access and control the switching mechanisms without touch. The authors [2] have done a detailed study on different wired and wireless automation systems and components like microprocessor(LPC812), Volt regulator, level converter, transistor logic relay.

The use of IOT based applications at home merging the use of sensors and real time analysis systems is an upcoming area of research. This arena provides a boom of opportunities for disabled people to live a comfortable life by controlling appliances of homes without making any physical contact [3]. A lot of extensive research has been conducted by researchers in this field and many analytics have been performed seeing an increasing curve in the use of IoT in automating machines and traditional mechanisms. Authors [3] have made a smart automation control unit using 4 relay modules and esp8288. This system solves and shows 2 advantages: that is using the interconnectivity of IoT devices, smart home systems have proved its working efficiency of energy. and second, it has taken a position as a helping hand for old and differently abled people.

The research study conducted by [4] discussed the use of zigbee and TCP/IP protocol in the communication. Here, the TCP/IP is accessed by the preserver, the person who maintains it and the user. Zigbee has been connected by the sensors and controller which is then transferred to the TCP/IP and then to the server. After their experiment they found that judging the RSSI, the transmission time could be reduced effectively. One limitation of IOT devices at the current stage of development is the lack of security which has been concluded after experimentation by them.

[5] have made a system that keeps human occupation and temperature as the main factors of consideration for development. In the system that they gave, we can control and monitor devices just using a router in short range. Their system depends on an MQTT server for which any devices connected to the MQTT, can publish a msg called a topic. The MQTT listens to this and responds by dispatching the topic to each device subscribed to the specific topic.

This article [6] discusses the various systems that are researched by their pros and cons. Home automation systems based on Bluetooth technology are flexible and inexpensive, such systems can work with the smaller range of Bluetooth networks. Systems based on voice recognition are most suitable for disabled and aged people, they can control applications by just saying the name of the application. Home automation systems based on the Internet of Things can only work in the presence of the Internet. The rapid growth brings both benefits and concern. A home automation based EnOcean is advanced in terms of energy consumption.

Due to fast development in automation, humans are becoming more advanced and better in all things. [7] Automated systems are better than non-auto systems. With the fast growth of consumers using the internet in earlier times the net became our family and IoT is one among us it is the biggest emerging star. ESP8266 is used for the WiFi tech. this can be expanded to various applications used in security and home. with the help of sensors if it remains in Wi-Fi coverage. worked satisfactorily using ESP8266 Wi-Fi module and internet via mobile phones, tablets and laptops.

In this paper authors discuss about 8 special features of daily life automation and suggest a related promising research direction [8]. We stress that consumers are exposed to implicit ambient interactions and come into contact with automation technologies through unintentional interactions. Living with such systems requires individuals to trust the dispersed system's adaptation and silent, frequently invisible operation, but it may also call for prompt manual interventions and thoughtful adaptation actions. We contend that despite the fact that key theoretical ideas have been put out for connected issues, a more thorough conceptual framework is required to fully and accurately capture the characteristics of everyday automation experience in all of its manifestations.

This study discusses Home automation (HA) systems have evolved as a new, promising paradigm that offers customers practical smart-home services thanks to recent advances in communication technology and Internet of Things (IoT) infrastructures [9]. However, there are a number of security vulnerabilities that can arise during the implementation and usage of HA systems, posing serious security hazards to users. On the one hand, HA systems are predisposed to the common IoT security risks (such as device infiltration, protocol flaws, and so on). The Signals Programming (TAP) approach, on the other hand, organizes cloud platforms, regional hubs, and smart devices via user-customized rules. However, the complex relationships involved provide significant difficulties for HA systems' security.

In this paper, this system consists of a software and hardware interface, ESP8266 WiFi integration (hardware) or technology to control home appliances and sensors, and an application is provided to control multiple household users with smartphones, tablets and laptops [10]. This system has been one of the finest for energy management systems and for providing simple control of many user home gadgets. Only some users have access to the full system, which is controlled by its administrator.



The author of this paper [11] has implemented an energy-efficient smart home automation system. In this system, they used the NodeMcu (ESP8266) wifi module to communicate with the system, as well as the IFTTT application and the Adafruit library for decision making and sending and receiving feedback. The java programming language is used to programme the system. This system can screen and access our smart home virtually from anywhere, and it can provide some assistance to mature and differently abled people.

In this paper [12], the author has proposed a smart home system that supports a lot of home automation systems. In this system, the user must issue commands to Voice Assistants, which are then decrypted and transmitted to the Arduino UNO. system makes use of C# language for programming the system, the Arduino UNO (ESP8266) and the Wi-Fi to communicate between both the microcontroller and the application that is being developed.

In this paper [13], the author has implemented the home automation system via. voice controlled. Additionally, the proposed system is operated from anywhere irrespective of distance. Here the Google assistant takes the user's command as input. The system consists of NodeMCU and a relay for switching ON or OFF as per user demand. It also makes use of Adafruit IO for cloud web servers and IFTTT for creating conditional statements that are further added as voice commands for Google Assistance.

In this project [14], the author has proposed and implemented a relatively low cost and adaptable housing automation unit based on the Arduino microcontroller. The paper describes the development and design of a framework that employs the ESP8266 Wi-Fi module. The proposed scheme covers a wide variety of home automation components, including energy monitoring and safety components. Furthermore, It connects a precise residence to a central database which could be accessed from almost anywhere via an IP address or web application. The author also has developed an user-friendly application that allows users to control devices through Google Assistant. The overall motive of this project is to increase the comfortability of people and reduce human efforts.

This study [15] suggests an effective and relatively low-cost monitoring system for IoT-managed smart home automation. The suggested solution, which is based on the Apriority algorithm, will assist in efficiently and reliably monitoring and controlling all household appliances and electronic gadgets through a supervisory system. By keeping an eye on the amount of electricity being used, both customers and providers will have the chance to govern the distribution of power.

This article [16] dealt with the possibility of remote control of the home automation system functioning. It looks at the issues with their application., explores potential fixes using a variety of network technologies and demonstrates how to optimize such systems. In order to create an appropriate home automation system (HAS) to suit its needs, the home must first be carefully studied because it is a perpetual environment for heterogeneous, distributed computing. However, the latest initiatives to introduce Home automation systems are starting to work well in actual houses for all kinds of users thanks to the continuous standardization process that reduces costs and increases the usability and ease of use of devices for the end user. However, there are a number of fundamental issues that must always be strictly addressed before designing and deploying difficulties with a home automation system, such as security, dependability, utility, robustness and cost, all of which are essential to assessing if the final product will satisfy the required standards.

The project offers a practical implementation of the Internet of Things (IoT) [17] that can be used to monitor and manage home appliances online. Portable devices are used as user interfaces for home automation systems. Through the Internet gateway, they can connect to the home automation network Using protocols for low-power communication such as Zigbee, Wi-Fi, etc. Using a Raspberry Pi server system and Wi-Fi as a communication protocol, this project aims to operate home appliances from a smartphone. While home appliances like lights, fans, and door locks can be easily controlled remotely through websites, the user in this case will interact directly with the device using a web interface.

Based on an exploratory investigation, a comparison of home automation systems is presented [18]. A comparison is made between microcontroller, user experience, communication efficiency, and related performance factors. Numerous

DIY platforms such as Raspberry Pi, Arduino and other microcontrollers make it possible to quickly and cheaply build home automation systems with minimal cost and excellent performance. Many home automation systems such as web, email, Bluetooth, mobile, SMS, ZigBee, Dual Tone Multi-Frequency based, cloud and internet based. in detail in this study. The future of home automation will be faster and smarter. It would be extended to include huge environments such as universities, offices, industries, etc.

The design and development of a web-accessible home automation system was summarized in the paper [19]. A thorough analysis of the literature detailing home automation effects systems as well as technologies has been

presented. There is also a presentation of system design techniques. Shows the components of a mobile app design. This highlights the monitoring and control capabilities of the user interface. In the next step, field tests will be put into practice. Data collection from experiments will be part of these trials. The results should demonstrate the effectiveness of the load management techniques used in the operation of the developed unit in reducing energy consumption. Other features were evaluated in real time, including camera placement, light brightness adjustment, and intrusion detection.

The design and implementation of the M2M system were examined in this research. The following findings are drawn from this paper [20]. The M2M system is dependable and may be used with a variety of technologies. The designer must choose the most suitable technology from DMTF, SMS, and GPRS for the design.

M2M systems are suitable for a variety of uses, especially straightforward ones. To make M2M systems appropriate for complicated applications, the designer must employ microcontrollers, digital to analogue converters, and analogue to digital converters. In this study, the M2M system's architecture and setup were evaluated. These conclusions are taken from this paper. The DMTF, SMS, and GPRS are only a few of the technologies that can be utilized with the trustworthy M2M system; the designer must choose the technology that best suits the design. The M2M system is appropriate for a wide range of applications, especially straightforward ones. Analogue to digital converters, digital to analogue converters, and microcontrollers must all be used by the designer to make M2M systems acceptable for complicated applications.

IoT refers to a system of actual objects (things). They are connected through the Internet and have sensors and software embedded in them. By connecting the devices, we can control them from a remote distance. The internet of things (IoT) enables us to make our homes smarter, safer, and more secure. The purpose of the project covered in this paper is to create a smart device that will sound an alarm whenever someone tries to enter the house [21]. Using the same sensor, this device can be used for home automation. The main benefit of this system over earlier projects is that the microcontroller can detect whether the phone is online or not. The TI-CC3200 microcontroller is used in the project. It has an integrated Wi-Fi shield and a built-in microcontroller that can be used to control and manage all electrical devices in your home.

[22] Door sensors for automatic lighting control are extensively developed for energy saving and security reasons. The automatic light switch uses an infrared door sensor based on electric and electronic combination switch technology. An automatic lighting switching system could lead to energy savings and efficient energy use, benefiting everyone. In addition, the system is designed in a safe environment when the light is "on" or "off", when the space is occupied or unoccupied. In addition to the safety environment, manual switching is also included in case the user needs their lights during the day.

The main focus of this document is the LPG gas leak sensor that detects LPG gas leaks and the SEN 1327 gas sensor module circuit [23]. The QM 6 gas sensor is used in the SEN 1327 module. The output of the SEN 1327 gas sensor module is used to drive an astable multivibrator circuit based on 555 timers. Here the 555 timer acts as a sound generator and the sound frequency can be changed by changing the VR1 preset. The system alerts the user with audio and visual indicators.

PV plant performance, monitoring, and maintenance can all be significantly enhanced with IoT technology. The global cost of deploying renewable energy is decreasing as technology advances, which is encouraging the deployment of solar PV on a large scale. An advanced system to automate plant monitoring remotely via a web interface is necessary for this large-scale solar deployment. The majority of them are installed in difficult-to-reach locations and cannot be watched from a specific location. The description in this paper is based on the application of a novel low-cost Internet of Things-based methodology for remote PV system monitoring and performance assessment [24]. In addition to real-time monitoring, this makes it easier to perform preventive maintenance, fault detection, and plant history analysis.

IV. CONCLUSION

With the growing advancement of IoT, its supporting devices, it becomes quite important to track the release of different products and technologies that are being recently developed for projects and other appliances. The field of IoT comprises a vast variety of sensors, actuators, network devices etc with varied application of each device. In this paper, we have tried to cover all the main recent developments and applications of IoT.

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