SMART AND EFFICIENT HOME AUTOMATION SYSTEM USING IOT

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ABSTRACT

Nowadays, IoT has become one of the important domains not just as an area of study, but also as a domain of implementation due to its invariable applications. Home Automation has become more of a necessity than a luxury to many households. Due to the increasing usage of mobile devices, providing security features to households through mobile devices makes a lot of sense. We are proposing a project where our main objective is to create a Home Automation System which helps us to save energy and at the same time is cost-effective and flexible. This project presents the methods used for developing Wi- Fi and Bluetooth Home Automation System for monitoring the electrical energy consumption of our houses tracked in real- time using a custom node MCU. There are many sensors that will be interfaced with the node MCU which will give us the real-time status of the surroundings and also assist us in monitoring various appliances like lights, fans, etc. Communication between people and devices will be interfaced through an android application which will help them to control the devices and will provide a real-time feed of various appliances and sensors.

Keyword : - *Home Automation System, node MCU, Wi-Fi, IOT(Internet Of Things), Android, Security.*

I. INTRODUCTION

In the 21st century, the entire world is revolutionized by digitalization. People from various backgrounds carry smartphones. A few years ago we found a significant change in how phones were developed and at the present times phones are used not just to make phone calls, but for a plethora of other reasons. Similarly, houses have also made their way from being normal to smart. This transformation came into the picture due to the advancement of IoT. Due to the rapid growth of IoT, smart homes can integrate various sensors, appliances, and robots. Consequently, many applications or use cases have been developed for mankind. Lately, home automation systems have been integrated with cloud services which have helped in real-time status updation and checking. It has unlocked new potential for controlling devices from anywhere across the globe. We can also observe a drastic surge in demand for home automation systems for many reasons. It brings security to the houses, it helps disabled people and most importantly, integration of these systems is available at affordable rates. Currently, the smart home provides the following features: Smart Refrigerator, Smart Washing Machine, Smart TV, Smart coffee maker, Smart clothing, etc. Smart homes usually provide an alert system. It is an absolutely essential part of a home automation system as it brings about security not just to the house, but also for the appliances. It provides monitoring and control for various appliances in the house. For example, we can control the lights/fans of a particular room in the house through an

app. It also brings an intelligence aspect. For example, we can set a threshold to a temperature sensor, once the threshold is crossed, the fans in that respective room can be turned ON/OFF automatically. Providing intelligence also helps in saving energy because tasks can be automated. We are proposing our project with the following features:

1. Weather forecast monitoring inside the house.
2. Safety measures are being provided using an LPG sensor and a Smoke sensor.
3. Controlling appliances like lights and fans using an android application.
4. Automating the control of various appliances based on sensor readings that are integrated with the appliances.

1.1 Benefits of our Home Automation System:

1. Cost-effectiveness is being achieved by using a custom-made Node MCU which is cheaper than a Raspberry Pi.
2. Cloud services have been integrated using Google Cloud platform (Firebase) which allows us to control and monitor our houses efficiently.
3. Integration of mobile app helps the users to check the status and control various appliances.

II. METHODOLOGY

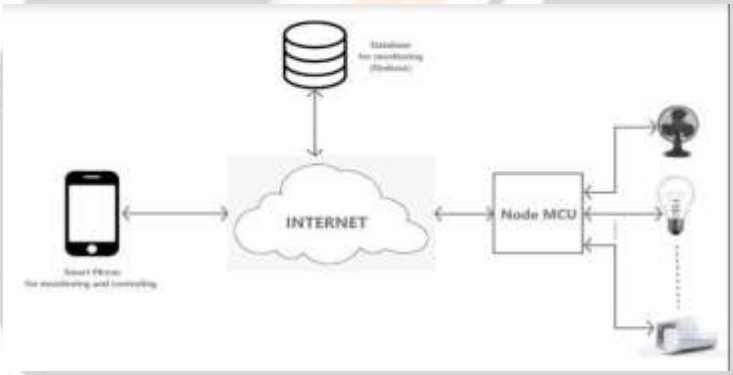

Fig -1: Schematic overview of implementation

The main intent of our proposal is to create an energy-efficient smart home automation system. The main component that we are utilizing is the custom-made IoT board that has a Node MCU integrated along with it and it also has an integrated Wi-Fi module. We are using a DHT22 temperature and humidity sensor to detect the weather conditions of our surroundings. Later, the result obtained will be stored in the cloud and will be displayed in the android app.We are also giving the option of automating the regulation of fans and controlling of lights. The readings obtained from the temperature sensor will be continuously monitored. There will be a threshold value set for the temperature readings. Once the temperature spikes above the threshold value, the fans in that particular room will switch on automatically and vice versa. Similarly, an LDR sensor will be used to continuously monitor the luminosity inside a particular room. If the room is dark, the lights in that particular room will be turned on automatically. The readings from these sensors will help us automate various tasks thereby contributing towards saving electrical energy. We are also integrating LPG sensors and smoke sensors to bring about security in the house. The LPG gas sensor helps to detect any kind of gas leakage and if in case a leakage is detected, a notification will be sent to the concerned user which will give an indication of gas leakage in the house. We are also integrating a smoke sensor in order to detect fire/smoke in the house. If the house is on fire then a notification will be sent to the phone of the concerned user. The user will also be able to control these devices through an android app. They can control and monitor the status of each and every smart appliance.

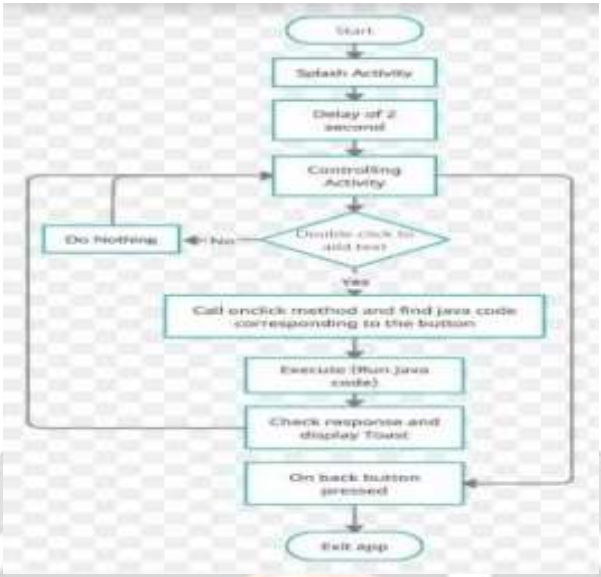

Fig -2 : Android Activity Lifecycle

2.1 WORKING :

The data from the server will be collected and the data will be stored in the Node MCU. Later the data will be transferred from the Node MCU to the cloud service (FIREBASE). Once the user logs into the app, the data stored in firebase will get displayed in the app. The user can also control the appliances by toggling through various available options. The option that the user selects gets automatically updated in firebase. This data will be collected by the Node MCU and the appropriate action will be performed.

2.2 HARDWARE USED :

Custom IoT board, Node MCU, LEDs, LED Screen, Buzzers, Jumper cables, Breadboard, micro USB cable, DHT22 sensor, LPG sensor, Smoke sensor, Motion detector, OLED Screen.

2.3 SOFTWARE USED :

Android Studio, Arduino IDE, Visual Studio Code.

III. IMPLEMENTATION

The main intent of our proposal is to create an energy-efficient smart home automation system. The main component that we are utilizing is the custom-made IOT board.

1. Connection of DHT11 sensor in order to determine the temperature and humidity (Weather Forecast).

The connections were made to the NodeMCU which was integrated onto the Custom IOT Board. The DHT11 sensor consists of a digital output pin, GND (ground) and VCC. After the connections were made the input from the sensor was read using the NodeMCU and the data was sent to Google Cloud Platform (Firebase) which acts as a database. The app was integrated to the Firebase which would fetch the data from Firebase and then display on the screen.

2. Connection of light/LED which can be controlled manually or automatically using the readings from the LDR sensor.

The LED/lights were integrated to the NodeMCU which was integrated to the Custom IOT Board. The LED has a digital pin and GND (ground) pin. Once the connections are made the Firebase is also set up which constantly monitors the app for any user input. The component consists of a toggle button which allows the user to turn ON/OFF the LED/light. The app also has the feature of disabling the component. If the component is disabled then the user has to either enable it or control the appliance manually. This feature will help to save energy.

3. Connection of servo motor which can be controlled manually or automatically based on the reading obtained from the DHT11 sensor.

In the project we had used a Servo motor in order to demonstrate the use of a fan. The servo motor has a digital pin, VCC pin and a GND (ground) pin. The motor is connected to the NodeMCU. Once the connection was established the device could be controlled through the app. The virtual component has to be created on the app. Later, we could control the device using a toggle button provided. There is constant monitoring of temperature of the surroundings being measured and if the value obtained from the sensor crosses the threshold limit, the speed of the servo motor(fan) increases or in case the servo motor(fan) is turned OFF the servo would turn ON automatically. There is a provision to disable this feature which is provided in the app.

4. Integration of MQ-2 sensor in order to detect smoke and provide warning to the user.

The MQ-2 sensor was used for detecting gas leakage or smoke which acts as a safety measure in a house. The sensor has an analog pin, digital pin, VCC pin and a GND (ground) pin. After the connection was made we tested with the smoke. On detection of smoke the sensor provides the digital output as 1. An event was triggered which would send an e- mail notification to the user regarding the smoke/fire alert in the house. We had used a third party service called IFTTT.com for e-mail feature integration. A webhook was created and the key and URL was integrated into the NodeMCU. At the time of smoke detection the URL would be called as an event trigger.

5. Integration of PIR sensor and LDR sensor in order to detect theft in the house.

Both the sensors were integrated onto the NodeMCU. Once both the sensors were set up we could test for the burglar activity. Once a burglar breaks into the house and passes through the set up that person would block the LDR sensor from detecting light and the PIR sensor would detect motion. From the readings we receive from the sensor we could determine the theft and provide an email alert to the user regarding the same.

IV. RESULTS AND SNAPSHOTS :

I. Light Control Test Results :

The Light Control Test is done by pressing the ON / OFF button widget on our android application. This is done after the system is turned on and connected to a Wi-Fi internet.

II. DHT11 Sensor Test :

DHT11 Sensor Testing is done by recording the temperature changes that occur every minute. This is done after the system is turned on and connected to a Wi-Fi internet connection. After successful connection establishment, the temperature and humidity readings fetched from the surrounding were visible on the app.

III. Servo Motor Test :

After the connection was successfully established, we could control the servo motor (fan) via our android application. The servo (fan) started rotating at a higher speed as the temperature increased above the threshold specified.

IV. Smoke Detection Test :

After the successful connection the smoke sensor (MQ-2 sensor) would send an email in case there was fire or smoke that it could detect. This feature was added as a safety measure to the house.

V. Burglar Test :

After the successful connection establishment, both the PIR and LDR sensors detect the person in the house and later an email was sent to the user regarding burglar activity in the house.

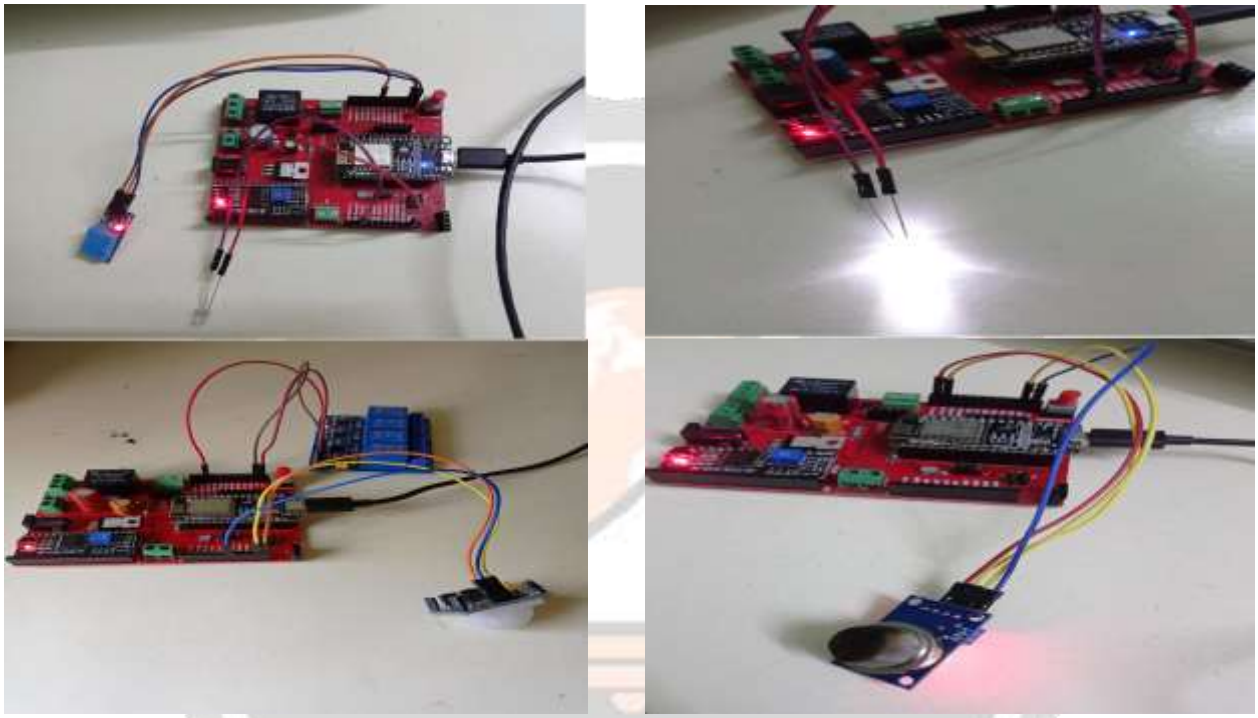

Fig -3: Hardware Implementation

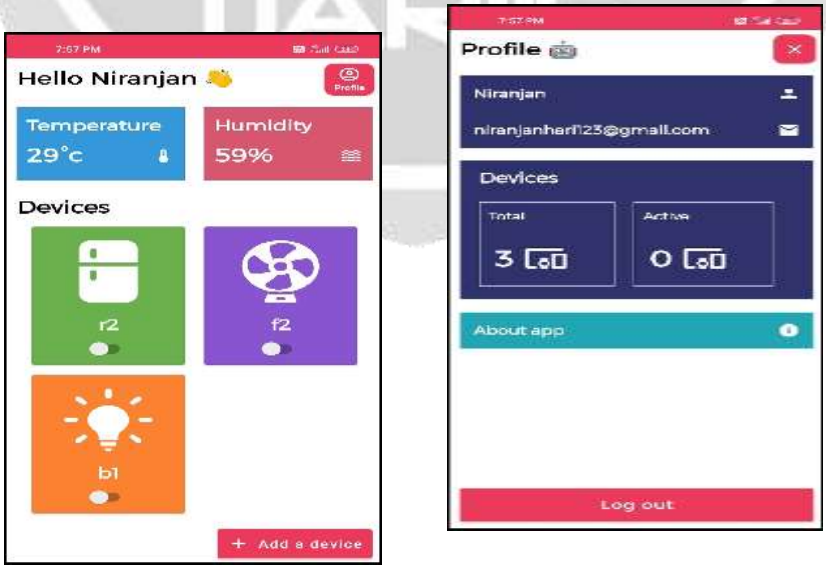

Fig -4: Android App design

V. CONCLUSION

We propose a secure and low-cost system that can remotely control smart home appliances through an android application. The methodology we discussed in this paper is novel in achieving the target of controlling home appliances remotely using Wi-Fi technology. The proposed system not only monitors the sensor data but also takes necessary actions according to the circumstances, for example turning ON fans when the temperature crosses a threshold value. The approach we discussed in this paper also stores the sensor data in the database to analyse the various conditions of the user's environment. Smart gardening can also be made part of a smart home where the sprinklers water the plants when they detect low moisture in the soil.

VI. REFERENCES

[1]. "Raspberry Pi Home Automation with wireless sensors using smart phone" by P Bhaskar Rao and S K Uma.

[2]. "Home Automation based on an Android and a web application using Raspberry Pi" by Dimitris Kehagias and Dorian Nini.

[3]. "Design and implementation of Wi-Fi based smart home system" by Vinod Choudhary, Aniket Parab, Satyajit Bhapkar, Nitesh Jha and Ms. Medha Kulkarni.

[4]. "Intelligent Smart Home Automation and security system using Arduino and Wi-Fi by J Chandramohan, R Nagarajan, K Satheeshkumar, N Ajithkumar, P A Gopinath and S Ranjith Kumar.

[5]. "Smart Home Automation security system using Arduino and IOT" by Siddharth Wadwhani, Shraddha Dwivedi, Uday Singh and Prakarsh Singh.

[6]. "Smart Home system using IOT" by M.L Sharma, Nipun Mehta and Sachin Kumar.

[7]. "Smart-Home Automation using IOT-based Sensing and Monitoring platform" by Majid Al- Kuwari, Abdulrhman Ramadan, Yousef Ismael, Adel Gastli, Mohiddine Benammar and Laith Al- Sughair.

[8]. "Customary Homes to Smart Homes using Internet of Things(IoT) and Android Application." By Vignesh Govindraj, Mithileyesh Sathiyanarayanan, Babangida Abubakar.

[9]. "Low Cost Arduino/Android-Based Energy- Efficient Home Automation System with Smart Task Scheduling." By Kim Baraka, Ranla Kanj and Sami Andrew Malek.