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Cadio Interfaced Smart Home with IoT Enabled Automation Systems

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Abstract - Smart home automation integrates advanced technologies for efficient, convenient, and secure residential living. It employs sensors and actuators to collect data and automate physical tasks. Connectivity protocols Wi-Fi enable seamless communication among devices. This project presents a simpler IoT based home automation system using ESP8266 and Cadio app. This project includes security features include smart user behaviour lighting, motion detection, automatic water level control and locks, enhancing real-time monitoring and remote access. Voice control via virtual assistants like Alexa and google assistant adds a hands-free dimension to device management. Artificial Intelligence teaches user behaviour, enabling the system to automate routines over time. Customization options allow users to create personalized scenarios and routines tailored to their preferences. Here there is no code needed and it is easy to integrate and control. Using this IOT based home automation system reduces electricity bill of consumer and reduces carbon footprint at lower cost by implementation of this home automation project.

Key Words: Cadio, Smart Home, Home Automation, IoT, Sensor, NodeMCU

1.INTRODUCTION

IoT is sweeping the globe because it is incredibly efficient in addition to making life easier. Occasionally, IoT is used to create a new, ground-breaking technological advancement. In the end, humans wouldn't have to rely on these slower and more labor-intensive conventional machines. Our goal is to promote electronics and machine-to-machine communication by presenting this project, which combines everyday appliances with the internet. With just a touch of a button on our device, our home automation system prototype can operate everyday appliances like fans, lights, and other loads. To use fewer embedded sensors and increase the use of wireless fidelity. The main objective of this project is to develop a home automation system using an ESP8266 NodeMCU with being remotely controlled by integration with Cadio app. By this the user can control and monitor their devices by any smartphone via voice control. Modern houses are gradually shifting from conventional switches to centralized control systems, involving remote controlled switches.

Have you ever imagined living in a world where we could just use our voices to tell our household appliances to operate when needed? Having an automated home with voice activation is no longer a requirement for being a billionaire. With this prototype, we can affordably use our voices to control electronic devices like TVs, fans, light fixtures, and the internet. Anything that makes it easier for us to utilise the appliances, heating system, and lighting in our homes more effectively is considered home automation. Using a smartphone or other networked device, a "smart home" is a viable home design that enables internet-based remote control of devices and appliances from any location. [1]. Effective security, remote monitoring, and astute Smart environments, smart appliances, health tracking, remote monitoring, and enhanced security are all features of smart homes [2]. Technologies used in wireless home automation systems include Bluetooth, ZigBee, GSM, and wi-fi based systems [3]. The automation system for smart houses consists of wireless home automation system [4], programmable controllers [3], sensors [5], voice activated assistants [4], and wireless home automation system [6]. Smart houses make use of automation system applications for energy management, security, entertainment, cooling, and other purposes [2]. Another difficulty is achieving interoperability, which will make it easy to integrate different smart devices with the current internet [7]. It might be as basic as controlling a few lights with a remote or automatically, or it can be a full system that manages every important component. It can be as simple as remote or automatic control of a few lights, or it can be a complete system that controls all major parts of our home. Custom set to our own personal preference. It focuses on wireless home automation technologies - these are easy to retrofit into existing homes now need for new wiring and no ripping up the carpets or drilling holes in the walls. Each technology has its own unique features and benefits that make some more suited to applications, whilst others can be seen for all general home automation installations. At present, most homes have some “smartness” because various devices have built-in sensors or electronic appliance controllers [8].

To monitor and operate home appliances, devices in a SH system can be connected to one another and accessed via an access point (AP) [9]. An all-in-one SH automation system, for example, can monitor and control lights, thermostats, TVs, door locks, cameras, washing machines, and refrigerators. When such a system is given an Internet connection, it transforms into an Internet of Things (IoT)-based automation system [10]. One of the numerous advantages of home automation systems is that they lower energy expenses and electric consumption. Furthermore, home automation technologies improve safety and security in homes [11]. For instance, certain appliances can report to fire stations in case of an emergency, and other systems can alert homeowners when any motion is detected at home while they are away.

The physical programmable circuit board that makes up NodeMCU is the same as that of any other development board, like Raspberry Pi or Arduino. The Arduino software, an integrated development environment (IDE), can be used to programming NodeMCU by writing the instruction codes and

uploading them to the microcontroller. By using devices to access and operate all household appliances and sensors, smart home automation systems have improved. The most popular devices are created as web-based dashboards integrated with open-source IoT platforms or as mobile apps running on top of smartphone operating systems like Android or iOS. All sensor data is collected and processed by IoT cloud computing servers into useful information that can be used to meet needs after the data is uploaded to the server. Through the internet, people may communicate and exchange info. "Home automation" is a notion that has been around for a while. Both "smart home" and "intelligent home" were created to describe the idea of home networking appliances. With home automation systems, lighting, security, and other appliances and systems may be managed and observed from a distance. It enhances user comfort and simplicity of use, security, and energy efficiency most of all. Home automation systems are gaining popularity among consumers and are a booming market in today's market. An IoT-based monitoring and control system for home automation provides an effective example of an Internet of Things (IoT) deployment for monitoring and controlling household equipment via the Internet. The proposed framework is predicated on the IoT (Internet of Things) implementation for monitoring and managing household appliances through the Internet is shown by an IoT-based monitoring and control system for home automation [12]. The suggested system is based on the Internet of Things, which intends to create a network between embedded and sensory devices that can store, analyze, and transmit data.

The least expensive discovery device we may employ at home is the infrared (IR) sensor. The sensor detects sound and sends a signal to the raspberry pi. An automated home automation system that integrates Internet of Things (IoT) connectivity with computer vision, online services, and additional mobile applications is described in Internet of Things for Home Automation [13]. The training methodology places a strong emphasis on using sensors and Cadio to communicate and receive data and instructions to and from the end user. This paper addresses one method to home automation that is based on Internet of Things software.

2. HOME AUTOMATION SYSTEMS

The Internet of Things (IoT) can also be used to build new ideas and a large development space for smart homes, which can offer intelligence, comfort, and an enhanced quality of life. As a result, home automation is considerably more common these days. The "smart house" concept was first presented by the National Association of Home Builders (NAHB) in 1984. Even though this subject has seen years of research and improvement, automating a building is still a very costly task. This raises the question, "Why is home automation so expensive?" Initially, interoperability is brought about via home automation: lighting may be dimmed or switched on based on daylight, and the temperature can be set to a specific degree based on certain conditions. Second, remote access is implied by home automation, including monitoring the house using a laptop or even our own cell phone. Third, a smart home automation system should have the possibility to be extended or reduced when needed. Therefore, it can bring expandability and energy savings. Nowadays, one of the hottest topics in the media is related to energy conservation. Automation systems can help with energy savings by, Simple features like turning on the sprinkler at a certain time of day or spotting burglars in the middle of the night are just a few examples of what these smart houses can do. More sophisticated ones use sensors to detect when someone is in the room, adjust the ambient light, regulate the temperature, or control the volume of the music based on a variety of criteria. "Domotic" is a field that includes all of a smart home's features. Journalist Bruno de Latour first used the term "domotic" in 1984. It is a system made up of several technologies and services that enhance life in terms of comfort, safety, and technical management. Things can occur on their own, when they're needed, or as they are scheduled by the users. However, the user does not lose control over the house, manual operation being available also.

Fig -1: Smart home and key components

Domotic systems often require data collection from multiple sensors to automate temperature and light adjustments. Furthermore, a variety of tasks can be carried out with the help of these sensors, including operating windows and curtains without the need for human intervention, opening, locking, or unlocking the garage gate, regulating the temperature inside the home, illuminating each room appropriately, activating the sprinkler system when the ground becomes excessively dry, and more. Nonetheless, because home automation is still a relatively new idea, it is becoming more and more popular on the market, attracting the interest of academics. This results in the development of new technologies capable of home automation.

Energy conservation, comfort, convenience, entertainment, safety, security, ease of use, and peace of mind are just a few benefits of SH automation systems. To determine the issues with the current home automation systems, research has been done. Because they are expensive and need a lot of maintenance, most current systems are not appropriate for many users. Furthermore, current home automation systems have clunky user interfaces and lack Internet of Things technologies. Certain SH automation technologies now in use disregard security and safety. To prevent mishaps, safety and security are crucial components of any SH. Because the original installer might not have had sufficient expertise of the system's installation and commissioning, some existing SHs lack essential capabilities and functionalities. Current systems' restricted wireless transmission range connection results from their utilization of short-range wireless interfaces, such as ZigBee, Bluetooth, and Wi-Fi.

Smart homes that employ technology to save energy costs and increase energy efficiency while offering comfort and convenience to their residents are referred to as energy-efficient smart homes [14]. An intelligent home's home energy management system is also essential to energy conservation [15]. For several years, the idea of "home automation" has been around. The names "smart home" and "intelligent home," which came later, were used to present the idea of networking appliances inside the home. Home automation systems, or

HASs, provide remote status monitoring and centralized management over the lighting, security, and other equipment and systems in a home. Energy efficiency is made possible by HASs, which also enhances security systems and user comfort and ease. In the current emerging market, HASs are becoming more and more popularity and has attracted the interests of many users. HASs comes with its own challenges. Mainly being, in the present day, end users especially elderly and disabled, even though hugely benefited, aren't seen to accept the system due to the complexity and cost factors.

A system that adds convenience and lowers electricity waste by offering a wireless remote-control solution for the lights and fan that can be used with Wi-Fi capable portable devices like smartphones. Although this idea is not new, its complexity, features, and cost make it only appealing to tech-savvy consumers; the project's target customer does not care about any of these things. In this project, devices like fans and lights that are linked to the Main Control Unit (MCU) can still be operated remotely from a smartphone or computer screen. A very basic Graphical User Interface (GUI), which is simple to use and understand for the intended user, is employed to accomplish this. Additionally, this system may be fitted with a monitoring feature.

3. AUTOMATION SYSTEMS FOR SMART HOMES

An SH is the integration of technology. It enables users to achieve a better quality of life through technology. SH is a voice assistant for the remote control of all home appliances. SH can help to improve security, comfort, convenience, and energy management. SH aids elderly and disabled people by providing them a safe and secure environment for house and user. Basically, SHs can be categorized into two types, namely, wired and wireless systems. Wired systems use optical fibers, bus lines, and power lines. Wireless systems are a combination of a sender and a receiver. At present, many new applications use wireless technology, such as radio waves or infrared, to communicate with other devices.

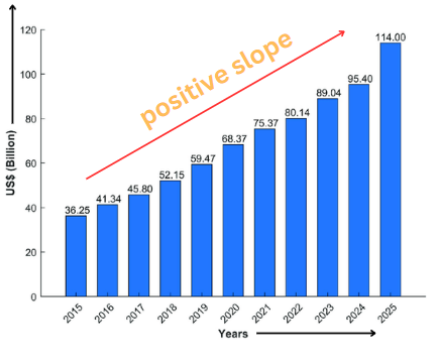

Fig -2: Home Automation Market Size and Analysis

Home appliances that are Bluetooth-based are linked, tracked, and managed by embedded Bluetooth technology [16], [17]. It is less expensive, has a hundred-meter operating range, and uses a lot of power. It has issues with weak encryption. This technology can be interfaced with microcontrollers, Arduino boards, and other devices. It can be accessed from a distance via GPRS or GSM.

Low-cost home automation is possible with the integration of mobile technology [18]. For instance, the home server manages the appliances, but the server functions based on the control signal that it receives from the mobile device via cellular modem. The devices could be mechanical, electrical, or electronic. These machines deliver data to the sensor, which then transmits it to the microcontroller. GSM receives a command signal from a microcontroller. The GSM chooses the proper control signal to operate the machine based on the command it has received.

When a wireless application control system is SMS-based, the authorized user can use SMS to modify the password. Using SMS, which sends a control signal from the registered cellphone number, lighting in the house can also be turned on or off from a distance. Password hacking is a weird drawback that attackers can exploit. Additionally, images can be used with a facial recognition system. It cannot tell the difference between a human and an image. Internet-based communication is a common strategy that is both flexible and scalable [19], [20]. It is inexpensive and has a large bandwidth. These days, interacting technologies like laptops and mobile phones are a regular part of our lives. With an internet connection, authorized users can access home appliances data using username and password. Each appliance has a sensor connected to the interfacing device via device controller. It communicates the status of the device to the user and passes the user command to the device. Some of the demerits are if the people or the user doesn't change the password for a long time it is prone to phishing attacks. It may also lead to leg intimate access, browser- based attack and password attack.

IoT and wireless sensors allow for remote control of simple equipment. IoT offers a cloud platform to make decisions by analysing vast amounts of data using a variety of data methodologies. However, achieving information integration is the primary issue of IoT [21]. The Internet of Things may use a device-to-device, device-to-cloud, or device-to-gateway communication architecture. Device to Device refers to the exchange of information between at least two devices. This model can be used with Bluetooth, WiFi, the internet, or other networks. For instance, turning on or off the light requires using two devices, which are shown in figure 3: the light and the switch. Between a device and a cloud, as well as between a device and a gateway, the communication model is delineated in figure 4 and 5.

Fig -3: Communication between two devices

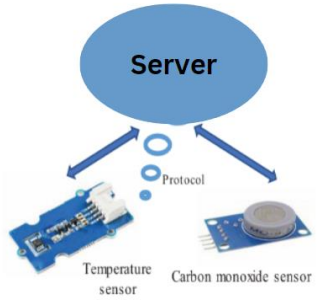

Fig -4: Communication model between devices and cloud

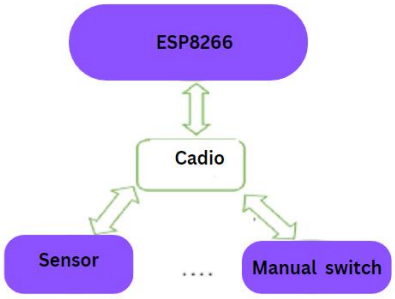

Fig -5: Communication Model Between Devices and Gateway

Table -1: Summary of all the Smart Home Automation Methods

Method	Topology	Power	Speed
Bluetooth	piconets	Very Low	Fast due to proximity
GSM	Star	Low	Slow due to delivery issues
WiFi	Star	Very High	Slow due to interfaces
IoT	Mesh	Low	Fast

3.1 Cadio

Cadio is a complete home automation platform. We can control any “supported by cadio” smart home devices. With cadio can control our devices, set timers, schedules, linking, notifications and other features. cadio supports on/off devices, dimmers, rgb, digital humidity/temperature devices, digital sensors, shutters and ir controlled devices. cadio was developed by “egycad smart solutions” with a great ambition to give high quality smart home experience. Developers can make their devices supported by cadio using a very easy and powerful api.

Fig -6: Cadio

3.2 IoT

In [22], a little web server, a smartphone, software applications, and controlling hardware were used to construct an Internet of Things (IOT) based control system and monitoring for home appliances. IoT and Wi-Fi based smart home systems are regarded as the most adaptable and user-friendly options because of their numerous smart features and capabilities [23].

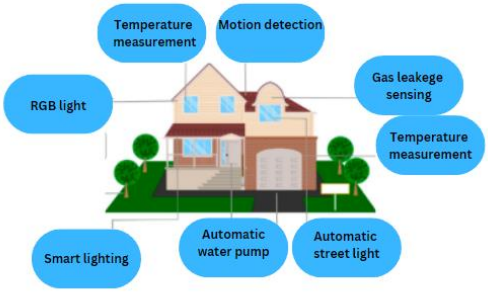

Fig -7: IoT Based Smart Home

The term "Internet of Things" has undergone significant evolution due to the confluence of many technologies, machine learning, embedded systems, and commodity sensors. IOT is a network of networked, interconnected devices that have been given unique identifiers (UIDS) to facilitate data transfer and device control. It lessened the need for direct human engagement when using technology. IOT is an advanced automation and analytics system that uses big data, artificial intelligence, networking, sensing, and sensing technologies to supply entire systems for a good or service. When used in any system or industry, these systems enable increased performance, control, and transparency.

3.3 Sensors

Sensors are essential to automation because they detect and measure a wide range of factors in a system or environment. These sensors are devices that translate physical phenomena into electrical signals that automation systems can understand, such as temperature, pressure, light, motion, proximity, or other characteristics. They provide real-time data for control, monitoring, and decision-making, acting as the automated processes' eyes and ears.

Fig -8: Sensors

3.3.1 Humidity Sensor

The quantity of moisture or water content in the air is referred to as humidity [24]. Four-pin DHT11 is a well-known Humidity sensor [24].

3.2.2 Motion Sensor

Motion sensor and human body detection sensor are achieved by Passive infrared sensor [25].

3.2.3 Gas Sensor

A common sensor for identifying several gases, such as propane, methane, and smoke, is the MQ2 gas sensor [26]. It is low-cost sensor with broad gas sensitivity that is requently utilized in the detection of gas leaks [26]

3.2.4 Light Sensor

Photoresistors, sometimes referred to as Light-Dependent Resistors, are the most popular form of light sensor utilized in a light sensor circuit (LDR) [27]. Photoresistors evaluate the relative light levels throughout the day and determine whether a light is on or off [27].

3.3 Node MCU

It is a microcontroller built on the Arduino platform that also includes an ESP8266 Wi-Fi chipset [28]. This microcontroller has a storage capacity of 4 MB and 128 kB of memory [29]. It is frequently used to eliminate the need for a central processing unit or for a single Internet of Things application. Due to its ability to connect to the global network via Wi-fi without requiring any additional hardware or modules, the Node MCU enjoys a significant cost advantage over its competitors [29]. It uses the Lua scripting language for programming, which makes WiFi-enabled gadget prototyping faster. The NodeMCU firmware can be flashed onto the ESP8266, and then developers may use its APIs to control GPIO pins, WiFi, and other features. NodeMCU's capacity to run Lua scripts enables users to specify actions, such gathering sensor data, interacting with servers, or managing devices. Its adaptability and simplicity make it a popular choice for IoT enthusiasts, enabling quick and efficient development without the need for extensive low-level programming.

Fig -9: Node MCU ESP8266

3.4 Relay Module

A relay module is an electrical device that consists of one or more relays mounted on a single board. A relay itself is an electromagnetic switch that allows a low-voltage circuit to control a high-voltage circuit. The module typically includes a relay coil, contacts, and often an optocoupler for electrical isolation. It acts as an interface between a microcontroller or other low-voltage control system and high-power devices, such as lights, motors, or appliances. Relay modules are commonly used in automation and control systems, allowing for the remote or automated switching of electrical loads. They provide a convenient and safe way to control high-power devices using lower voltage signals from microcontrollers or other digital control systems [30].

Fig -10: Relay Module

3.5 Voice activated assistants

Speech assistants are software agents that can comprehend spoken language and respond with fictitious voices [31]. The most well-known examples are Google Assistant, Apple's Siri, Microsoft's Cortana, and Amazon's Alexa; all of these are built into smartphones or smart speakers [31]. These gadgets can perform simple math and informational tasks, but most crucially, they can manage Internet of Things devices. These gadgets can even make phone calls and read and transmit emails, texts, and other messages [31]. These gadgets were examined by Edu et al. [32]

4. DESIGN AND IMPLEMENTATION

A smart home with IoT-enabled automation systems functions through the integration of various devices, such as lights, thermostats, and security cameras, into a unified network. These devices are equipped with sensors that collect data on environmental factors, including temperature, motion, and light levels. Connectivity is established through wireless technologies like Wi-Fi, allowing these devices to communicate with Cadio IoT platform.

4.1 Proposed System Implementation

We'll make a very simple loT-based home automation project using the ESP8266 and Cadio. To make this project we don't have to write a single line code, upload the Cadio firmware to ESP8266, then configure it from their mobile app. After that, they can be able to control all appliances with Cadio, Google Assistant, Amazon Alexa. and if there is no internet, still y can control the appliances manually with switches. and can also add timer and create a scheduler to control these appliances automatically. We can monitor the real-time feedback on Cadio. Also, we can control it with voice commands like, "turn on light" and "turn off light". Typically, a web dashboard or smartphone app serves as the centralised interface that gives users control and monitoring capabilities. Automation rules allow users to tailor and optimise their home environment for convenience and energy efficiency. These rules are activated by conditions like time or specific events. Enhancing flexibility, remote access features enable users to control their smart home appliances from any location. Hands-free operation is made possible through integration with a voice assistant like Alexa. To protect user data and privacy, security measures including encryption and secure authentication are put in place. Certain systems employ machine learning algorithms to adjust to the actions and preferences of users over time, resulting in a more efficient and customized living environment. Smart houses with IoT automation are a disruptive solution because of these systems' interconnectedness and adaptability, which offer not only convenience and security but also contributing to sustainable and intelligent living. Determining the devices and systems to be automated as well as creating requirements that grasp the automation's reach are crucial steps in designing and executing a smart home automation system. In order to offer remote control, automation, and monitoring, smart home automation implementation entails integrating multiple systems and devices within a household. Choosing appropriate devices, establishing communication via wireless protocols (Z-Wave, Zigbee, and WiFi), configuring a central control mechanism (smart hubs, applications, and voice assistants), and making sure security precautions are taken are all common steps in this process. By giving consumers, the ability to remotely control and automate devices such home lights, HVAC, security cameras, entertainment systems, and more via a centralised interface, the aim is to improve convenience, energy efficiency, and security.

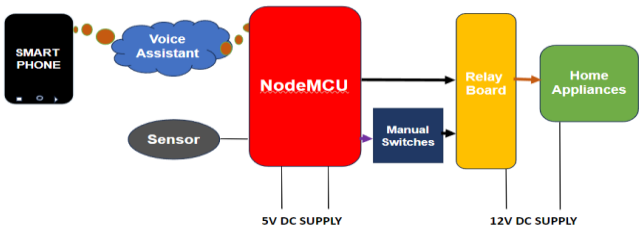

Fig -11: Design

Here we want to connect and control our devices with manual switches and by Cadio and voice activated by Alexa and Google assistant. So, we are connected our devices through relay module to our microcontroller NodeMCU (ESP8266). And adding sensors like DHT11 humidity sensor for temperature and humidity measurement, PIR sensor for automatic motion detecting lighting, IR sensor for automatic water pump control, LDR sensor for automatic street lighting and a gas sensor (MQ-5) for detect the presence of gaseous in home and buzzer triggers.

Here we have 7 LED lights at sit out, master bedroom, bedroom, dining, kitchen, toilet, streetlight. And fan, motor and a buzzer. So, 9 home devices and a security alarm. Also, we are connecting 8 manual switches for control devices at without internet connection time. Here we designed a small house model to implement this device like bedroom 2, hall 1, dinning 1, kitchen 1, sit out 1 and toilet 1. Added an outdoor streetlight and a water tank outside. So, these all devices and linked with sensors and cadio app.

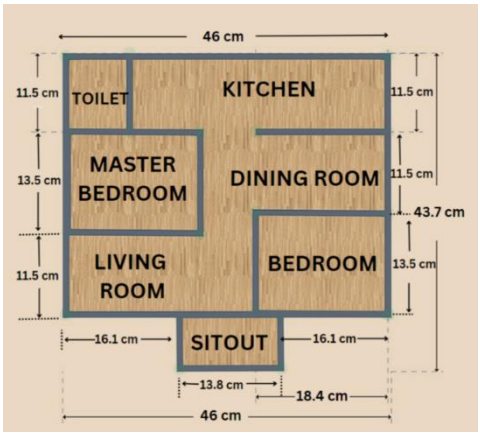

Fig -12: Home layout

Fig -13: 3D Model house prototype

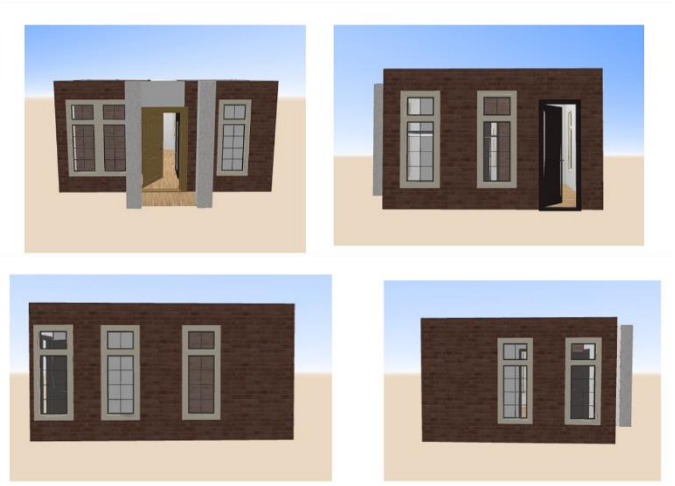

Fig -14: House prototype side views

And making a small 3D model of house (46 cm x 43.7 cm) using Muti wood. Muti wood is used because it is affordable, widely available, sturdy, and can be cut easily. Then, we cut the small pieces of each wall and attached each other with flex kwik glue to strengthen the attachment. The prototype is painted to improve its appearance. A primer is applied on the surface before painting with the selected colour. A smooth surface is an important feature of the prototype.

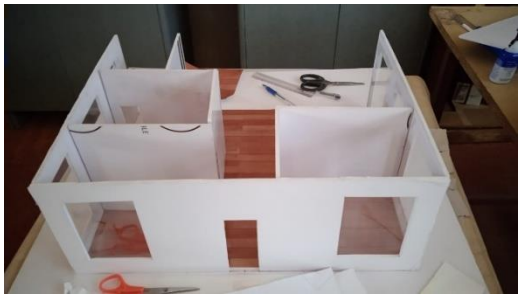

Fig -15: Model Making

We will add a digital sensor, and a DHT to measure temperature and humidity, and link them with our devices to create automation. Digital sensors are natively supported in CADIO platform. We can easily add digital sensors to our unit, and use them to monitor their status, or send orders to our devices to create automation. We are using 4 sensors to the ESP8266, the IR sensor, the MQ-5 gas sensor, the PIR motion sensor, and the door sensor. every sensor VCC is connected to the VCC, GND to GND, and the data output pin is connected to an ESP GPIO. The MQ-5 has 2 output pins, digital and analog. We will use the digital output pin. The door sensor has only 2 pins, we will connect one of them to the ESP GPIO, and the other to the GND, and add a pullup resistor between the ESP GPIO and the VCC. To add sensors to unit, all need to do is add them to the info file devices table, and select their device type as sensor, and select their GPIOs. They will appear on the app interface as sensors without any details, we should now rename them, and select their icons. Some sensors' data output pin is turned to HIGH when activated, and some to LOW, we can set the sensor mode to inversed to correct its status. All the software will be handled by CADIO platform, we just need to install CADIO firmware on the ESP, and tell CADIO some information about our unit, and done.

A DHT11 temperature sensor is used because of its advantages, such as low cost, long-term stability, excellent quality, fast response, strong anti-interference ability, long distance signal transmission, digital signal output, relative humidity and temperature measurement, and precise calibration. This temperature sensor is used to detect the temperature and humidity of the room. It triggers the buzzer when the temperature is higher than the room temperature. It also sends data to the NodeMCU, which sends a command to switch ON the mini fan in the prototype or air conditioning (AC) system in the real implementation of the system. A PIR motion sensor is utilized to detect the presence of humans in the home and is sent to the NodeMCU, which responds by taking the proper action. For example, the obtained signals from PIR can be used to open/close the doors or to switch ON/OFF the lights. In addition, PIR sensor output can trigger the buzzer and send notifications to the server when a person is detected for security purposes when the homeowner is away. Similarly, MQ2 gas sensor is utilized in this system to detect gas leakage at home. This gas sensor is sensitive to a range of gases and is used indoors at room temperature.

Addressable RGB strips are natively supported in CADIO platform. We can use the RGB devices to control the light color and brightness. To add an RGB device, all we need to do is select RGB as a new device type from the info file devices table, and select its GPIO, we can also set a switch for it by selecting the switch GPIO, we can add multiple RGB devices to the unit. We are using now WS2812B RGB strips models. Addressable RGB strip has more benefits than the regular RGB. It uses only 1 GPIO, and there is no need to a special power circuit to power it. just wire the VCC and GND wires to the power supply, and the DATA and GND wires to the ESP. Now the RGB devices are appear in the app Interface, and we can control them from the CADIO app. We can also control them using the switches, and the status is automatically synced with the app. Some RGB strips models use different ordering for the strips LEDs. if the output color is incorrect, can go to settings, and set the RGB color system to match RGB strip order, for example, the WS2812B strip order is BRG, and I have chosen it to get the correct color. When we want to control regular RGB we can add to circuit an addressable RGB IC like UCS1903 IC and will have normal 3 PWM pins for the red and green and blue, then can normally continue building power circuit, and will be able to control it using only 1 ESP GPIO.

Monitoring temperature and humidity are among important features in smart homes, even our moods change with changes in the temperature and humidity in CADIO platform, we can easily add a DHT sensor to monitor temperature and humidity, and link our devices to it, to create an automation. To add a DHT device, all we need to do is select a DHT as a device in the info file devices table and select its GPIO and simply the DHT will appear as a device in the unit devices

The DHT device will display the temperature and the humidity on the main interface. And when we click on it, the device page will open. From settings, we can select the DHT type, it can be DHT11, or DHT22. DHT11 is cheaper, and DHT22 is more accurate and has more range. With a DHT device added on the unit, all the unit devices will have a linking section activated in their device page. A long press on any device will open the device page, and from linking, we can select linking type, and link the device with temperature or humidity, we can adjust the linking temperature or humidity

range, and set a delay when switching the device on or off. And after saving our settings, the device will be linked with the DHT, and it will be turned on if the temperature or the humidity is in range and will be turned off if it isn't. Whether it's adjusting the temperature before arriving home, turning off lights automatically, or receiving alerts about potential security concerns, smart home automation offers convenience and peace of mind.The deployment of a smart home automation system is suggested by this project. Automating your home entails using manual switches to operate appliances, entertainment systems, and lighting with the least amount of human interaction. We can also incorporate alert systems and access control into home security. One significant component of the Internet of Things ("IoT") is home technology. The locally located keen automation framework in this working framework evaluates the enhancement of a low-cost security framework.

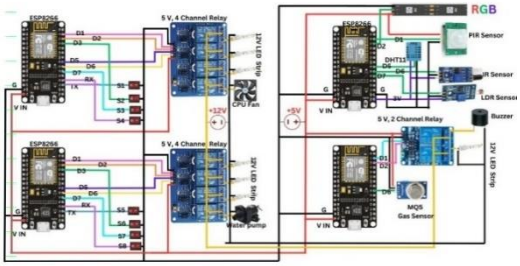

Fig -16: Circuit Diagram

We connected 8 channel 12V relay, manual switches, sensors like DHT 11, PIR motion sensor, IR sensor, LDR and RGB lights to ESP8266 and configured through cadio app. So, with help of internet, we can control our devices with voice activated or by clicking device icon and at there were no internet using manual switches we can able to control it. We can make the sensors send orders to our controllable devices, from the orders section we create some orders, and simply save it! and it will start working immediately. We can make the sensors send orders to any other unit linked to our account. We can set notifications to be pushed when the sensor status is changed, I will now tell CADIO to send me notification when the gas sensor is activated. Using RBG lights we can change the colors, adjusting the brightness with user interest. Here we are using DHT11 humidity sensor from this data link the device with temperature or humidity, we can adjust the linking temperature or humidity range, and set a delay when switching the device on or off. And after saving our settings, the device will be linked with the DHT, and it will be turned on if the temperature or the humidity is in range and will be turned off if it isn't. When the MQ-5 gas sensor smells of any gas, it activates and appears in the application. We can make the sensors send orders to our controllable devices, from the orders section we create some orders, and simply save it and it will start working immediately. We can make the sensors send orders to any other unit linked to our account. We can set notifications to be pushed when the sensor status is changed, CADIO to send notification when the gas sensor is activated. Using PIR sensor, we can use it outside for motion detection to turn ON the light. Here we used IR sensor for automatic water level control operation. And LDR sensor is used for automatic light at nighttime only.

By this we can be able to control all our appliances with Cadio, Google Assistant, Amazon Alexa, and if there is no internet, still we can control the appliances manually with switches. and we can also add a timer and create a scheduler to control these appliances automatically and we can monitor the real-time feedback on Cadio. This function helps elderly people to use mobile applications and improve their mobility. Google Assistant was implemented because of its user-friendly features, which are updated with each new generation and are applicable for use by elderly people.

5. RESULT AND DISCUSSION

By implementing our home automation system to homes and industries we can control and monitor our devices with Cadio app, Google assistant, Alexa and manual switches at lower cost. Sensors help the user applications automatically without human interaction. The PIR sensor automatically turns ON/OFF when there is a change in motion, so it helps the owner light more effectively. By the automatic water tank control using IR sensor the user can save wasting of water and energy by automatic cut offing the water pump. The LDR sensor detects light levels and is often used in automated lighting control systems, so the flood light turns on at nighttime only. Gas sensor MQ2 detects the presence of LPG in house, and it gives information to user by notification to phone and alarm triggers, so it helps in security and protection to the house and user. Also, by RGB light the user can change the light brightness (dimmer circuit) and color by Cadio app with the user interest.

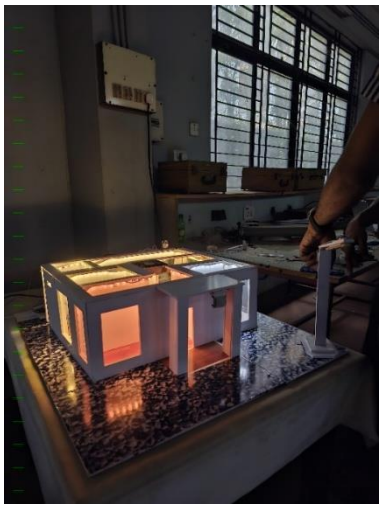

Fig -17: Final Model Prototype

Table -1: Summary

Method	Module	Software	Sensors used	Power	Energy Saving	Cost	Speed
Bluetooth	HC-05+ Uno	Cloud	No	low	low	High	low
IoT	ESP8266	Cadio	DHT11 LDR IR MQ5 PIR	Low	High	Low	Fast

6. CONCLUSIONS

The need for smart home automation is evidently growing due to busy lifestyles and mundane routines. This study presented the design, fabrication, and implementation of a portable, user-friendly, and low-cost automation system for SHs based on IoT. The repetitive daily tasks usually take up a lot of time that could be otherwise utilized in more important activities. A smart home application enables users to lead a stress-free life as they can manage all their activities effortlessly. The main aim of home automation is to conserve energy. It is evident from this project work that an individual control home automation system can be cheaply made from low-cost locally available components and can be used to control multifarious home appliances ranging from the security lamps, the television to the air conditioning system and even the entire house lighting system. And better still, the components required are so small and few that they can be packaged into a small inconspicuous container. The home automation system was tested a number of times to control different home appliances used in the lighting system, air conditioning system, home entertainment system and many more. Hence, this system is scalable and flexible. The project's emphasis on energy efficiency has not only contributed to cost savings but has also aligned with our commitment to sustainability. Automated lighting and climate control systems adapt to our preferences and daily routines, optimizing energy usage without compromising comfort.

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