EMBEDDED BASED HOME AUTOMATION SYSTEM

E.Ramya

Assistant Professor,Department of Electronics and Instrumentation Engineering,

Bannari Amman Institute of Technology,

Sathyamangalam, Erode district

TamilNadu, India

Email id: ramyae@bitsathy.ac.in

ABSTRACT: Automation systems have become widespread in many process-related operations. This project presents a Domestic automation system which can be controlled via a remote and thereby provides a user-friendly interfacing environment. The main objective of the proposed project is to automate the functioning of domestic appliances using a single remote control which incorporates Internet of Things (IoT), Radio Frequency module, Voice control (Google Assistant) and Android application (Adafruit) If the internet facility is available, the electrical devices are controlled by using IoT, Google Assistant and Android application. In the absence of internet facility, RF module is used.

Keywords: Home automation system, IoT, RF module, Google Assistant, Adafruit, Node MCU ESP826

I. INTRODUCTION

Home automation was started from 1900s.The Home automation Systems are widely explored by the researchers in the field of Engineering. It incorporates controllers for the continuous monitoring of the proper functioning of the appliances. A secured and automated house using a hybrid communication system such as IoT and mobile communication methods was designed. The owner of the house will be alerted with a message once suspicious act are occurred [1]. A home appliances control in automation using GSM was developed. The ON/OFF process of home appliances can be done remotely [2]. A directionality feature called Point-n-Press was implemented an intuitive control by pointing to the target device. This device is used to display the target's control interface on the screen of the remote controller. [3] A Radio Frequency module based voice-controlled smart home with multi-functions was implemented. The user's voice-password acts as a security for the proposed system. The voice-commands are recognized by a dedicated hardware module and the recognized data is sent wirelessly through a radio-frequency (RF) transmitter attached to a Arduino microcontroller board. The Raspberry Pi attached to the RF receiver decodes the commands spoken by the user and the home appliances are controlled. Additionally, the proposed eHome system is capable of sending the sensor data over the internet to the cloud for monitoring purposes. [4] The Home automation system was designed using voice as input. It has been captured by the android and will be sent to the Arduino Uno. A hardware setup was developed which controls the home appliances up to 20 meter of range to via Bluetooth. [5] The domestic appliances (i.e., lights and electrical systems) can be controlled using Voice recognition system. [6] A domestic automation system is developed using Bluetooth technology. This proposed system can be accessed from a PC/laptop or smart phone. [7]

The major discrepancy faced with all the home automation devices is that the appliances can be controlled using only IoT (Internet of Things) or by using RF (Radio Frequency) or by using voice control (Google Assistant, amazon Alexa) or by using iOS/Android application. In this project, the devices are controlled by including all these modules wherein the controllable module can be switched using a remote control according to the availability of internet facility. This project mainly focuses on electrical devices such as lights and fan. The lights can be switched on and off and the speed of the fan can be controlled.

II. PROPOSED METHODOLOGY

The main objective of the project is that the appliances (Turning on/off the light and speed regulation of fan) are controlled using

- IoT
- RF
- Voice control (Google Assistant)
- Android application (Adafruit).

The Internet of Things (IoT), Voice control and Android application are used when the transmitting module is connected with the internet. If the remote (4*4 keypad) is available, then the appliances are controlled using IoT. If the smart phone is available with the Android version 6.0 and above, then Google Assistant and Android application can be used. In other cases, Radio Frequency (RF) module is used to control the appliances. The major hardware components used are Nodemcu and Keypad. The software used is Arduino IDE

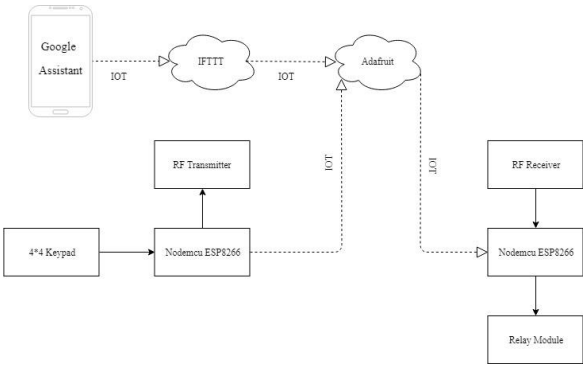

FIGURE.1. BLOCK DIAGRAM

1.1 KEYPAD

In this project, the 4*4 keypad controls the appliances and regulates the fan speed. Appliances are controlled in two ways. One is turning ON or OFF of the light and fan and second is controlling the speed of the fan. When * is pressed in the keypad, the remote is used for controlling the appliances. When # is pressed in a keypad, then the remote act as a fan regulator. After pressing *, the room to be controlled is mentioned i.e. room A or B or C or D. When * is pressed, the numbers 0 to 9 in the keypad act as controlling button. When # is pressed, the numbers 7 to 9 in the keypad act as the controlling button for speed regulation of the fan i.e. the number 7 indicates the speed of the fan is of 25% of its full speed. Number 8 indicates the speed is 75% of the full speed and 9 means the fan rotates at full speed. If a second light in room A is to be turned ON, then * is to be pressed followed by A and then 2. If a second light in room A is to be turned OFF, then 2 is pressed if and only if * and A are already pressed.

1.2. NODEMCU ESP8266

This WiFi microcontroller continuously scans for the key pressed in the keypad in the transmitter side. Depending on the key pressed, the microcontroller takes action and sends a signal through IoT (if WiFi is available) or through RF (if WiFi is not available). In the Receiver side, the microcontroller receives a signal through IoT or through RF and it will take the control action accordingly and send the controlled action signal to the relay module to control the appliances.

1.3. ADAFRUIT

It is an open source Internet of Things (IoT) platform in which the data can be sent or can be received by the WiFi controller and also the data can be monitored from anywhere in the world.The transmitting microcontroller send a data to the Adafruit depending upon the key pressed and the receiving microcontroller receive the data from the Adafruit only if there are any changes in the Adafruit.

1.4. IFTTT

IFTTT stands for “IF This Then That”. If the condition is satisfied in “THIS” then it will execute “THAT” condition. In our project we are using IFTTT only for the purpose of Google Assistant. In IFTTT we made condition in “THIS” i.e. if the particular word is spelled in Google Assistant, then it will trigger “THAT” condition which is connected to Adafruit and a particular value depending on the spelled world is send to the Adafruit.

For example, if Light 2 in Room A has to be turned on, Then “Light 2 ON” or “Room A Light 2 ON” is to be spelled in Google Assistant. Thereby, the IFTTT sends”4” to Adafruit.

1.5. ARDUINO IDE

Arduino is an user friendly community that designs a single-board microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world.

1.5.1 RECEIVER PROGRAM

The transmitter first scans for the availability of Wi-Fi. If it is available then it is

connected and scans the keypad. When any key is pressed, the program sends a suitable value depending on the key pressed to the receiver through Adafruit. If the WiFi is not available then the value is send through RF Transmitter.

1.5.2 TRANSMITTER PROGRAM

The Receiver program checks for the availability of Wi-Fi. If available then connect to it. Then the program will receive a value from Adafruit. If WiFi is not available then the Transmitter will receive the data from RF Receiver.

RESULTS AND DISCUSSION

The home appliances to be controlled (light and fan) are connected to the receiver part of the micro controller. The transmitter sends the control signal via Internet or RF to the receiver and the receiver takes the control action accordingly. The receiver can also be controlled by using Google Assistant (voice control) or Android application (Adafruit).When the receiver part is connected to the Internet, a blue led starts to glow and thereby the light and fan can be controlled using IoT, Voice control or Android application accordingly. When the receiver is connected to the RF module, the blue led does not glow and thereby the appliances are controlled.

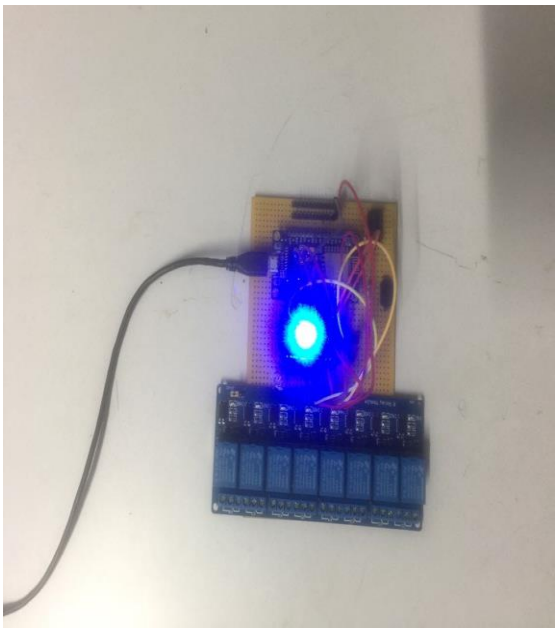

FIGURE 2: Receiver connected with internet

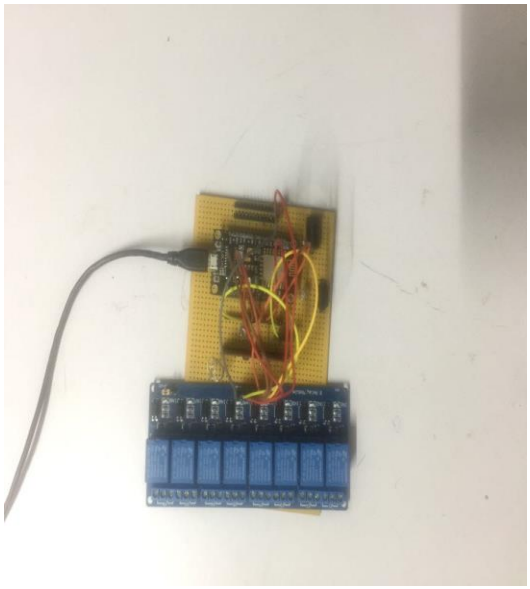

FIGURE 3: Receiver disconnected from internet

CONCLUSION

A model for home automation for turning on/off the lights and speed regulation of fan by connecting it with and without internet was developed in this project. The major problem which is faced is the moment when the NodeMCU micro-controller is disconnected from Wi-Fi and then reconnected with it. While considering other home automation techniques, this is very cheap and also very less power consuming device. This project may also be extended

- By checking the status of the appliances connected to the receiver part by using transmitter.
- And may change the value in the transmitter corresponding to the data received at the receiver.
- By increasing the matrix size of the keypad, the number of appliances to be controlled may be added.

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