

Home Secure Automation with IOT

T S Syam Sunder¹, Amarchand G², P. Madhavan³

¹Department of Computer Science and Engineering, School of Computing, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, Chennai, Tamilnadu, India-603 203.

²Department of Computer Science and Engineering, School of Computing, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, Chennai, Tamilnadu, India-603 203.

³Department of Computer Science and Engineering, School of Computing, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, Chennai, Tamilnadu, India-603 203.

¹shyamtr007@gmail.com, ²ag7330@srmist.edu.in, ³madhavap@srmist.edu.in

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Abstract: Home automation has experienced increased attention due to the growth of the introduction of communications technology. The Internet of Things (IoT) involves the use of the Internet to manage any of the household equipment and applications. as IoT technology hasn't gained any traction in the market, existing-home automation systems haven't met user expectations, unworkable interface and costly issues have created, and constrained the possibilities, and wireless range has proved to be too limiting This paper presents a cost-effective crossbred home automation system with a both simple and highly efficient user interface for smartphones and an as well as for laptops. The system, which they refer to as IOT based Home, takes advantage of the Internet of things and Artificial Intelligence algorithms to help homeowners monitor their home environments and control their devices over the Internet any time of the day or any place they're located. different IoT systems are tied together using a single device (based) gateway (the NodeMCU) as a Wi-Fi-enabled bridge to collect data from various sensors and deliver it to the IO Cloud server there is no matter where they are accessing IFTTT software, users' smartphones and computers are connected to the internet can pull the collected data from several sensors (color several; for this application in casual writing, reading, radio-frequency identification, ultrasonic, and temperature sensors) A relays set is applied to service nodes, such as the one used in home environments to interconnect circuits. The design of the system is flexible enough to allow for its use in home applications, as well as on-site facilities that can be connected via a control box for measuring and The IoT system is intended to be used in homes and businesses to automate and enhance both life-safety applications easily and can be expanded to include autonomous The Internet of Things can provide value, convenience, safety, and security to SH residents for a low investment and energy consumption is of great significance for Smart home devices.

Keywords: IoT, Smart Home App, Google Assistant, NodeMCU, Biometric, MQTT, IFTTT, ReactJs, Google Firebase, Adafruit IO

1. Introduction

In addition to advancements in communications technology, there has been a lot of research on home automation. Instead of managing the home equipment via a remote, the consumer manages and watches it over the internet of application. a SH can be described as a person's home that utilizes sensors, actuators, and automation to enhance their quality of life with greater safety and comfort as well as improve security and ensure their well-being. Daily lives are equipped with all the role in-dependent activities, from consuming media to daily household chores, including media consuming, programming, and measuring sensors are more involved with day-to-to-day lives these days. Connection must be built to support the position and communication of intelligent computing devices. There could be a number of products on the market that do the same thing, making it possible to use a smaller industrial-scale automation device. A lot of microcontroller technology became readily accessible in the early 2000s, and home automation became a financial option for growing microcontroller capabilities as a result. At present, home automation is in the realm of the hobbyist and the rich. Over the required monitoring and control systems have been installed in various home appliances using the remote control, for example, have various many innovations on the market, including TV controller, regulation for air conditioning and audio devices have been made accessible to the customer [expands] The widespread use of electricity, coupled with advances in information technology, has introduced new and exciting ways of controlling home appliances, such as short-range interfaces like Bluetooth and GSM and Wi-Fi coupled modules such as modules that work by using Bluetooth and a GSM chipset to be employed on both wired and wireless networks.

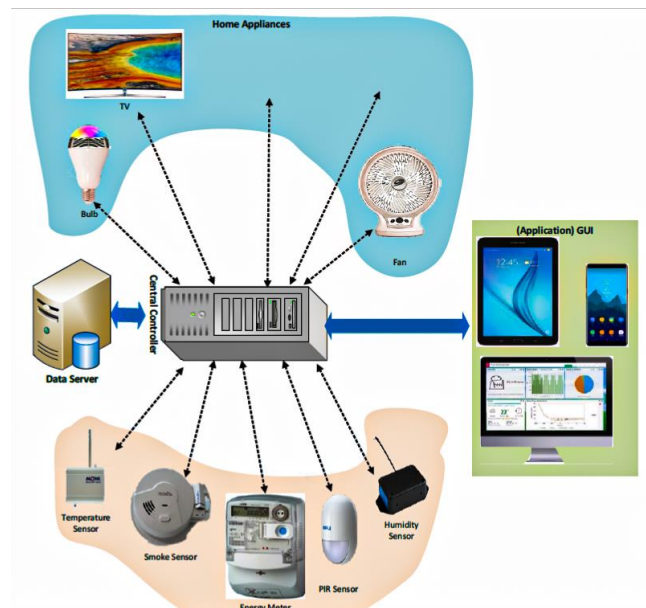


FIGURE 1. SH environment

This whole lot of systems and technologies can be used for interior use only, and residents are not permitted to have them operational control on their own property. While such systems are well-suited for optimum interaction, usability, flexibility, and security, they have some inherent constraints with regard to the usage and scope of the final product. The vast majority of these systems do not make use of powerful IoT a part of their strategy, instead focusing on connecting billions of internet-connected devices (smartphones, laptops, and sensors) to the internet. The monitoring devices of a Smart Home is directly linked to other devices, such as security cameras so that the house is in general and to manage them can be expanded by adding access points (APs) which allow for the creation of a single Management Station to manage home functions (cf. this phrase allows for linked devices). An example of this is that while other similar controls may simply be incorporated in a single box, one room, many appliances (e.g. HVAC controls, light, TV, door lock, washing machine, and refrigerator) must be controlled with an all-in-one SSH automation system. When the system is connected to the Internet, the information technology revolution becomes an Internet of Things (IoT) system. A home automation system can help you use less energy, while keeping your home comfortable, reducing your electric bill. Home automation systems also contribute to the overall security and safety of a home. This project uses an open-source, NodeMCU IoT platform to run the main programmable board (the main microcontroller is a NodeMCU Wi) that controls the entire project's IOT codebase network. A sensor network links to the commercial Ethernet, which collects information from the sensors and encrypts it and uploads it to the IoT server/ interface, the microcontroller may receive commands that can be carried out by either a phone or a laptop with specified in advance a lot of sensors and mini-entrepreneurs

2. Related works

A. PROBLEM STATEMENT & RELATED WORKS

Ease and accessibility is one of a machine that means more customers will have access to it. More customers will have access to machine automation for their staff with benefits, it saves on energy, is pleasant, and is fun. home automation systems. Some of the existing safety and security systems aren't taken into consideration in existing SH systems.. The existing system may not have adequate features or functionalities because the commissioning phase of the other systems may not know what they were previously there. existing systems such as Short-Range wireless (which use low-range wireless such as Bluetooth or Wi-Fi) only have a short transmission range.

Much functionality is available in the market for self-powered home automation systems. which are divided into two main groups based on their operating concept. The first is the former, with which the systems are capable of only executing local commands and the second, capable of issuing remote/global commands. It is essential that protection and privacy technologies be built to protect users while preserving the reliability of industry concentration IT systems Ref [2]. A home automation device must be user-friendly, but still able to track and manage a variety of home electronics. When these problems are resolved, an economic and user-friendly optimized

IoT device is used. Anything to be included in the new framework is reviewed for both the protection and welfare of the school and student family communities

SHs stand for abstract concepts, rather than tangible building structures. In the realm of things like health and safety, the integration of technology is for customers to increase their quality of life. With the Wi-Fi framework, a home automation system was built and placed in place by Ref [3]. a reliable development kit, which is also known as Virtuino, which has Android integration It enables your television to make calls to all your other electronic devices in your home to receive assistance when you change channels or search for a different source. "SH" may be beneficial in the areas of defence, ease, protection, and resources, and "comfort" and management are likely the benefits offered. The community provides a safe and compassionate atmosphere for the aged and disabled. In the majority of networks, two forms of communication are identified: Wired and Wireless systems. It has been argued that computer networks use fibre optic fibres, bus lines, and control lines. There are two components in wireless systems: the transmitter and the receiver. use a number of new technologies, such as radio waves or infrared to send and receive information at the present, take advantage of the presence of present designs This technology works in both wireless and wired as well as in traditional systems related to ref [11]. People have gradually come to rely on portables for a wide range of applications and for everything from simple activities to life-saving conveniences. is a SH: The world comprises electronic devices that are heterogeneous, all of which are linked to provide smart services. The Internet of Things (iT) is being developed into smart communities in all sorts of places (ref [4]), even urban environments. When SHs store such information, safeguards such as data protection of privacy and security must be developed to help prevent unauthorised users from affecting services, data transfers, an effort also needs to be made to ensure user data privacy and confidentiality, to ensure accurate services are always provided. a SH system utilising Bluetooth and GSM modules was suggested in Ref [7][14] The key aim of this research is to assist individuals with disabilities and senior citizens to utilise resources from afar. People started using GSM and Bluetooth technologies to hold the home in place. Madhavan. et. al proposed bio inspired techniques which is an artificial immune based design to provide novel security solutions in IoT[12].

However, when the user is out of range of Wi-Fi, the controller cannot explicitly connect to the server and cannot make use of the mobile to issue commands. In Ref [9], an Arduino Super 2560-based home automation and environmental monitoring system was created. We employed multiple sensors and switches to take charge of different home appliances, often via the Android OS or software. We may use the website to power Arduino by sending codes to it. By its design, MQTT produced less power and needed lower bandwidth, hence was chosen for deployment. The ESP8266 board was a lot less costly than some boards like the Arduino UNO. However, only minimal flexibility was included in the programme architecture of the gui. The machine was risk free, but had nothing to do with safety or stability. The values gathered from various devices converge to imply online analytic waves that are best suited to particular needs. IoT can identify only the important and useful filled requirements[15]. With these data, patterns can be recognised, advice on course of action can be made, problems can be detected, and provided, and a way to address them can be found. The use of Bluetooth and GSM communications was proposed in a SH automation control module. Thus, the GSM used in the kitchen was connected to the whole house, but Bluetooth was also connected inside to the house's electronics. Due to the existence of Bluetooth on most mobile devices, and desktop computers, there is a reduction in system costs. Varun et. al developed blockchain-based transaction system to run the errand and deploy an IoT-based, low-investment platform for ensuring profits in the long run[13]

3. Proposed methodology

A. METHODS:

This specific section will explore about different research phases that were employed in the creation of this system, Furthermore, components and their integration have been chosen to fulfil the design goals laid out and are discussed in detail. This study is primarily conceptual in nature and is represented in the diagram in Figure 2. Before getting to work on new projects, a research group first looks for gaps in existing SH systems. Most issues with all current market available solutions have to do with their high costs of implementation and unfriendly user interfaces During the modelling phase, material and component selection and implementation are done to go into making the SH prototype and the IOT based Home design. NX10 Software was used to design the NX prototype, and plywood was used to manufacture the first product. At the moment, the designing and implementing the IOT based Smart Home systems are underway. Connecting the relay board, wiring, and the component, to the source, as well as to various other parts of the SH (the lightbulb, fan, and sensor), is verified in the prototyping phase. Then, after connecting the microcontroller and the rest of the hardware, a firmware programme is run to realise the specific tasks. the design is then rechecked to see if there are any other areas in which functionality may be inadequate. to ensure that the system is capable of being used This happens when the problem is located in a

specific phase, during which the system expands and evolves to the next phase, Once the system has demonstrated results, it's considered to be finished.

B. SmartHome Designing:

Smart Home systems were created on NX10 software to meet the NX10 specifications. The prototype is a home with bedrooms, bathroom, kitchen, and a front room. The circumference is one hundred centimetres. In order to regulate temperature, windows are either closed or opened by sliding. We use a steel rod as the foundation for the upper windows. There is a motor at the top to help the doors open and close. A motion sensor is set up to monitor motions to notify the person as to when the door is opened or closed. an RFID sensor is situated on the perimeter of the building, For ease of flow, a tank has been mounted at a higher position. The tank is equipped with an ultrasonic sensor to check the level of water. A cluster of three rods is strategically mounted in the centre of the tank, with a copper core surrounded by two of lead and iron.

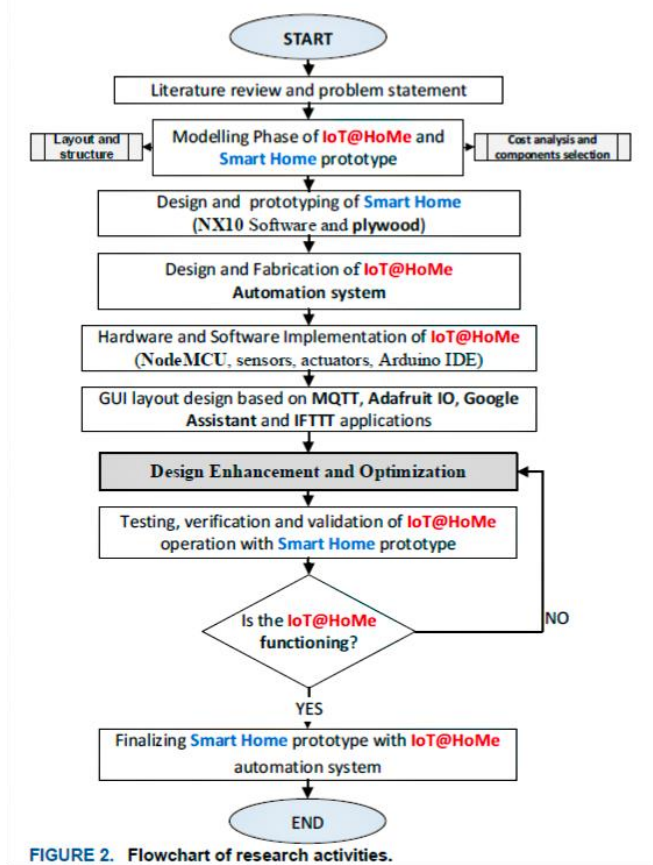


FIGURE 2. Flowchart of research activities.

4. DEVELOPMENT OF SMART HOME AUTOMATION SYSTEM with IOT

A. COMPONENTS SELECTION :

In developing an Internet of Things (IoT) infrastructure, hardware and software are important for the architecture as well as the implementation. Once all the IOT based Home's components have been selected, In a traditional home automation scheme, you design and implement all the automation features, such as lighting, climate, security, etc. Every programme has several software modules, and together they comprise the overall structure. As we see in Figure 3, the NodeMCU (low-cost microcontroller) is the most important of the low-cost peripheral systems, with one more of its control nodes expanded. NodeMCU is an open-source software and hardware kit that can be installed on a System-on-on-Chip (SoC) named ESP8266, helping people prototype IoT devices with scripting languages like Python and Ruby. The Tensilica Xtensa is equipped with a 32-bit-class low-speed engine with an 8MHz clock. It serves as a link between microcontrollers and has the ability to run self-contained applications on both local Wi-Fi and to get data from external sources. node-MC allows connecting to sensors and actuators using a single node's KB of RAM, 4MB of RAM-on-on-board, and/or, and a 20 general networking through its integrated 4MB of the 25-way controller, 20 GPIO, and APIs. Many aspects of the Node.js board, such as its low cost, simplicity, are similar to Arduino UNO, while others are much better, like the built-in

power regulator, onboard processor, and compatibility with software packages Based on the NodeMCU's incoming signals, the relay is energized or re energized. an advantage of using the relay board is that it surpasses the controller's voltage limitation, which is of 3.5 V, allowing control of 240 V devices to be accomplished using DC voltage. In this investigation, several sensors were used for several different purposes.



FIGURE 3: NodeMCU.

The volume of water in a tank can be measured by utilising a smaller HCR04 ultrasonic sensor. The water level sensor activates the relay, and the submersible water pump when the tank is empty. The tank sensor transmits data to the NodeMC, which shuts off the pump when the tank is loaded.



FIGURE 3.1: Brushless submersible water pump.

The benefit of this system involves low expense, long-term reliability, quick reaction, signal measurement, anti-interference, and immunity to shifts in electronic media. Through this sensor, you can measure the room's temperature and humidity. If the room is over the specified temperature, the lamp would turn on.



FIGURE 4. Adafruit.IO.

The data is also sent to the NodeMCU, which then issues an AC command in the implementation. A PIR sensor is used to detect human presence and that and that signals the NodeU; which then responds accordingly In addition, signals obtained through PIR can be used to open or turn the lights on and off. Unlike the ultrasonic sensors, PIR sensors will submit server warning when an individual is found in the space, so the server can sound the alarm and

activate the built into the home automation system. One common application of MQ2 sensors is detecting gas leaks in buildings. When smoke is reported, the NodeMC receives an analogue report/signal.

B. DESIGN ENHANCEMENT & OPTIMIZATION

In SH prototype, a new hardware system is added to see if it is free of errors until it functions well. If errors are found, then the original design is re-modified and evaluated, and then implemented. This process is critical for the system's overall performance and to be able to detect errors. These issues have thus been fixed, so we can get to the next step in the project. Until this step is finished, the project is completely done, it is expanded. Because for example, LEDs are often used in machinery as actuators, before being adopted in the full implementation of our system, they were tested as component options.

After all the programming of the codes, such as fan, motors, and buzzer and relay have been completed, the actuators are connected and connected to them to the breadboard (board), the results are used to make sure everything is working correctly. A multimeter is used to check all the wires and connections that are already in place. any part of the system can be verified via the respective cable and cord in which the wires are marked and labelled. After this phase is completed, all the sensors, actuators, and NodeMCU will be checked to see whether they are working correctly.

C. IMPLEMENTATION

This work advances a new, market-friendly IoT-ready controller (IOT based Home) that can monitor home equipment without restriction regardless of location. the mentioned above, I thought of another home automation and control algorithm, which is in addition to the previously mentioned one (Algorithm 1) Node-MC was picked for the system as it had capabilities and had already proven to be effective and is the best value. To help systems run smoothly and safely a few sensors like temperature and humidity are implemented to allow a system to be self-determining and self-enforcing. The final implementation and manufacturing of the system occurs on a breadboard for a number of different sensors and actuators prior to any experiments on an individual device. All in all, the IoT designs are configured to be plug and play. The design incorporates them, and is implemented for, and allows it to be fitted, in, for use, in prototypes and onsite as well. Two GUI applications are built for the software implementation of the SH prototype, with two primary purposes: monitoring and controlling. The web-based dashboard is built to communicate with the Adafruit.IO server and is part of the overall Adafruit platform. This feature (among other aspects of the programme) includes numerous indicators to display the obtained readings and multiple switches for various aspects of the software. The second GUI used in MQTT uses the apps available on Google Play for the smartphones to provide a smartphone-based interface. To the greatest extent possible, the two user interfaces are synchronised and end users are given two different choices they can monitor and modify SH. We will explain how the GUI-based user interfaces and their application in the IOT based Home system works in greater detail in the coming section.

D. OVERALL SYSTEM ARCHITECTURE

In Figure 5, Overall, the built Home Automation Device appears like an unbroken creation, but in the parts depicting the phase of development, it will be seen as different stages of progress.. This research is conducted in part by the NodeMC in order to facilitate the capabilities to acquire the collected data from the node, and the responses of the user, such as control of actuators which function similarly to LEDs, such as ON/OFF status instead of an external router or wireless adapter, it is connected to the Internet using the embedded Wi-Fi module. all the user needs to do is log in to the server using any device which is connected to the Internet, such as a PC, tablet, or smartphone and they can have access to all of the available data. expanding on, when the temperature is greater than 30°, causes IFT to send an email to the user. Once a person is detected as an intruder by the PIR sensor, the buzzer sounds, and the intruder's information is stored in the memory. a. This causes the gas and temperature sensors to download, as well as turn on the ventilation and cooling fans.

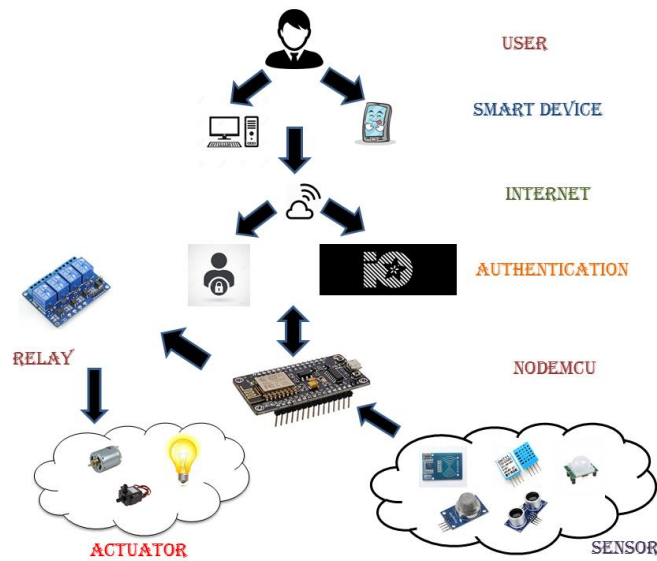


FIGURE 5. IOT based Home system architecture.

In the case of the sensor and water pump, the ultrasonic sensor is collecting the data and running the pump through the same relay. the front panel and the back of NodeMCU sensors have a one-to-one correspondence. The microcontroller's design analyzes the information that has been established so far.. They use numerous samples in the project prototype, including sensors and actuators. To this system's advantage, the addition of various sensors and actuators can increase the possibilities for expansion. See Figure below for a full details of the system operation details of the flowchart below.

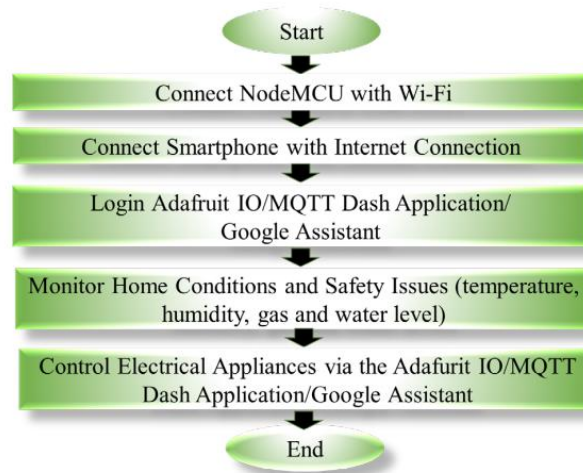


FIGURE 6: Operations Flowchart

5. Results and discussion

The findings and results for the SH prototype are laid out in this section. to prove that the functionality of the IOT based Home system has been confirmed. Thus, it is in a position to control various home appliance (lights, fans, etc.) sensors (that detect a number of things) and can monitor various other sensors (such as humidity and gas sensor input) by using mobile phones/Google voice search and Adruit IO.

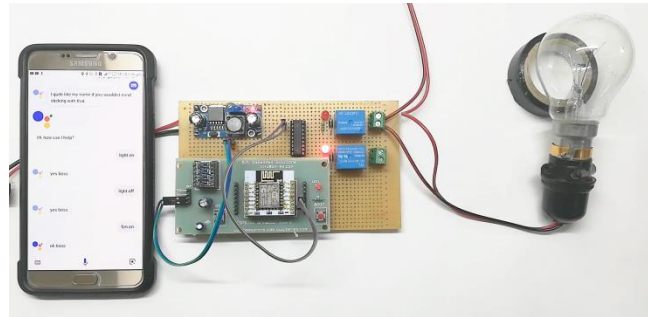


Figure 7: Prototype with IFTTT and relay control with google assistant

As with a smartphone or computer, the user is still able to use and manage the SH prototypes anywhere and whenever they wish to, as well as track and control them. One of the big achievements of this report is artificial intelligence making it possible for disabled people to use Google Assistant commands to support others who are less able. Customers may use multi-dashboards to customise how many metrics and visualisations are available for each data view, and are able to monitor and control the home from anywhere with any device connected to the Internet, as long as they are capable of accessing the internet. The network connection between NodeMCU and the IOT based Home can be made to keep the system in communication with the Internet while performing a set of tasks. There are no special requirements for utilising this system. This system does not have any prerequisites for logging in to the applications that have been developed by Adafruit and Google; all participants can use their smartphone, laptop, or personal computer to access it. All the users are in charge of the main electrical appliances, as well as all levels of temperature, water levels, and humidity can be monitored. This prototype incorporates IoT capabilities to control home automation in order to utilise the IoT system.

The major issues were identified during the testing phase, and one of the difficulties that arose was trying to keep up with the readings and comprehending them. In order to the existence of only 16 AnalogIn pins on NodeMCU, an increase in the number of analogue ports was desired and implemented. A system lacking a multiplexer was next turned on, and all the sensors passed their tests. Then, all the sensors began to function correctly and gave accurate readings to the server. There was a reduction in the amount of time it took to shift home appliances, and response times were improved. Problems were experienced when it came to implementing the RFID system during this process, which were not unanticipated. For example, the battery wires got in the way of the antenna, causing the antenna to be damaged, which shorted the relay. This was dealt with by putting an insulation on top of two circuits to eliminate any chance of an accidental shorting. The plus was that NodeMCU made our project go more simple, but the downside was that we couldn't design it without careful consideration of its future needs and demands. The popular chips for home automation, including Arduinos, such as the UNO, Pi, and the Raspberry Pi have already been put to use in small controller form factors.

6. Conclusion

This research demonstrated a simple, versatile, and cost-effective sensor device, or also called a sensor system with a simple architecture, a go-anywhere, go-anywhere concept, and low-automation functionality. Real-time monitoring of the developed IOT based Home system is easy to implement in a real-house model. The controller was connected to a number of sensors and actuators, which transmitted this information to the IoT server. MQTT produces data that can be monitored using mobile application, and AdafUI on a PC/laptop. non-emergency, unspecified notification will be sent to the user's phones so that the user will know when everything is fine in their house when they return from wherever they went during their 'off-the-the-grid' use of the IFT system. Managing household appliances using MQafruit.IO or voice commands is very easy and effective with Google Home. The developed system has the potential to enhance safety, intelligence, and luxury. actuators and/Also actuators may be incorporated into the system. Alternatively, the developed system can be made more appropriate for future marketability. In our next experiment, we'll power the control box using solar panels instead of batteries. If possible, we will place all the circuit boards on the printed side. We'll maximise circuit placement to reduce the chance of connection failures.

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