Automating Your Home Through The Use Of A Smartphone Application

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Abstract
Introduction: The IoT refers to the interconnection of many commonplace items, such as smartphones, Internet TVs, sensors, and actuators, with the Internet.
Aim of the study: The Main Aim Of The Study Is To Automating Your Home Through the Use of a Smartphone Application
Material and method: the experimental configuration of the proposed system, including sensors, microcontrollers, relays, and mobile units
Conclusion: Home automation is undoubtedly a tool that can render a residential environment automated. Individuals may manage their electrical gadgets with Home Automation systems and configure control actions on a computer.
Keywords: automation, home, smartphones, internet of things etc.

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I. Introduction

Overview

The IoT refers to the interconnection of many commonplace items, such as smartphones, Internet TVs, sensors, and actuators, with the Internet. This connectivity allows for intelligent integration among these devices, facilitating novel modes of communication between people and objects, as well as between objects themselves. The development of the IoT has made great progress in recent years, introducing a new dimension to the realm of information and communication technology. The Internet has seen significant advancements and developments in the last three decades. The transition from the traditional IPv4 protocol to the more advanced IPv6 protocol is occurring in order to facilitate the allocation of unique IP addresses to every device connected to the Internet. The prevalence of machine-to-machine (M2M) communication is increasing, facilitating the interchange and use of information across devices without human intervention. The breadth and size of the Internet have seen significant transformations. According to industry experts, it is anticipated that the quantity of interconnected devices would exceed 15 billion nodes by the year 2015 and then escalate to more than 50 billion by 2020. The embedded industry faces the task of harnessing the potential of the expanding network of networked devices, often known as the IoT, which is generally seen as a pivotal instrument in our forthcoming surveillance endeavors. The potential of this network to fundamentally transform urban landscapes is significant.

An IOT-Based Smart Home Automation System

The IoT refers to a networked system that enables the interconnection and remote monitoring of various objects over the Internet. Over the last several years, the IoT idea has seen significant advancements and is now being used in diverse fields such smart homes, telemedicine, and industrial

contexts, among others. The integration of wireless sensor network technologies into the IoT facilitates the establishment of a worldwide network connecting intelligent devices that possess enhanced capabilities. A wireless home automation network is the backbone of intelligent home technology. It comprises of interconnected sensors and actuators that operate together and share resources. An Internet of Things (IoT) "smart home" aims to automate several aspects of a homeowner's daily life. When home appliances, electronics, and other objects are networked, users may control and monitor them from afar. These encompass light switches that can be activated or deactivated through the utilization of a smartphone or via vocal instructions, thermostats that automatically regulate indoor temperatures and provide analyses on energy consumption, and intelligent irrigation systems that initiate at predetermined times during the day, adhering to a personalized monthly timetable, thereby effectively managing water conservation. In recent years, there has been a significant rise in the popularity of smart home solutions. The provided visual representation in In Figure 1.2, we can see a smart home that makes good use of many utilities connected to the Internet of Things.

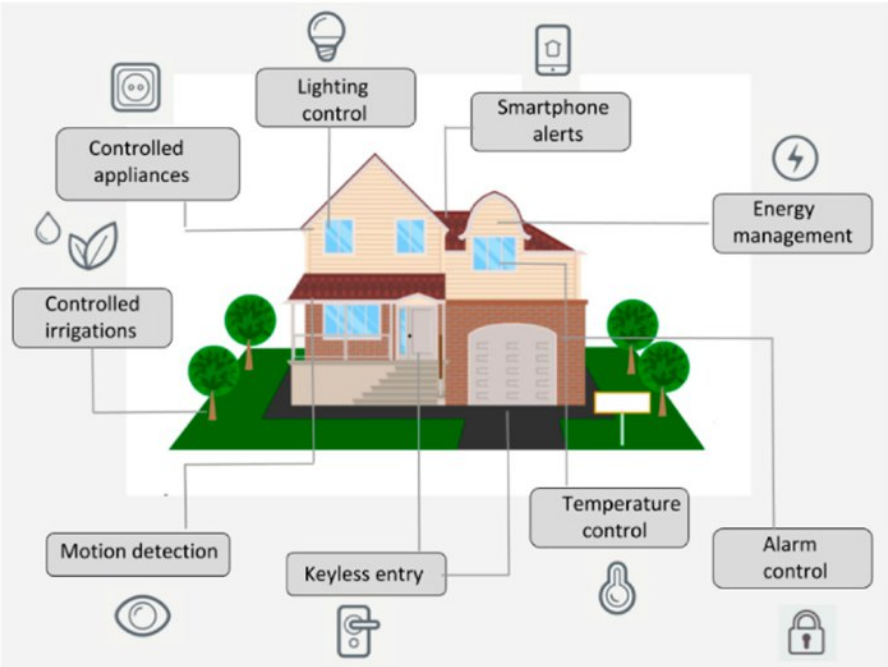

Figure 1.1 An Internet of Things (IoT) smart house illustrating the multipurpose use of smart sensor devices

II. Literature Review

Sinha, Sahil & Raj, T & Kumar, Sumant (2023) This chapter explores the concept of a "smart home," which combines IoT technology with cloud computing. The goal is to include intelligence into sensing and acting components, as well as community intelligent devices, and to simplify interactions via cloud computing. The suggested approach makes use of three augmentations, which are cloud-based services, a large hub, and IoT-enabled devices. This connection has the potential to increase efficiency, boost selection-making, and expand upload capabilities. By leveraging these technologies, smart homes have the potential to give a multitude of benefits, including increased levels of convenience, security, and comfort, as well as improved levels of efficiency in their use of energy.

Umer, Muhammad & Sadiq (2023) Over the course of the last several years, there has been a rise in interest in the idea of the "smart house." Data security, difficulties relating to privacy, authentication, secure identification, and the automated decision-making of IoT devices are some of the most significant challenges associated with a smart home. While it's true that current home automation systems might potentially address these issues, being trustworthy, secure, and equipped with automated decision-making systems are essential features for any home automation system. An artificial intelligence (AI) system that uses deep learning to make decisions—like turning a smart home appliance "ON" or "OFF" depending on its usage—is proposed in this study. The system would employ a convolutional neural network (CNN). Examining the system's potential was the driving force for this research. We also used the emerging blockchain technology into this study to provide a decentralized, secure, and reliable way to

ensure the authentication and identification of the IoT devices. Raspberry Pi, which serves as a server and maintains a database of each item being used, together with a 5 V relay circuit and other sensors, make up the majority of the recommended system. Plus, we integrate the Raspberry Pi interface with the Apache server and the HTTP web interface by developing an Android app. The effectiveness of the planned home automation system is ensured by testing and evaluation in both controlled laboratory environments and real-world scenarios. This research guarantees that the suggested smart home system's software and hardware are not only cheap, but also easily accessible, scalable, and widely used. It becomes clear that smart home designs need to include a more comprehensive security and privacy model after discussing the risks analysis's outcomes, which encompass cyber attacks, hardware security, and cyber threats. This requirement is underscored by the fact that smart homes are becoming more popular. The results of the experiments not only highlight how significant the suggested system is, but also prove its applicability in the actual world.

Doddam, Nagaraj & Dr. E. N. Ganesh (2023) Because the Internet is available pretty much everywhere, researchers have turned their attention to developing IoT-based applications, which has become the most cutting-edge innovation in the field. Many new age technologies, including To make the program user-friendly, web-based and android-based technologies have become important in this cutting-edge technology. In the most recent few years, people all over the globe have seen a great deal of advancement in the realm of automated home systems. The currently available home automation systems are rather basic, allowing users to turn on and off switches, as well as other functions, over the Internet. On the other hand, this does not provide a very satisfactory level of home security. Although there are technologies that allow you to monitor the footage from your security cameras, doing so is very time consuming and serves no useful use. There are many different electrical equipments that can be purchased on the market, and they may be combined with one another to provide a powerful solution. This solution will close the security holes, and it will put automation at users' fingertips. The home automation systems that are presently on the market are quite pricey and are out of reach for the average person. This article assists in creating powerful home security automation utilizing Raspberry in a cost-effective and efficient manner. Additionally, it assists in the saving of energy and gives the user the ability to operate it using their smart phone.

Khan, Muhammad & Ahmad (2022) Recent years have seen a rise in the popularity of home automation systems because of the rapid and progressive development of technology, which has contributed to the simplification of day-to-day life. Virtually everything has been digitized and mechanized at this point. The use of the IoT will make the creation of home automation systems less difficult and will lead to an increase in their level of popularity. In this study, numerous systems of actuators and sensors for enabling diverse home automation implementations were detailed, along with their connecting mechanisms. The acronym for this system is HAS, which stands for "Home automation system." It does this by establishing a connection to the dependable Application Programming Interface (API), which is the essential component of a generalized mode of communication. The HAS utilized devices, which often implemented the actuators or sensors, must have an upwardly communication network to be followed by the HAS (API). Raspberry Pi boards and ESP8285 processors were used in the creation of most of the HAS (home automation system) gadgets. An application for smartphones has been created that gives customers the ability to operate a broad variety of home electronics and sensors using just their mobile devices. The program has a high level of usability, is very customizable, and is helpful to both consumers and individuals with disabilities. Its scope might be expanded using a variety of different tools. The primary goals of this project are to improve the safety and intelligence of the home automation system that we have. The HAS is a computing system that is capable of a very high level of effectiveness and efficiency, and it may be improved using a wide range of devices and add-ons.

Mittal, Shreya & Bharadwaj (2022) In the modern world, there is an absolute need for innovations that are beneficial to the community. The IoT is a cutting-edge area that stimulates the production of tools that can carry out a wide range of menial activities automatically. The IoT is a network of devices that can complete activities and are linked to one another over the internet. This reduces the need for human intervention. Devices that are enabled by the internet of things may be of great assistance to persons who have impairments if they are used appropriately. This facet of IOT is the primary emphasis of the article, and the idea is used in the creation of a gadget that will be of assistance to those who have mobility impairments. The suggested apparatus may primarily be broken down into two distinct parts. The hardware portion of the project consists of a channel relay, a smart light bulb, and an Arduino. The software component includes both the IoT platform and the cloud platform, in addition to an app that was designed expressly for this function. The primary purpose of this gadget is to recognize certain words said by a person and then activate or deactivate the smart device in accordance with that recognition, so

establishing a smart home environment. In the beginning, we are going to demonstrate this concept with a standard light bulb. The application will be developed using the Java programming language. The feature of the software that stands out from the others is the microphone integration, which will allow users to enter commands. With Bluetooth and Wi-Fi modules installed in both the light bulb and the mobile phone, we can achieve the maximum transmission speeds feasible. Along with this, we will give serious thought to transmission speed and noise sensitivity. Additionally, the proposed gadget may be easily adjusted to include other household equipment, including fans, air conditioners, and similar devices. In situations in which the application will only reply to one voice, a provision for greater safety may be taken into consideration.

III. Experimental Setup

Figure 3.1 illustrates the experimental configuration of the proposed system, including sensors, microcontrollers, relays, and mobile units.

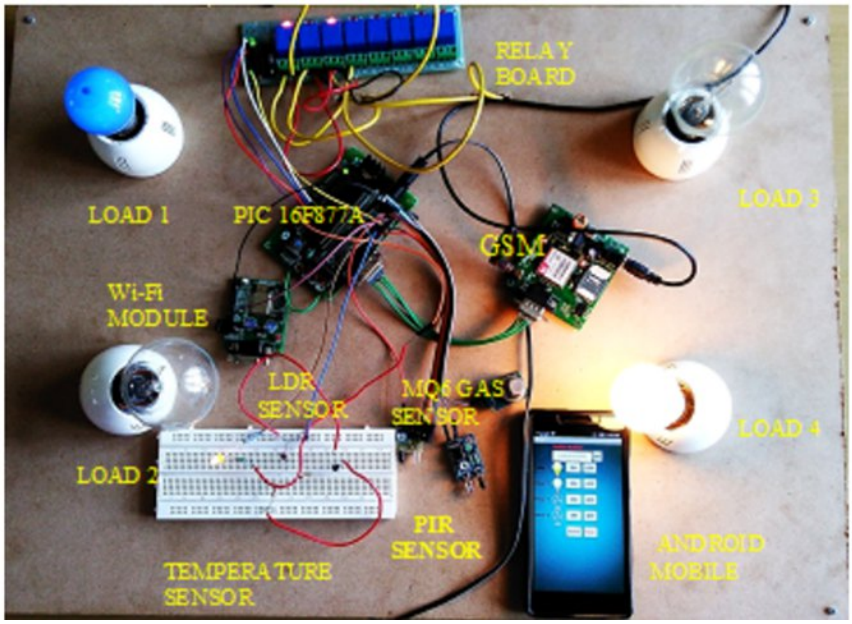

Figure 3.1 Hardware setup

PIC 16F877A:

The microcontroller is in charge of all the electrical driving operations and acts as the device's control unit. A microcontroller is essentially a miniaturized computer that fits into an integrated circuit. This is known as a System on a Chip in the world of modern technology. One or more central processing units (CPUs) make up a microcontroller. A voltage of 5V is required to operate the microprocessor. It has a reset pin that may be used to return software to its original configuration. As an 8-bit microcontroller system, the PIC16F877A functions according to the Reduced Instruction Set Computer (RISC) architecture.

PIR Sensor:

One kind of electrical device is the Passive Infrared sensor, or PIR sensor. It measures the amount of infrared (IR) light that objects in its field of view emit. Detectors that rely on infrared technology use PIR sensors. When one infrared source, like a person, moves in front of another infrared source, like a wall, with a different temperature, the difference in temperature creates the illusion of apparent motion.

LDR Sensor:

A photocell, light-dependent resistor, photoconductor, or light-dependent resistor (LDR). The resistance of this variable resistor decreases as the intensity of the incoming light increases. The components of a light-dependent resistor (LDR) are semiconductors with a high resistance. The semiconductor can absorb photons if the frequency of the light striking the device is high enough.

GAS Sensor:

A MQ-6 sensor for Methane and LPG (liquid propane gas) detects ammonia generated by

methane. The detecting element adsorbs it after it has been ionized into its parts. The resistance of the sensing element induces a change. The change in resistance results in a variation of the potential difference, manifested as a heating current that emerges over the sensor's output line. The MQ-6 can pick up gas concentrations between 200 and 1000 parts per million. The sensitivity and response time of this sensor are exceptional. With this sensor, you can measure analogue resistance.

Relay:

One name for a relay is a switch. The two circuits may be connected or disconnected using the relay. Spring, an electromagnet, a mechanically movable contact, and switching points are the main components of a relay. In order to operate high-power devices with low-power control signals generated by the microcontroller, relays are often employed. To protect the transistor from inductive loads that may cause damage from their back electromotive force, the diode is set up in reverse bias mode.

GSM:

Thanks to the GSM shield, the suggested system can make and receive phone calls, send and receive SMS, and connect to the Internet. You may use any suitable alternative shield on the microcontroller platform. The TX and RX pins are the basic connections of this shield. They allow the microcontroller to communicate with the GSM shield in a serial data transfer mode.You need a SIM card to use the GSM. Obtaining a SIM card requires signing up for a mobile service plan. As a result, the user could be able to access the mobile network. Data may be encoded and decoded between serial and parallel formats using the UART (Universal Asynchronous Receiver Transmitter) Interface. In order to send bits in a sequential fashion, it transforms bytes of data. Therefore, data may be sent serially to the microcontroller or to the network via an antenna.

ESP82666 Wi-Fi Module:

Any microcontroller may connect to a Wi-Fi network with the help of the ESP8266 Wi-Fi Module, a self-sufficient system-on-chip (SoC) that has an integrated TCP/IP protocol stack. An external application processor may delegate entire Wi-Fi networking functions to the ESP8266, or the ESP8266 itself can host an application. Connecting to a microcontroller and offering Wi-Fi capabilities comparable to a Wi-Fi Shield are both made possible by the pre-configured software that comes with each ESP8266 module, which contains an AT command set. With a large and ever-growing community, the ESP8266 module offers great value for money.

IV. Results

The proposed workaround calls for programming an Android app to relay user input to the microcontroller. This system's Android app is built on the App Inventor platform developed by the Massachusetts Institute of Technology (MIT). The Android app's user interface is shown in Figure 4.1. The home screen of the proposed system has two buttons for controlling the device. The first is the Internet Mode, and the second is the SMS Mode. When using the SMS control mode, the microcontroller will receive instructions in the form of regular SMS messages transmitted over the GSM modem. When the device is in internet mode, the Wi-Fi module will transmit instructions to the microcontroller. Internet access will be required for any operations of this kind. To send and receive commands in this mode, you need an internet connection on both the Wi-Fi module and the Android smartphone.

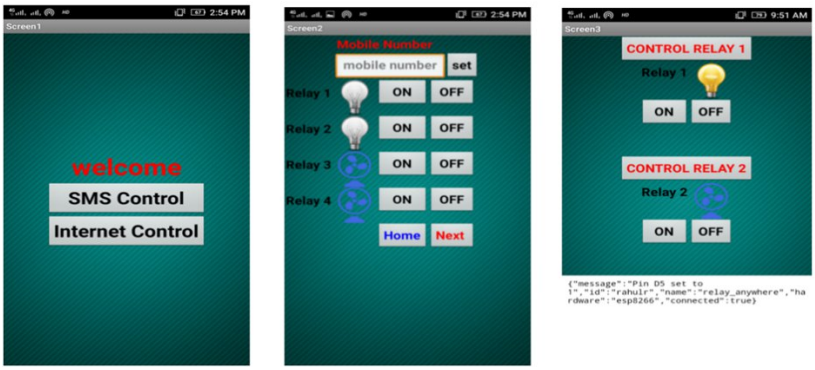

Figure 4.1 UI used by the Android app

How the Android App Works:

Below, we've broken out the functionality of each screen in the Android app. Select "Add Screen" to bring in other screens into the Designer. So, let's pretend you called that screen the "Home Screen." At that point, you might add a "Home Button." To get to screen 1 after pressing the home button, use the "open another screen" block. On screen1, we may use a similar technique to return to the main menu. The corresponding control screen is activated when the user presses the SMS or Internet buttons. Screen 2 displays the SMS mode, while screen 3 displays the Internet mode. The smart home app's main screen's functionality is shown in Figure 4.2.

Figure 4.2 Obstacles beyond the first display

The functionality of the smart home application's secondary interface is shown in Figure 4.3. Normal text entry will be used to simplify control on the second screen. To do that, a texting component will be used. Simply input the cellphone number you want the message sent to, and the texting function will make it happen. A pop-up notification will be shown on the screen to confirm the number has been configured. The correct relay will activate and deactivate according to our requirements by pushing the respective on and off buttons. In this system, the message to be sent is already assigned to the matching button. A message may be sent to the pre-configured telephone number by pressing the corresponding button. As an example, pressing button 1 will send the "on1" command to the specified number that was set up at setup. When you press button 2, the "off1" command will be sent to the specified number. The microcontroller can process the data and provide results that meet our requirements if we tell it to.

As shown in Figure 4.4, the third screen of the smart home app is working. Appliances may be controlled over the internet using the third screen. This can only be accomplished if the user's Android mobile device and microcontroller are both connected to the internet. To begin, turn on the corresponding relay that has to be controlled. The control configuration of the appropriate relay is shown on the screen. Simply press the "Control Relay 1" button to activate relay 1. Relay 1 is set up for control, according to the notification.

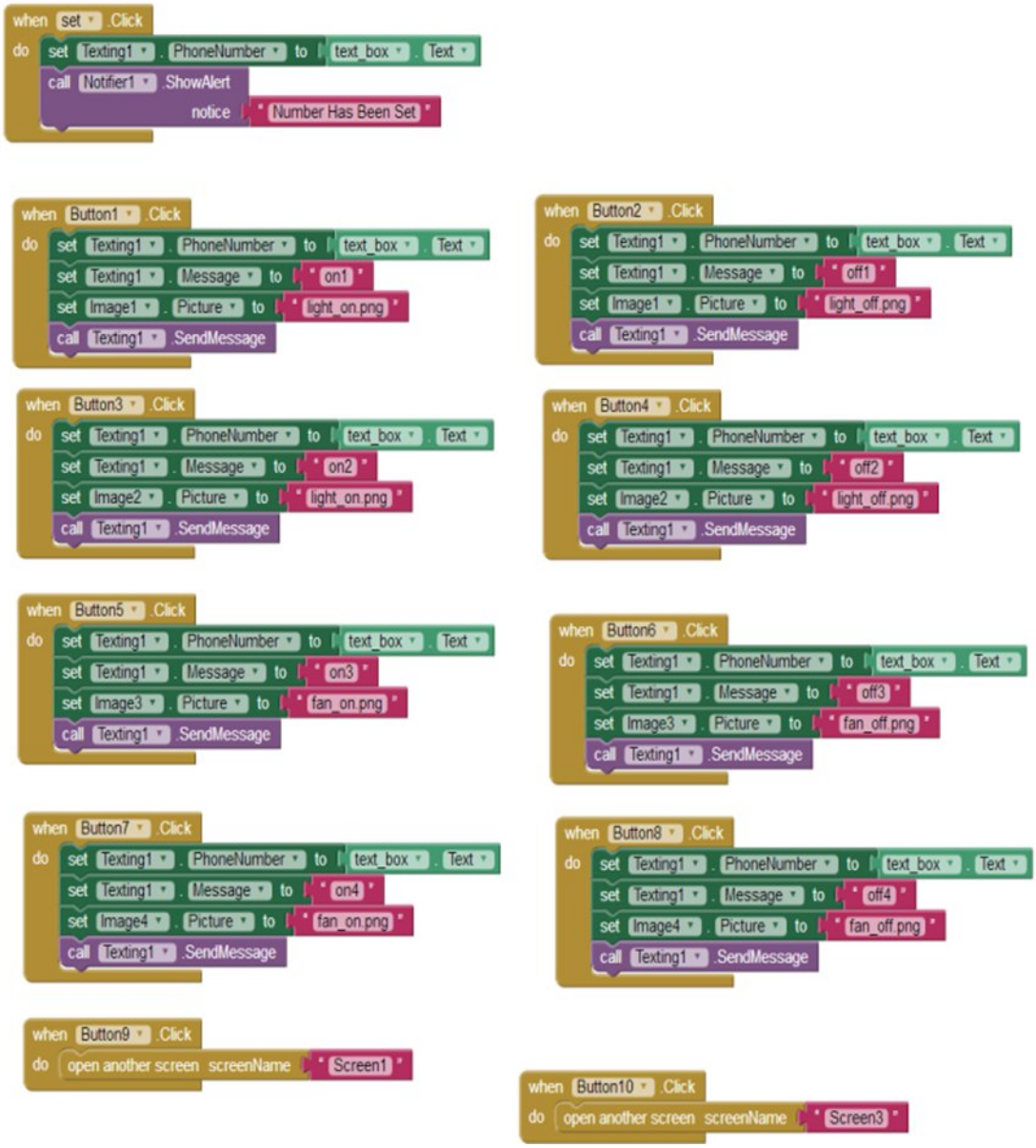

Figure 4.3: Blocks behind the second screen

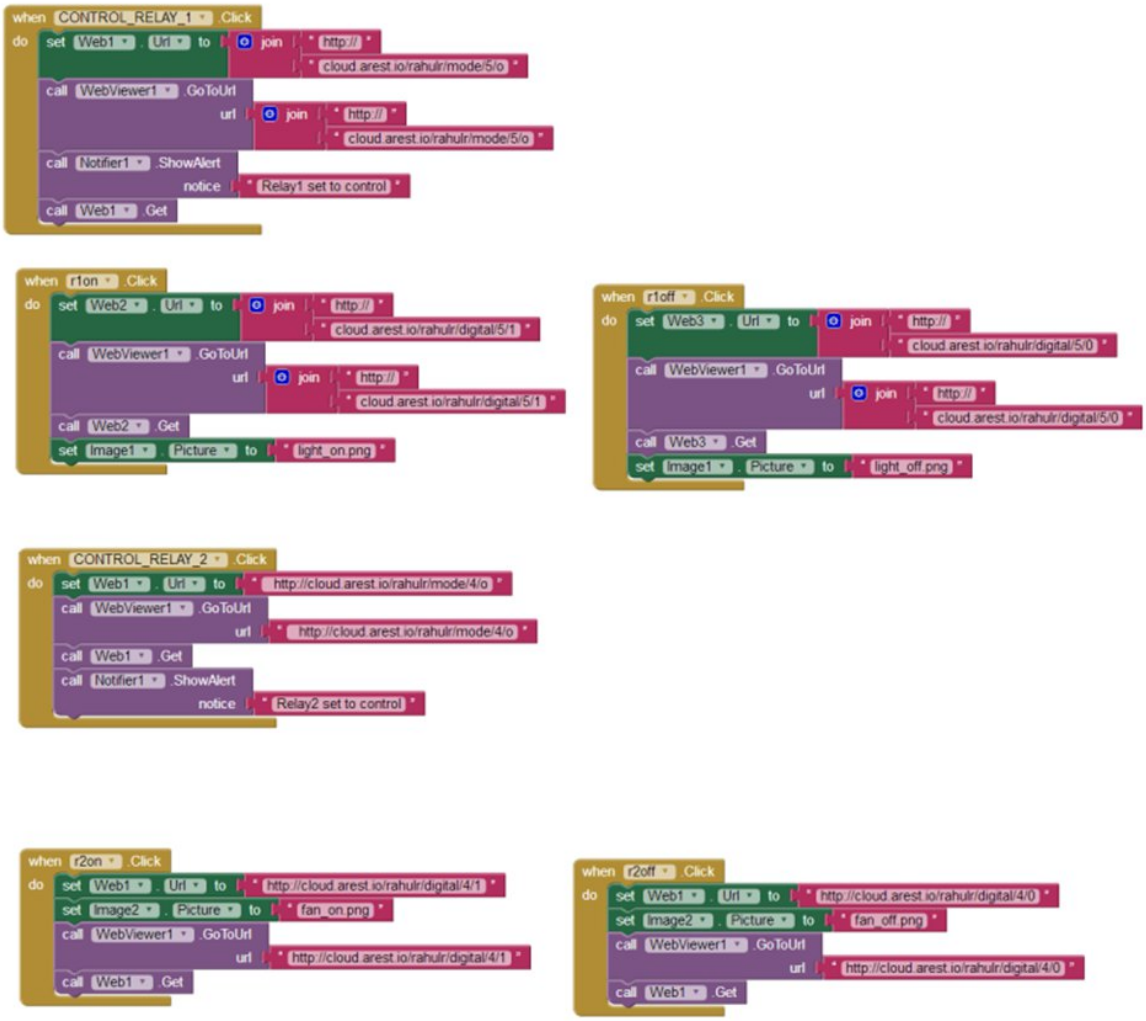

Figure 4.4 Obstacles positioned below screen three

Subsequently, activate the on/off switch for the appropriate relay. To turn off the corresponding relay, press the "off" button. The status of the relay will determine how the image is changed. This will bring the UI up to the required level of quality. This web-based player will show the status of the relay when the user configures it for control.

V. Conclusion

Without a doubt, home automation is a technology that can automate a domestic environment. Individuals may manage their electrical gadgets with Home Automation systems and configure control actions on a computer. The system's wide capabilities make it particularly intriguing. A user may operate and monitor almost all electrical gadgets using the ease of a basic mobile phone. This enables consumers to be certain that their possessions are safeguarded and that the television and other electrical devices were not left operational upon their departure from the residence, exemplifying only a few of the many applications of this technology. The final product will have a minimalist design, facilitating user interaction. This will be crucial due to the extensive array of technological expertise possessed by homeowners. Future enhancements to the proposed system include:

• Detection of power theft.
• Functionality as a reminder for bills or tariffs.

References

[1] Sinha, Sahil & Raj, T & Kumar, Sumant. (2023). Smart Home Automation Using Iot With Cloud Computing.
[2] Umer, Muhammad & Sadiq, Saima & Alhebshi, Reemah & Sabir, Maha & Alsubai, Shtwai & Hejaili, Abdullah & Khayyat, Mashael & Eshmawi, Ala & Mohamed, Abdullah. (2023). Iot Based Smart Home Automation Using Blockchain And Deep Learning Models. Peerj Computer Science. 9. E1332. 10.7717/Peerj-Cs.1332.
[3] Doddam, Nagaraj &, Dr.E.N.Ganesh. (2023). ENHANCED FACE DETECTION USING COST EFFECTIVE HOME

AUTOMATION. European Chemical Bulletin. 12. 1881-1893. 10.31838/Ecb/2023.12.S3.241.
[4] Khan, Muhammad & Ahmad, Ijaz & Nordin, Anis & Ahmed, El-Sayed & Mewada, Hiren & Daradkeh Phd., P.Eng, Dr.Yousef & Rasheed, Saim & Shafiq, Muhammad. (2022). Smart Android Based Home Automation System Using Iot. Sustainability. 2022. 1-17. 10.3390/Su141710717.
[5] Mittal, Shreya & Bharadwaj, Tarun & Malleswari, T.. (2022). Survey On Voice-Recognized Home Automation System Using IOT. 10.1007/978-981-16-5652-1_8.
[6] Baballe, Muhammad. (2022). AN ORGANIZED STUDY OF SMART HOME AUTOMATION SYSTEMS. 1. 1-6.
[7] Adoghe, Anthony & Owuama, Ebere & Oguntosin, Victoria & Morawo, Boluwatife. (2022). Design And Implementation Of A Low-Cost Cloud-Powered Home Automation System. Journal Of Engineering Science And Technology Review. 15. 177-192. 10.25103/Jestr.153.20.
[8] Baballe, Muhammad. (2022). A Systematic Investigation Of Smart Home Automation Systems: Review.
[9] P., Sathish & Rajamohan, Kumudham & Kumar, D. & M., Dhamodharan & S., Vetrivel. (2022). Smart Home Automation Using Raspberry PI 4. AIP Conference Proceedings. 2463. 020012. 10.1063/5.0080751.
[10] Katkar, Smita & Kharade, Kabir & Kharade, Shraddha & Kamat, Rajanish. (2021). Review Of Home Automation Strategies Analysis Using Sensors.