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Upgradation of Present Electrical Control System Using Smart Application

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Abstract— Electricity has become the lifeline that runs the world. Saving of energy not only saves money but also helps in saving the environment. Home automation is one of the many answers to the dilemma of energy wastage. Home Automation is the control of domestic appliances by electronically controlled systems or computers. Home automation includes both automatic and remote actions for control. Many home automation products are available in the market today but these are complex systems and are either out of reach due to high costs or do not provide required results. Our aim is to introduce a low-cost model that brings comfort, convenience, ease of control and is cost effective. The model will not require a complete overhaul of the users' system and will not interfere with the aesthetics of the house.

Keywords— Home Appliances, Automation, Energy Conservation, Applications.

I. INTRODUCTION

Technology is what separates humans from other species. Things like the wheel, the compass, the printing press, the industrial revolution have heralded a new era for humanity. Technology has evolved greatly in last few decades and has become an important part of our lives. In fact, the primary goal of revolution in technology is to help improve our quality of life at work, home, and anywhere else. And Home automation is the next big thing in our era. A home automation system is a technological solution that enables automating the bulk of electronic, electrical and technology-based tasks within a home. It uses a combination of hardware and software technologies that enable control and management over appliances and devices within a home. A home with an automation system is also known as a smart home. With the rise of Smartphone, we have the option to use applications (apps) for every aspect of our lives. Apps go beyond social media; it is possible to download a suitable application for everything. We use our phones for everything today; to check emails, shop, book flights and hotels, pay bills, get food, and so much more. Thus, we have an option to monitor and control our home remotely.

II. THE DIFFERENCE

The problem associated with present electrical system is that it only provides for manual control i.e. the person must be near to the switch to turn on or off the electrical equipment. The present automatic control systems are neither cheap nor widespread. So, system present in the market do provides an option to control through hand handle devices. But this option does not bring an ease of control for people of all classes. Furthermore, there are smart devices available in the market which can control their output according to change in input. But most of these are standalone devices which will require their own platforms for human interaction. But the biggest problems associated with these systems and devices are, first, they burn a hole through the pocket. And second, they require a major over haul of the present system which again leads to problem number one.
Benchmarking our system against those available in the market produces an optimum result. First, it uses multiple ways of control thereby promising convenience to the user. It introduces remote control, thereby eliminating the need for physical presence near to the switchboard and brings comfort to the user. It requires a single app or platform for control of various appliances bringing ease of control for the user. It neither requires costly equipment nor it requires a major overhaul of one's home. This leads us to cost effectiveness.

III. FRAMEWORK

Our main objective is to bring Comfort, Convenience, ease of Control and be cost effective at the same time. To complete the said objectives, we will be employing three methods of control to our system which comprises of two lamps and a fan. The three methods mentioned are: -

1) Manual Control
2) Knock Based Control
3) Mobile based Control via Bluetooth

The system is divided into three main parts which are

A. Master Module
B. Slave Module
C. Mobile/ Cell phone

A. Master Module

The master module is the heart of the system and will be located in a central location or in drawing room. The master module comprises of a microcontroller which includes IC ATmega 328P-PU, voltage regulator 7805, 16 MHz crystal oscillator, capacitors, resistors, LEDs and push buttons. The Master Module will also house SW 420 vibration sensor, HC-05 Bluetooth module, 433 MHz Transmitter, DS3231 Real Time Clock (RTC) module, Seven Segment four-digit display, IR blaster and a Piezo buzzer. The master module is shown in figure 1.

Users can communicate directly with master module through knocking or indirectly via mobile. HC-05 Bluetooth module is used to communicate with the mobile. Users can send appropriate commands via Bluetooth to master module using mobile application. The master module will transmit the commands to slave module via 433 MHz transmitter. DS3231 RTC module, seven segment display and piezo buzzer add more functionality to the system. These will be used to add reminders and show real time. The IR blaster will be used to control some functions of TV.

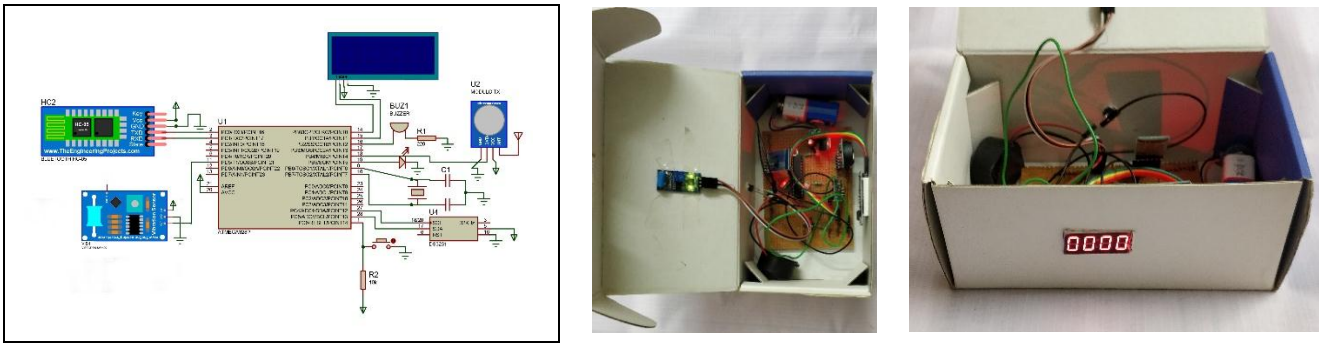


Figure 1 Master circuit design and actual photograph

B. Slave Module

The Slave module is the second part of the system. It consists of a microcontroller which includes IC AT mega 328 P-PU, voltage regulator 7805, 16 MHz crystal oscillator, capacitors, resistors, LEDs and push buttons. The Slave module also includes a 433 MHz receiver which is used in conjunction with the transmitter in Master module. A driver circuit which includes four relays for the four appliances, transistors, resistors, diodes and LEDs is connected the microcontroller. The driver circuit is used to isolate the high voltage circuit from the low voltage circuit and also to switch the appliances on or off. The slave module is shown in figure 2.

The slave module will be integrated with the manual switches on the wall in a way which does not pose an aesthetic problem. The slave module will send appropriate signals to the driving circuit upon receiving commands from the master module via the 433 MHz receiver. During normal switching operations too, the slave module will send appropriate signals to the driving circuit. The driving circuit on it's part will do the switching action by means of relays.

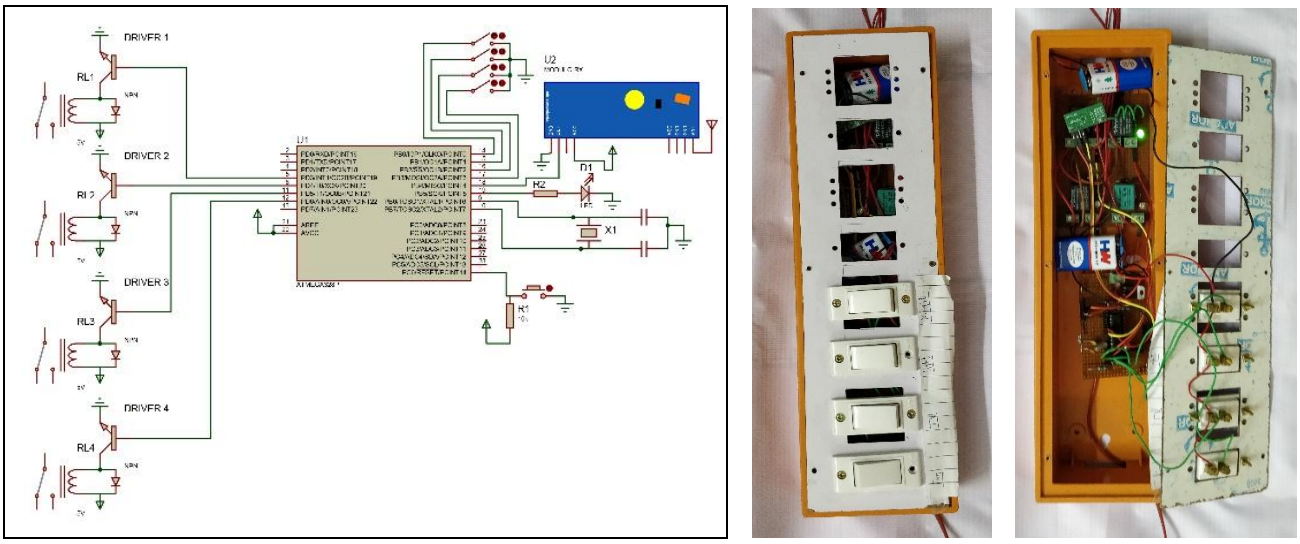


Figure 2 Slave circuit design and actual photograph

C. Mobile

Mobiles represent the third part of the system. Mobile is the epitome of comfort, convenience and ease of control. Most of homes nowadays have at least one Smartphone and these quite easy to use once you get a hang of it. Four our system we considered an Android Smartphone. The application for the same was made in Android Studio. The Smartphone will communicate with the master module via Bluetooth. The Smartphone can be used to switch on/off lights, fan and TV or

switch off all the said appliances simultaneously. Smart phone can also be used to control certain other functions of the TV like volume and channels. Reminders can also be set from the Smartphone.

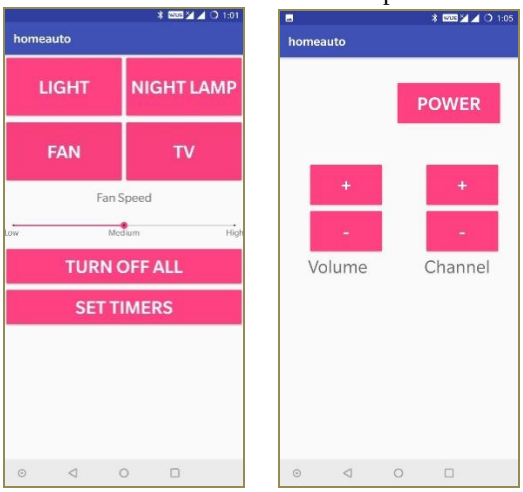


Figure 3 Mobile application screen shot

IV. WORKING

As explained earlier there are three main parts to the system. First is the Master module, second is the slave module and lastly the Smartphone. Users can use the manual switches (which will also hold slave module) or knock near the master module (which houses the vibration sensor) or use their Smartphone to control these electrical appliances. Let us take a case by case method to better understand the working of the system.

1) Users use the Knock function

The SW 420 Vibration sensor will sense the vibrations caused by knocks and send signal to the microcontroller. The microcontroller will take the input from the sensor and according to the code given, the microcontroller will send appropriate commands to the slave module via 433 MHz transmitter. The slave module will process the commands of the master module and will send commands to the driving circuit. The driving circuit will switch on or off the appliances based on the commands.

2) *Normal Switches are used*

Users can press the switches present on the wall to switch on or off the appliances. The switches are connected to the microcontroller in the slave module. The microcontroller compares the input with the stored values of the state of the appliances and sends commands to the driving circuit. The driving circuit will switch on or off the appliances based on the commands.

3) Mobile application

The users can use their Smartphone's to control various appliances. The mobile application has been made in Android Studio. The mobile will send commands to the master module via Bluetooth. The master module will send appropriate commands to the slave module via 433 MHz transmitter. The slave module will process the commands of the master module and will send commands to the driving circuit. The driving circuit will switch on or off the appliances based on the commands.

There are other functionalities like reminders and TV control. For TV an IR blaster is provided in the Master module itself. Users can power on or off the TV, change channels or volume through the Smartphone application. The Smartphone will send commands to the master module via Bluetooth. The android application can also be used to set reminders. The master module will notify the users regarding the reminder using piezo buzzer. The Master module also has a RTC unit which will be used to display real time.

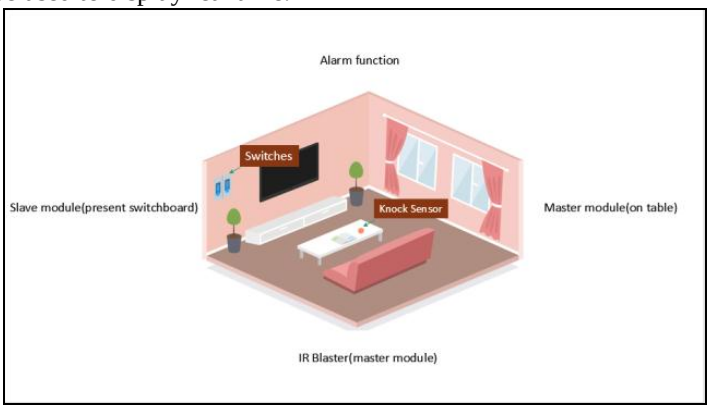
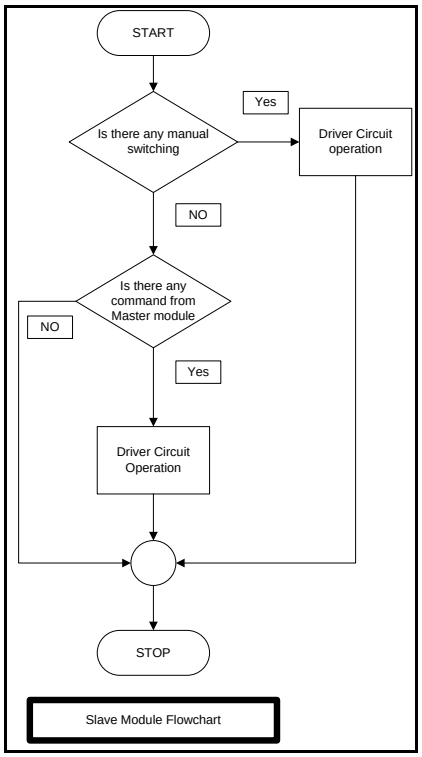


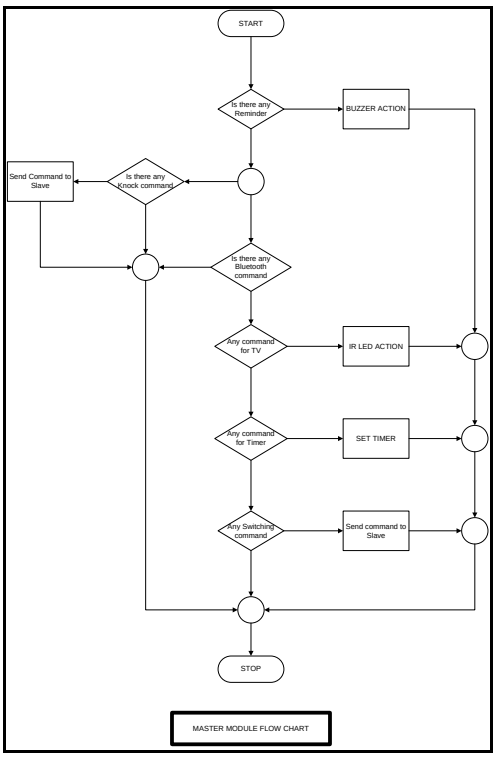
Figure 4 Demo picture for working

V. FUTURE SCOPE

In future we can go for one master multiple slaves, this can be used to control multiple appliances spread over multiple locations in the house. This will bring more comfort to the users as they can access all of their appliances on their fingertips. IOT is the next big thing in the Techworld and with the introduction of GSM or Wi-Fi as a medium of communication between the modules and the user, in the system we can increase the reception range and also increase the functionality of the overall system. We can also go for better protection systems to protect our appliances and the various modules. Security of the system is an important issue as the system in future will control most of the appliances of the user. We can go for username-password authentication or OTP authentication for increased security measures. We would also like to go for fan speed control so as to add more functionality to the system.

VI. FLOW CHART





VII. CONCLUSIONS

Our system revolves around Four C's which are Convenience, Comfort, ease of Control and Cost effectiveness. Use of technology to remotely control the appliances brings comfort. Use of various other functions like reminders, real time display, changing volume and channels in TV brings convenience. Multiple methods of control bring ease of control for users of all classes. The system does not require a major or complete over haul of the user's present system and hence is cost effective. The system presented here coverts a user's home into a smart home with a few tweaks. It overcomes the weakness of smart system available in the market like cost and complex control. In future we can go for one master multiple slaves to include most of the user's appliances. We can also go for GSM or Wi-Fi and add more functionality to the system. Increased security measures will help in protecting the system from misuse. Range of reception for Bluetooth is quite less compared to other systems like Wi-Fi or GSM and may hamper the working of system. There is no way of knowing whether power is back after a power cut as the control system will revert back to the initial zero values i.e. all appliances will remain switched off.

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