Home Automation and Intelligent Light Control System using Microcontroller

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***Abstract*-This paper describes the Automation systems and the design of the effective remote control system which makes life easier, comfortable, flexible and luxurious too. Wireless control is a foremost concern for everyone and this system provides low cost and flexible home automation & intelligent light control system [4]. Automation is not only widely used in industries, but also progressively entering into daily human life. Automation provides help to disabled and normal people too in professional and daily life. With automation, this system also provides the remote access facility not actually going nearer to the regulators or switch boards. We can control all our electronic gadgets like light, fan, ACs etc using Bluetooth remote, mobile app, manual keypad and human body motion and also it can control the speed of fan or other gadgets. This paper provides the best solution for electrical power wastage.**

Keywords: STM-32, TRIAC Dimmer module, nRF51822 module, CC2541, PIR SB0061, Relay 5 Amp, Mobile app etc.

I. INTRODUCTION

Home automation and Intelligent Light Control System using microcontroller (HAILCSM) is providing a research opportunity in creating new fields in engineering & technology. HAILCSM becoming most popular in today's world [2]. Due to the improvement of wireless and communication technology, there are various connections in this system such as MOBILE App, Bluetooth remote, keypad button and PIR sensor to provide the home automation. All connections have their own specifications and applications.
In HAILCS project, Bluetooth nRF51822 module and C2541 has been used with suitable capability. The frequencies of nRF51822 and C2541 is 2.4 GHz respectively which Supports the data rates of 250-kbps, 500-kbps, 1-Mbps, 2-Mbps. This automation system explained to control various electronics gadgets likes lights, fan, ACs, etc. with mobile app, Bluetooth remote and human detect motion sensor command through the STM32 controller. This system provides relaxation and comfort to the people in the house and offices. Applications of this system are in Home, Offices, Hospitals, Shops, Hotels, Street lights, Park etc. This system is very much beneficial for disabled person and also focuses on the comfort of common people. A very large amount of energy can be saved by using this system because there is timing system with which we can set the time according to the usage of the user and the lights will turn ON/OFF according to the fixed time. Sometimes people forgot to OFF the electronic appliances, so they can OFF them by using Mobile app. This system is also beneficial for illiterate people because this it also uses Bluetooth remote which is easily operational by anyone.
The paper organization is as follows: Section II. and III. provides the hardware and software used. Section IV. describes the designing of the system. Section V. explains the mechanism of the system. Section VI. gives the conclusion of the implemented system and section VII. gives the references used in this paper.

II. HARDWARE USED

A. STM-32

STM-32 is a family of 32-bit microcontroller IC by the company ST Microelectronics. It is a 32-bit product range that combines the features of very high performance, real-time capabilities, digital signal processing, low voltage operation and low power while at the same time maintaining the full integration and simplicity in development. Fig. 1 shows the STM-32 Micorcontroller.

Fig. 1 STM-32 Micorcontroller

B. TRIAC Dimmer Module

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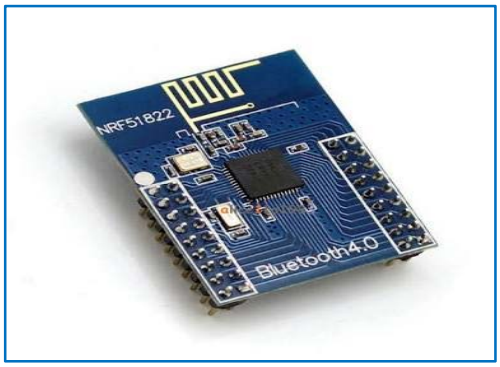
The TRIAC dimmer module is a single channel receiver that controls both 12v and 24v and they are designed for resistive loads. It controls the device which there upon regulates its voltage for example, to control the fan speed.

C. *nRF51822 Module*

The nRF51822 Bluetooth is designed to explore the full range of development possibilities using Bluetooth Smart technology. It is a low cost ARM embed enabled development board for Bluetooth and it consists of hardware, firmware and apps for both IOS and android on Bluetooth 4.0 enabled smart phones. Fig.2 shows the nRF51822 Bluetooth Module.

Fig.2



nRF51822 Module

D. *CC2541*

The CC2541 is a 2.4 GHz Bluetooth low energy RF system on-chip combines the excellent performance of a leading RF transceiver with an industry-standard enhanced 8051 Microcontroller, in-system programmable flash memory, 8-KB RAM and many other powerful supporting peripherals and features. The CC2541 is suitable for those systems where ultralow power consumption is required. Fig.3 shows the CC2541 ble.

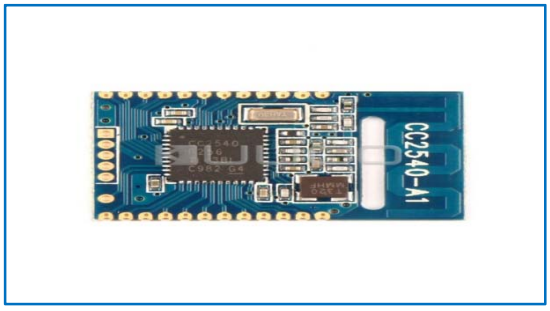


Fig. 3. CC2541Ble

E. *PIR SB0061*

SB0061 is a pyro-electric sensor module which is developed for human body detection. A PIR detector combined with a Fresnel lens are mounted on a PCB together with an analog IC, SB0061. High level output of 3.3v of presetting variable width is provided.

F. *Manual keypad*

There would be manual switch keypad on controller and they directly provide output to stm-32 microcontroller.

G. *Relay 5 Amp*

Relay are the switches that open and close circuits electromechanically or electronically. Relays control over one electrical circuit by opening and closing contacts in another circuit.

III. SOFTWARE USED

A. *Mobile app*

This mobile app is supportive to android and IOS. We can control the room light and fan through this app and also can control electronic gadgets like lights, fan, ACs etc. according to timing. With this mobile app we can also change the automatic to manual configurations or vice versa.
This system works on two functions such as manual and automatic. Manual function works on commands to use the Bluetooth remote to ON/OFF light and also through mobile app and timing system such as to control light by providing fixed timing. Automatic function has commands to interface PIR motion sensor with human motion so that light will turn ON/OFF automatically by sensing the human motion. Mobile app configure according to nRF51822 Ble module after that mobile app provide command to nRF51822 module which is further interfacing with stm32 microcontroller.

IV. DESIGNING OF THE SYSTEM

Fig. 4 shows the mechanism of Home automation and Intelligent Light Control System using microcontroller (HAILCSM). The proposed system has been implemented in a room with four lights and one fan.

A. *Bluetooth Remote*

In the designing of Bluetooth remote which uses cc2541 module in remote PCB and this PCB module then gives an

output to the cc2541 Ble module which is again further interfaced to the stm-32 microcontroller.

B. STM-32 Microcontroller

nRF51822 ble and cc2541 ble low energy module both provided their output to the microcontroller and this microcontroller provides 4 outputs according to the programming. 1 to 3 outputs are directly applied to the 1 to 3 relay and 4 output is applied to TRIAC after that according to TRIAC condition and this will further applied to 4 relay.

C. Relay

Relay connects 240 volt source which can ON/OFF according to the microcontroller output.

V. MECHANISM OF THE SYSTEM

Fig. 5 shows implemented proposed Home automation and Intelligent Light Control System using microcontroller (HAILCSM). This designed system works on remaining the switches with the modified keypad switch work on low voltage (5 volts) activating method, to provide easy control to the people compared to the high voltage switches. Bluetooth module is used to establish the Bluetooth connection in this system that directly inputs/outputs commands from/to Stm32 controller [1]. With the help of mobile app this design system configures automatic condition to manual condition or vice versa and control our electronic gadgets or appliances like light, fan etc. In manual program this system directly ON/OFF through Bluetooth Remote and mobile app and also it can set timing to any light separately. In automatic condition the light which is set on automatic mode will ON by sensing the human motion otherwise turn OFF [5]. If we want to use this system by remote control or manually then this automatic condition will get disabled automatically.

VI. CONCLUSION

We proposed an automation and intelligent lighting control system and architecture using ambient PIR sensor and microcontroller in the home environments. This low cost system is designed to improve the standard of living of the people in home [2]. With this system we can control all our electronic gadgets like light, fan, ACs etc using Bluetooth remote, mobile app, manual keypad and human body motion and also it can control the speed of fan or other gadgets.

VII. REFERENCES

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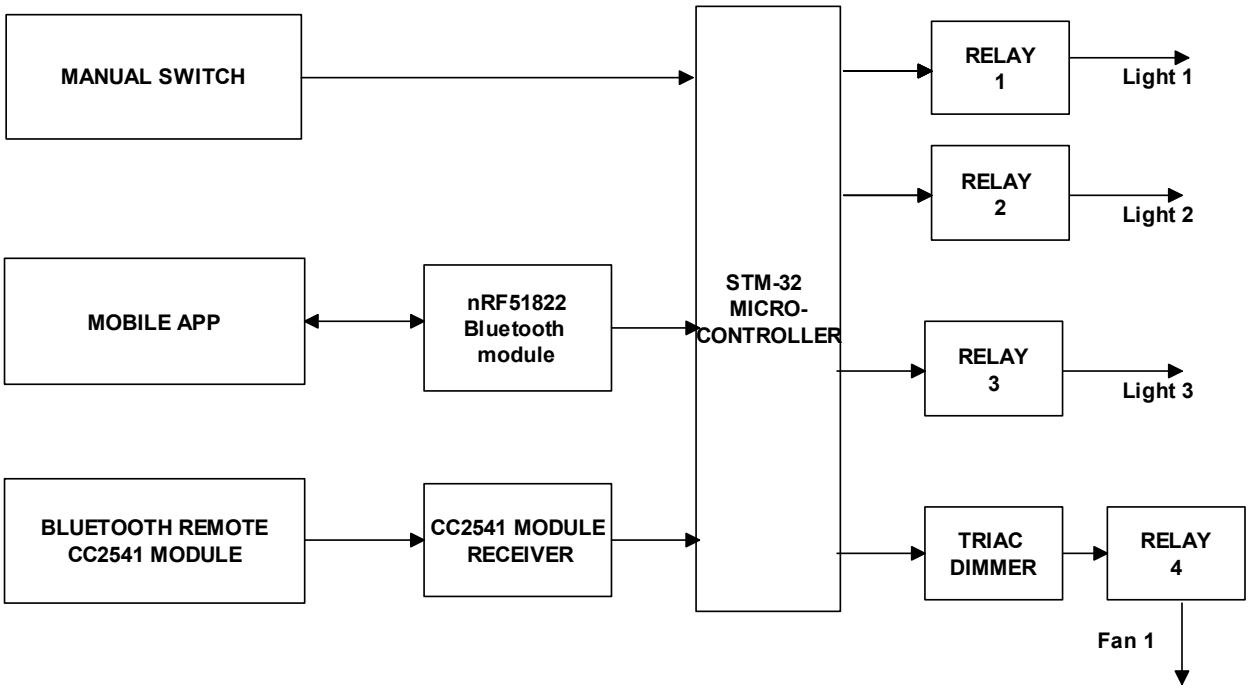

Fig. 4 The mechanism of Home automation and Intelligent Light Control System using microcontroller (HAILCSM)

Fig. 5 The implemented proposed Home automation and Intelligent Light Control System using microcontroller (HAILCSM)