Design of Smart Home System Using Google Assistant

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ABSTRACT :

In today's world Automization using smart devices is seen in every field where things are being controlled automatically making the system more efficient. The concept of remote management of household devices over the internet from anywhere, any time in the world is reality. The paper discusses the Home automation system (can be named as Smart home) which involves the control and automation of lighting, heating, ventilation, air conditioning as well as home appliances. The project has demonstrated an Automated System using Google Assistant. In the developed system any electronic gadget such as lights, electric fans, A/C, freeze, oven, T.V. and other home appliances can be controlled either by sensing actual controlled variable values or by remotely through voice commands and the Notification or SMS alert is send on mobile. These appliances are controlled remotely from Smartphone using WIFI module through android app. The system is implemented using ESP8266 (one of the most popular and low cost wifi module). It sends control command through a Google Assistant.

The developed system is economical and operationally feasible. It's user friendly interface makes it pretty much operable by anyone having little experience of using android phone. The system is helpful for physically disabled too, controlling home appliances with the click of a button. The concept can be applied in industry automation.

KEYWORDS: Automation, smart home, ESP 8266, Google Assistant, Adafruit IO, IFTTT.

1.1 INTRODUCTION

The quality and comfort of living has been improvised by the use of smart devices in daily activities. The automation is seen in both homes and industries. Centralized control of appliances, cost reduction, energy saving, security and safety are some of the advantages of automation [1]. Higher affordability and simplicity in interconnectivity of virtually every object leads to exponential development of remote controlled automated systems. The evolving technology of the "Internet of Things", is playing a vital role in the popularization of remote management of household devices over the internet from anywhere and at any time[2]. Assume a system where from the office desk, the user could view the status of the devices and decides to turn on the cooling system, say the air conditioner, and switches on or off some of the light and take control by tuning his TV set to his favourite channel, This user could walk back home and only find a very comfortable, pleasant home.

The paper has discussed **Design of Smart Home using Google Assistant**. In the present work, the home appliances are controlled either by sensing real time parameter values or through any Smartphone using WIFI module through android application. The system is implemented using ESP8266 (one of the most popular and low cost wifi module) which act as a server. It sends control command through a Google Assistant.

The developed system is economical and operationally feasible. It's user friendly interface makes it pretty much operable by anyone having little experience of using android phone. The system is helpful for physically disabled too, controlling home appliances with the click of a button or through the voice command. The concept can be applied in industry automation.

1.2 Literature Survey:

Concept of home automation is not only limited to operating household appliance by remote control. With the advancement in technology the changes are seen in Home Automation System. In early 1900' home gadgets like washing machine, water heater, refrigerator, sewing machines, dishwashers, clothes dryers etc. became popular in market. The development of an Internet-based monitoring of important process variables from a distributed control system (DCS) was proposed by Tan, Lee and Soh in 2002. In other paper by Tan et.al. Bluetooth was used for home automation [1]. Using speech recognition theory home appliances were operated through speech by Potamitis, Georgila, Fakotakis, and Kokkinoss, G. in 2003 to help for people with disability to perform real-life operations at home [2]. Microcontroller based system was designed by E. Yavuz et.al. [3] in 2006. In the same year, personal computer was used to control the home appliances by S. M. Anamul Haque, S. M. Kamruzzaman and Md. Ashraful Islam for the proposed system entitled "A System for Smart-Home Control of Appliances Based on Time and Speech Interaction". The system was developed using the Visual Basic 6.0 programming [4].

Now wireless systems are getting acceptance and lot of research is being done in this regard. Wireless Home automation systems have certain advantages over wired system. There are various techniques to control home appliances such as IOT based home automation over the cloud, home automation under WIFI through android apps from any Smartphone, Arduino based home automation, home automation by Arduino application based remote control, home automation using digital control, RF based home automation system and touch screen based home automation [5 to 12].

1.3 SYSTEM DESCRIPTION:

In the proposed system any electronic gadget such as lights, electric fans, freeze, oven, T.V. and other home appliances can be controlled by means of two ways.

A] One way is to operate appliances by sensing real time parameters such as light intensity, room temperature, humidity and motion. The sensed values are interfaced to ESP 8266. They are compared with the set threshold values and accordingly the related appliances are switched ON or OFF. In the prototype ON/OFF of electrical lights and fans is shown. Here room light intensity is sensed using LDR sensor. The lux requirement of luminous intensity is different for different parts of home (eg. Corridor, hall, kitchen, bedroom, reading area etc). Depending upon the location of light bulb the intensity threshold is set. (as per ISLE standard). If sensed value is less than set threshold value of intensity, then bulb will be ON otherwise it will be in OFF condition. One more parameter is used for switching of light bulb i.e. whether room is occupied or not. For this motion in the room is detected by PIR motion sensor.

On similar principles fan / A.C. are switched ON/OFF by sensing temperature and humidity of the room.

B] Second way is to operate the appliances remotely through voice / text commands using Mobile. Here the Notification or SMS alerts are send on mobile. The sensed parameter data is send to mobile. Depending upon this the appliances are made ON/OFF by sending the commands. The control command are received through a Google Assistant.

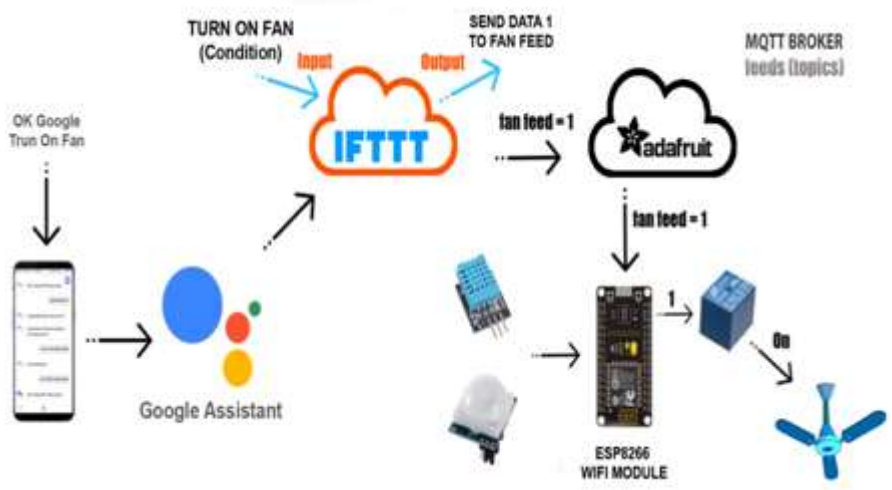

Figure 1: System Overview

1.4 SYSTEM DESIGNING

The development of system involves hardware and software development. Figure 2 elaborates detail block diagram.

1.4.1 Hardware Development : The system hardware development involves appropriate interfaces of sensors and actuators with the controller. Also it deals with establishment of wireless connectivity. The system uses Temperature and humidity sensor (DTH11), PIR Motion sensor, LDR light sensor. These modules drive the analogue inputs of a low power 32-bit ESP8266 Wi-Fi module having Transmission Control Protocol/Internet Protocol (TCP/IP). The DTH11 serially outputs both temperature and humidity and is read by the analogue input pin of the ESP8266 controller. The acquired temperature and humidity is compared by the microcontroller and produces logic low or high. Passive Infra-red (PIR) Motion Detector sensor detects the animated movement in the vicinity. It sets the digital output pin to logic high when any gesture is detected. The digital outputs of ESP 8266 drive the power actuators which is 4 channel relay module. These digitally controlled electromechanical switches control high-voltage, current or power appliances at home. The acquired light intensity, temperature and sensed motion values are send to mobile through developed wireless link (using Adafruit and IFTTT servers).

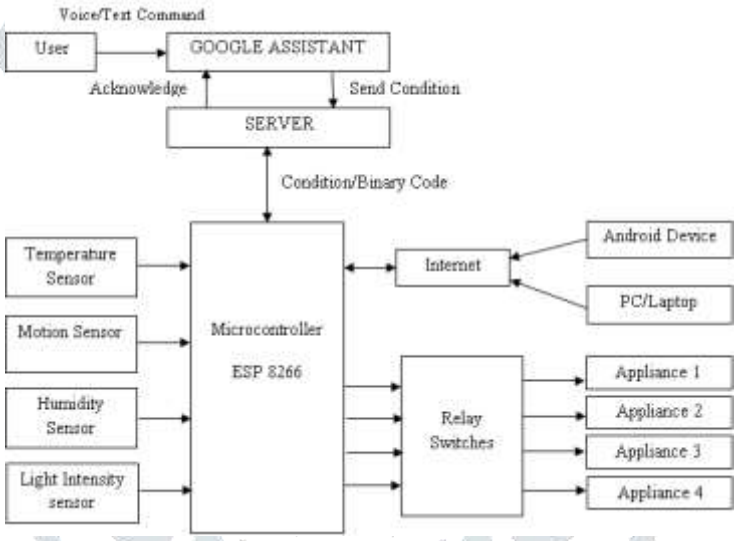

Figure 2: Block Diagram of Smart Home System

1.4.2 Software Development : It can be divided in two parts. First part deals with the program for generating digital output based on comparison of sensed input parameter and set threshold. Second part deals with development of wireless connectivity. The steps for second part are discussed below :

1:Setting Up Adafruit IO: Adafruit IO is an IOT platform built around the Message Queue Telemetry Transport (MQTT). MQTT is a lightweight publish/subscribe messaging protocol. It allows multiple devices to connect to a shared server, called the 'MQTT Broker'. It subscribes or writes to user defined 'topics'. After subscribing a device to a topic, the broker sends a notification whenever "topic" changes. MQTT protocol is selected as bandwidth and battery power are at a premium.
Along with MQTT Broker service, Adafruit IO also allows set up of dashboards by which one can directly manipulate or view the current value of each topic.
2: Connecting the ESP8266 to the Adafruit IO system/ MQTT Broker.
3: Connecting to Google Assistant Through IFTTT : Google Assistant is connected to the Adafruit IO MQTT Broker to allow us to control the appliances with voice commands. IFTTT (If This Then That) platform allows hundreds of different services to trigger actions in a variety of other services. For project, activation phrases chosen are "Turn the light on," "Turn on the light," and "Switch the light

on". Finally two applets are created in response to two triggers for turning the lights “ON” and "OFF". The two applets can be viewed on IFTTT Platform page.

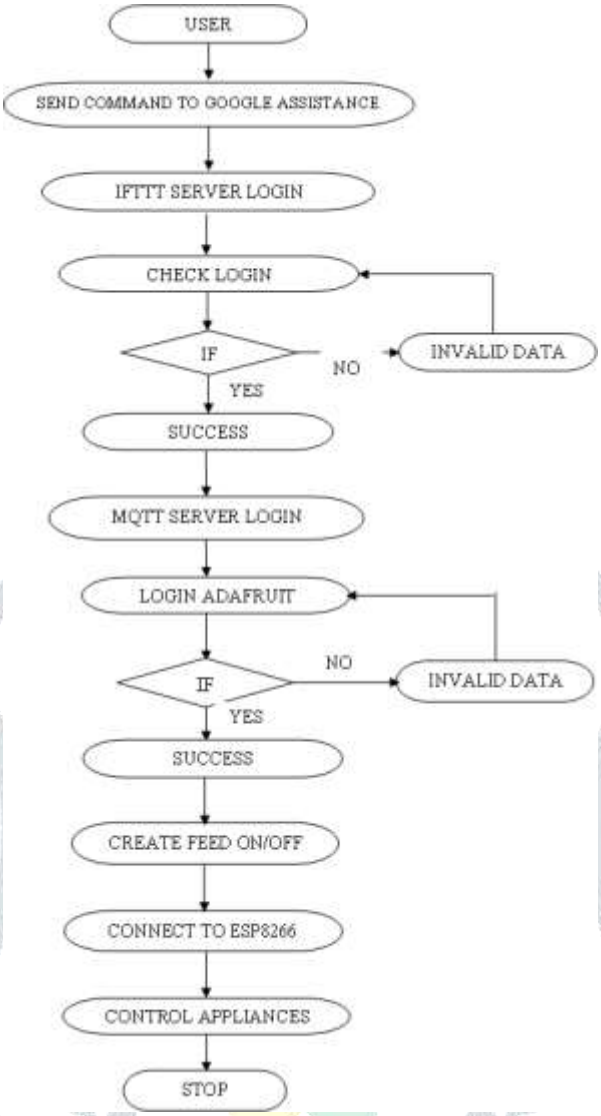

Figure 3 : Flowchart to establish Wireless Connectivity

1.5 RESULT :

The robust and scalable architecture has been build and tested. The lights, fans and A/C were controlled first by setting threshold values of light intensity, temperature and humidity.

For the second method, the Google Assistant enabled device is built into the latest versions of the Android operating system (or using the Google Home series of devices). This was implemented using messaging app, available for Android and iOS, also includes the Google Assistant. After verification of valid log in of the activation phrase, the voice command to switch ON the appliances was given serially for all four appliances. After a 2-5 second delay, the action was implemented and devices become ON one after the other. Then the voice command was given to switch OFF the appliances.

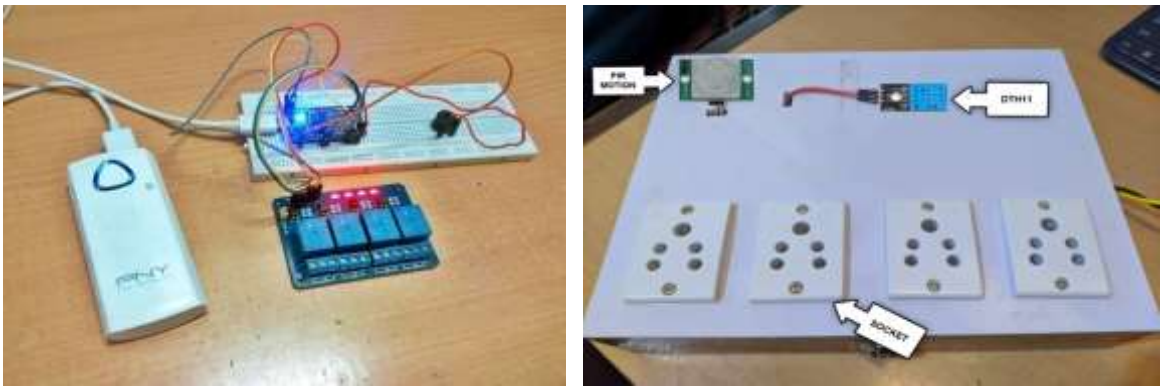

Figure 1.4 (a) Testing of Model under development (b) Developed System (front panel)

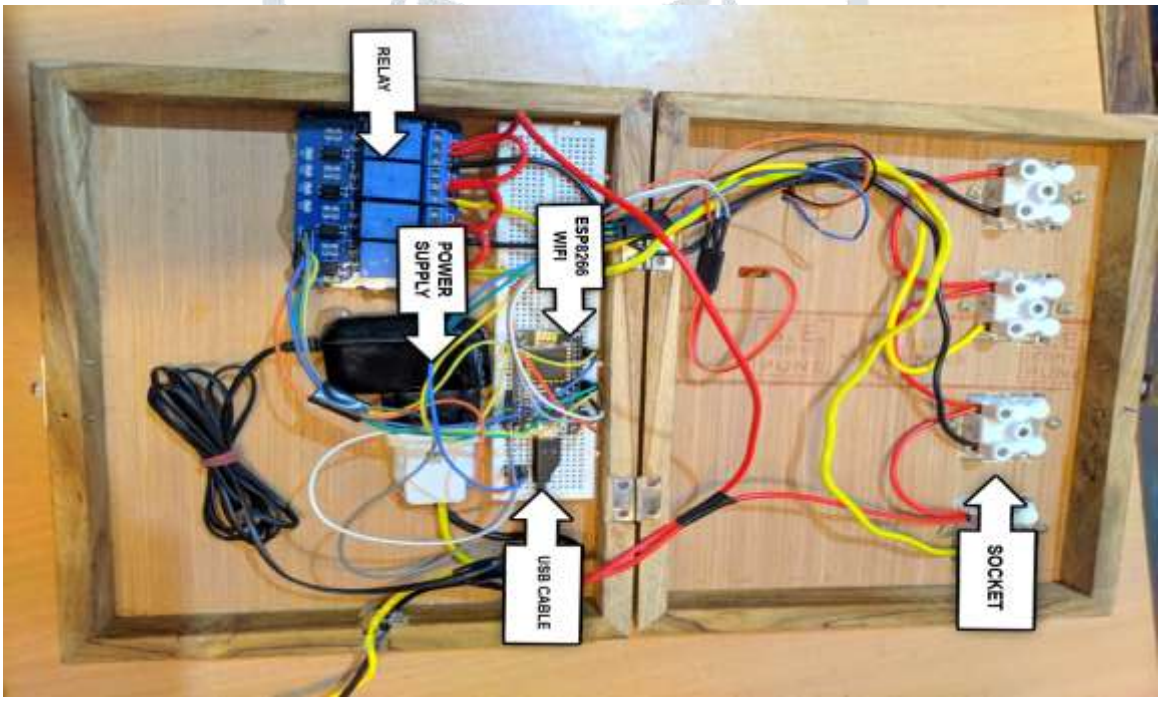

Figure 1.5 Developed System (rare view)

1.6 CONCLUSION

Thus system was designed, built up and tested for controlling home appliances such as lights, fans and A/C. The home appliance control using voice has revolutionized way of living. The system is more economical and conserves energy by ensuring occupancy in the room before turning on the devices. It's feature of checking brightness and turning off lights if not necessary also contribute in energy saving.

The system has got one hidden advantage for today's life style. Most of the time people are on the move from place to place for business/ work purpose. When they are away from their home leaving all their household appliances without any kind of monitoring and control, there is the possibility that some devices are left plugged into power sockets whereas others are supposed to be plugged into and out of power sockets at different intervals depending on the time of the day. It's not possible to manually to take care of these devices independently from time to time. All such monitoring and

control can be done without necessarily being around or inside the home. In time switching ON/OFF of devices saves a lot of energy which reduces extra consumption of electricity.

In future, more sensors can be added in the system so as to make home more smarter. The controlling of opening of door, ON/OFF of freeze, washing machine operation etc. can be achieved. It's necessary to add more security features. One limitation of the system is the dependency on third party for both the servers. In case of one of the server failure, the entire system fails.

The system can be expanded to automate a large scale environment, such as offices and factories.

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