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## IoT Based Home Automation System Using Renewable Energy

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*Internet of Things, Home Automation, Sensors, Cloud Computing, Relay Module, ESP 8266, Renewable Energy Source*

### ABSTRACT

Smart Homes are becoming a part of the Internet of Things, which is growing in applications across a wide range of industries. Current smart home systems have discrete features, low portability, limited updating capabilities, and a reliance on personal computers. The proposed system is expanded on renewable energy source from solar with monitoring and controlling website and mobile application. In this article, we recommend an Internet of Things-based smart home system for comfort, entertainment, and security. Smart home technologies using a smart home app on a smartphone or other connected device to control smart devices like security cameras, smart locks, automated doors, and electric appliances (light, fan, air cooler, air conditioner, washing machine, cooking oven, and so on), a user is able to control the comfort, security, convenience, and energy efficiency of their home. This technology will help to prevent wastage of electricity. Users will be able to reduce their total cost to a great extent and this technology will be a milestone in the overall development of the country. This system addresses these issues by utilizing renewable energy source, ESP 8266, and relay module and cloud computing technologies.

### INTRODUCTION

The objective of the project is to create a cutting-edge intelligent home automation system utilizing Wi-Fi. Through Wi-Fi, the gadgets can be turned ON or OFF. It can be used to replace the current switches in homes that occasionally cause fire mishaps and create flakes. The concept behind home automation systems hasn't changed much over time. When the machines have complete control over the appliances, monitoring and managing them becomes a more challenging task. Renewable energy is defined as energy produced from resources that are found in nature, such as sunshine, wind, rain, tides, waves, and geothermal heat. Renewable energy displaces conventional fuels in four main uses, including the production of electricity, hot water/space heating, motor fuels, and rural (off-grid) energy services. The entire project is implemented by renewable energy sources. As more home equipment is used, the energy consumption in residential areas increases. We take energy conservation and renewable energy sources into consideration when trying to solve the household energy problem. We must also reduce the cost of household electricity at the same time. Energy generation and consumption are two factors that must be taken into account for this. Using a Wi-Fi module, we will also apply the IOT concept.

The world is becoming faster and easier in this era of technology, therefore our houses need to follow suit. We can control our home with only our smartphone, no matter where we are in the world. It's possible thanks to the node MCU and the Blynk app, isn't it a brilliant idea? The ESP8266 Wi-Fi module, the Blynk app, the battery, the solar panel, the LCD display, and the microcontroller are all included in the proposed system block diagram

(Doshi, H. S. *et al.*, 2017). It serves as an example of how we carried out the project and the numerous components that made it up. Energy generation and consumption make up the two main components of this system (Princy, S. *et al.*, 2019).

**Energy usage:** This section includes household lighting and equipment that can be controlled by IoT and Wi-Fi-enabled devices.

**Energy production:** The solar panels in this area are used to produce energy by harnessing the power of the sun. Here, a voltage sensor and a current sensor are used to measure the voltage and current generated by the panel, NodeMCU is used to generate the IP address.

Home Automation System (HAS) based on IoT is growing around the world day by day, especially in the last few years as things become connected and interacted with each other through the Internet Wi-Fi is a wireless technology that uses radio frequency to transmit data through the air. The data sent from device over Wi-Fi will be received by Wi-Fi module connected to NodeMCU. NodeMCU reads the data and decides the switching action of electrical devices connected to the Relays. The controlling device for the automation in the project is a Node Melt. Home Automation System (HAS) based on IoT is growing around the world day by day, especially in the last few years as things become connected and interacted with each other through the Internet.

### Objective

The major objectives of project are as:

1. Generation of electrical energy using renewable energy source
2. Home Automation using IOT

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## Motivation

Several systems have implemented on home automation but very few had considered on renewable energy with IoT based automation system becomes possible in Wi-Fi range and at any time and any location. Now the age of information technology system, so we want to make that type of application which can be remotely monitored and controlled using Internet of Things (IoT) based automation system. We think future demand will increase, so we want to do this.

## Related Works

Smart home systems are providing security and comfort to their owners. In addition these systems are energy efficient which represents one of the most important issues of concern to the world today. Some researchers have done design and implementation of smart homes based on different technology using different sensors. In (Doshi, H. S. *et al.*, 2017) internet of Things (IoT) based smart home system using 3G embedded system and Zigbee technologies were introduced. Variety of smart home systems has been constructed based on Bluetooth, internet and short message service (SMS). In (DUTTA, K. P. *et al.*, 2012) Bluetooth might be one of the best wireless systems. However, the main limitation in this system is the short range which makes it feasible for smart home indoor applications. In (Vikram, N. *et al.*, 2017) home automation system based on IoT for monitoring and controlling different were introduced based on the android smart phone and using internet service.

Smart homes with different sensors were introduced in (Churasia, T. *et al.*, 2019) to monitor and control different household appliances. To some extent home automation process equals to smart home. (ARAVINDHAN, R. *et al.*, 2017). They are both bringing out smart living condition and make our life more convenient and faster. These servers are remote serves on the internet, which helps you manage and process the data with the help of personal mobile or computers. We want technology to touch every facet of our lives.

## DESIGN METHODOLOGY

The methodology of this project design can be divided into two sections, hardware and software implementations for energy production and energy usage. In fig-1, the solar cell takes heat from the sun and gives 5 volts and is charged through the charge controller, until it is fully charged, the red light will be on and when it is fully charged, the green light will be on. The system is a wireless technology that uses radio frequency to transmit data through the air. The data sent from device over Wi-Fi will be received by Wi-Fi module connected to NodeMCU. The microcontroller will draw power from the battery and generate IP address. NodeMCU reads the data and decides the switching action of electrical devices connected to the Relays. After activation, the relay can be turned on and off by sending a signal through the android application and website through cloud data then the connected loads will be activated. For internet connection user can control and monitor their home appliance form remote location.

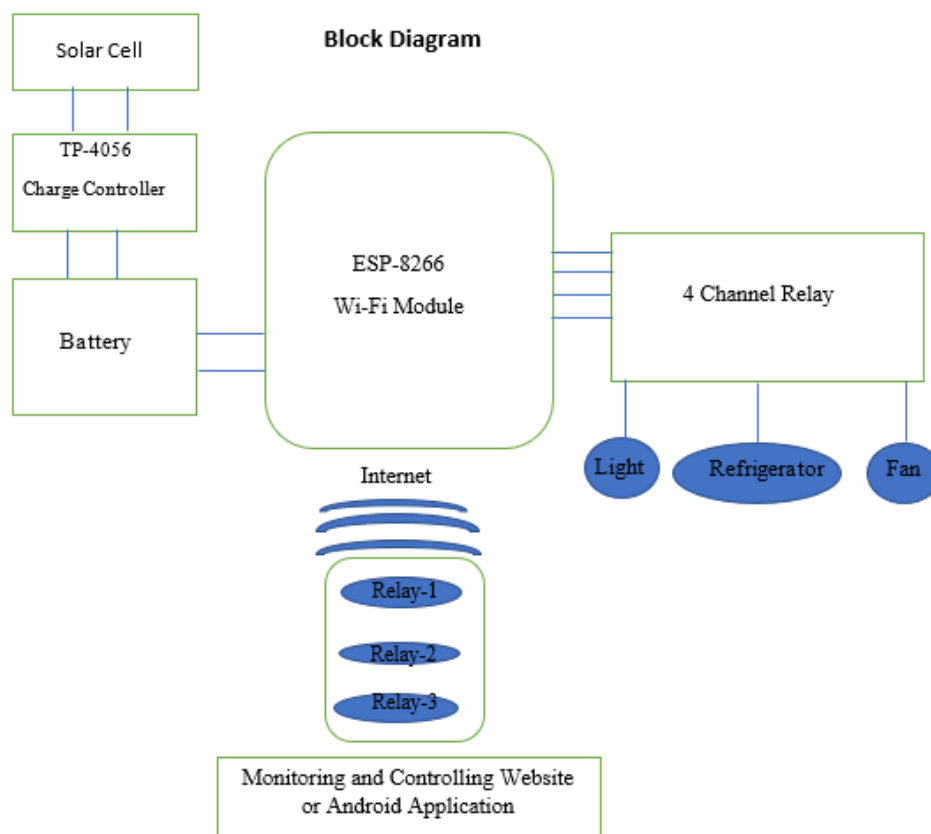


Figure 1: Methodological Diagram of IoT based Home Automation

### Circuit Diagram

As power we used renewable solar panel which is connected to TP-4056 charge controller. Charge

controller is connected to battery. 4 channel relay is connected to NodeMCU in Fig-2.

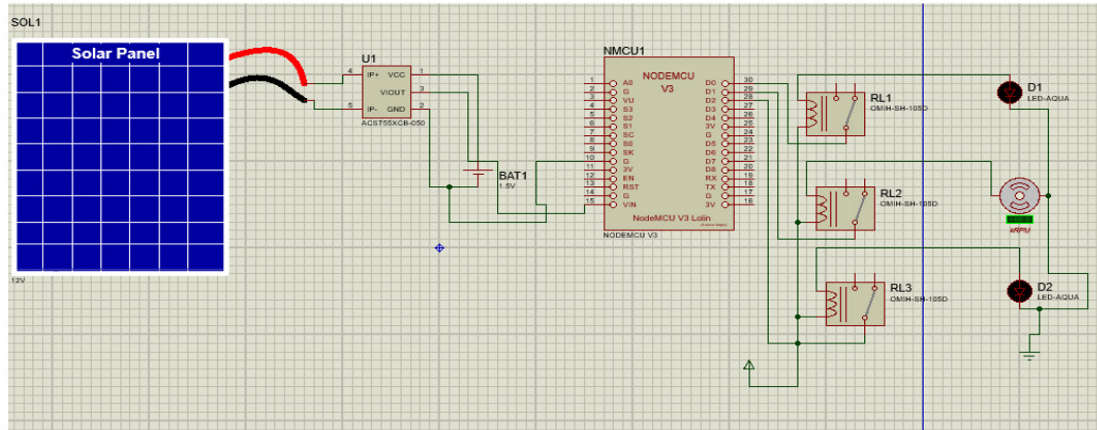


Figure 2: Wi-Fi Based Home Automation System Circuit Diagram

### METHODOLOGY TOOLS

In this system we use an esp-8266 wifi module for control hole system. ESP8266 is a low-cost WiFi module that belongs to ESP's family which you can use it to control your electronics projects anywhere in the world. It has an in-built microcontroller and a 1MB flash allowing it to connect to a WiFi. The TCP/IP protocol stack allows the module to communicate with WiFi signals. We use a 5V solar panel for battery charge, TP-1056 Charge controller for control the charge system. we use 5 volt rechargeable Battery in our project. And we use 4 channel relay. The 4 Channel Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps, Fan etc.

### System Implementation

The IoT based home automation system on renewable energy is depicted in Fig-3 and uses a variety of hardware. Including solar panel, charge controller, Nodemcu-8266, TP4056 Charge Controller and 4 channels relay etc.

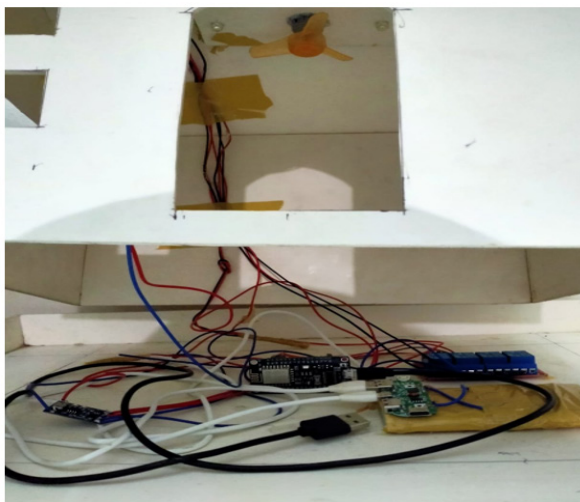


Figure 3: Implementation of IoT based home automation system on renewable energy

### System Implementation Flowchart

The home automation system is explained with android application and website which includes multiple modules, how to manage with control and monitor from remote location based on cloud data. System properly works IoT based renewable energy with responsibility of the main program whose flow chart is presented as Fig-4.

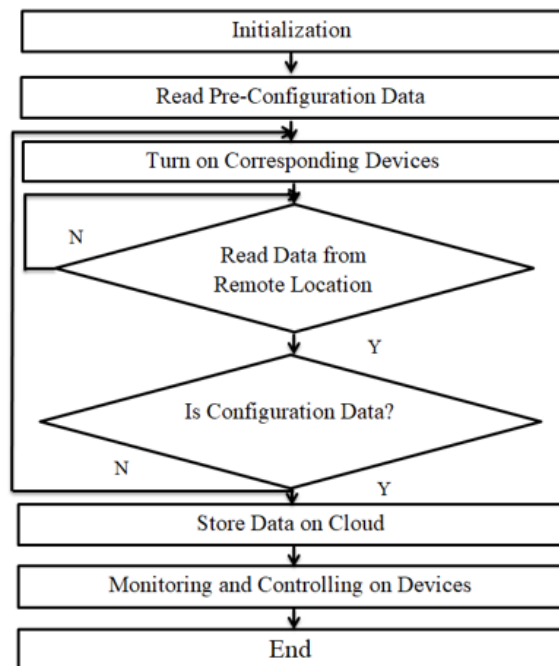


Figure 4: IoT Based Home Automation Flowchart

### IP Address Generation Block Diagram

After generating solar powered, esp -8266 wifi module connect to provide IP address, the implemented system works with this IP address based on home automation which is depicted in Fig-5. Each end user will get different IP address for monitoring and controlling from remote location.

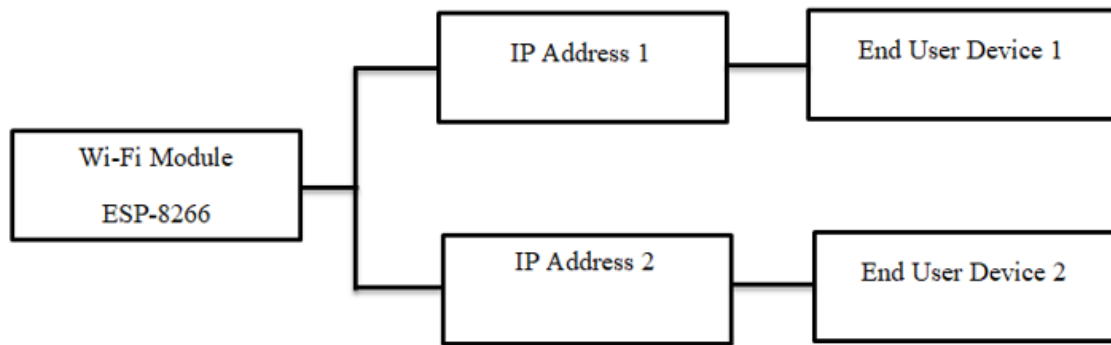


Figure 5: IP Address Generation from Wi-Fi Device

## DISCUSSION

After searching the browser with IP address, the user interface page will appear, and users want to turn on or off a device easily from remote location using android application or website which is depicted in Fig-6.

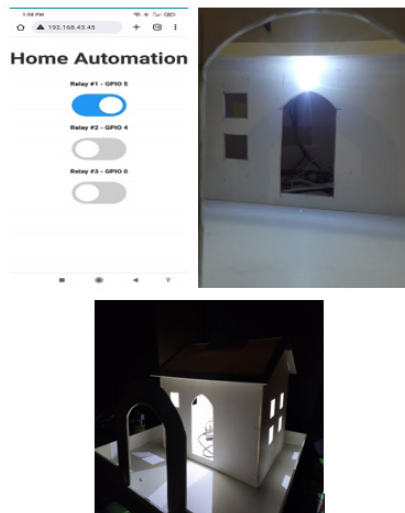


Figure 6: Outside Light on mode

## CONCLUSION

We utilized renewable energy sources in order to reduce the cost of energy. Energy generation and consumption are both crucial components of this system. The energy use of Wi-Fi-based home appliances is included in the energy consumption, and Wi-Fi transmits the data it collects to a home server. Solar panels are the basis for energy production. The Renewable Energy Gateway (REG) can be used for both production and consumption. The home server hence optimizes home energy utilization by considering both consumption and generation. Wi-Fi technology offers home protection, and it is more cost-effective than the prior system. Thus, we can draw the conclusion that the main goals of a home automation system based on renewable energy have been achieved. Finally, compared to the previous home automation system, the proposed system is superior in terms of scalability and versatility. The total implementation cost of the project is very cheap and it is affordable by a common person. The users interact with the application interface of the android device and

send control signal to the Arduino which in turn controls home appliances. With improvements in technology and the fact that android also website is free and open source, cheap smart devices can be used as the controller in the project, making the overall system cost affordable for mass adoption. This system, though primarily aimed to reduce human effort, but it has a great market value if we can introduce it properly.

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