



Software Controlled Switchboard: A novel technique for Home Automation

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ABSTRACT

Comfort and luxury has been an utmost priority in today's time. It has also been linked with a necessity of automated systems for the help of physically challenged people and senior citizens as they find it difficult to perform the tasks which are repetitive in nature or the ones which require them to get exhausted or tired up easily. A switchboard is one thing which we have always seen and not many designs have modified its structure or functioning. Only its outer appearance and looks have been modified to cater to the need of growing demand of consumers to make it more appealing for the purpose of matching it with the interiors of rooms and house. This paper presents an extra module to be attached with the switchboards which can increase its functionality and make it more usable. The added module is a circuit designed with controller and wifi module to make it accessible for users. An app has been designed along with it to control the switching mechanism through mobile phones. The proposed module is a novel approach to provide automation of switching mechanism that is efficient and cost effective. This module is scalable for homes, schools, colleges, offices etc. The app designing is done through MIT app inventor website. WEMOS board has been used in hardware circuitry along with relay to control the switching mechanism. Router has to be used to provide internet connectivity as WIFI is needed to connect to the app and hardware module. This module is dependent on WIFI connection but it doesn't act as a limitation of this project because internet in today's time is a facility which is available in majority of the places where this module can be used.

Keywords : WEMOS, Relay, WIFI, automation

I. INTRODUCTION

Automation in industries, factories have been noteworthy but automation in lives of common man doesn't lag far in terms of automation in electronic appliances or in household items. An example is televisions with remote controls which helps the consumers to control various functionalities from a restricted distance. If every electrical device is accompanied with a remote, users shall have to maintain remotes for every device and also every device shall have to be attached with extra control

circuitry. This system shall not be economically feasible and also won't be feasible according to consumer's usability. Appliances like T.V, A.C's are accompanied with remotes keeping in view users usability of these. Fans with remotes were launched in market but didn't become a huge success owing to its high cost as compared to conventional fans apart from this important parameter is its maintenance according to the consumers point of view. This gap among the market scalability and automation at small scale was the motivation factor for the authors of this paper. Some important points that were kept in mind

that is while designing this module were economic, technological and consumer feasibility. Past research works related to this idea were studied and their research gaps were taken under consideration to design a system which has market scalability in field of automation and that can also be employed with the current infrastructure without the need to employ new devices and appliances. This paper proceeds with literature survey and then the methodology to design this module is discussed. This module is implemented in our college to prove its user accessibility and economic feasibility.

II. LITERATURE REVIEW

A. DTMF based home automation system

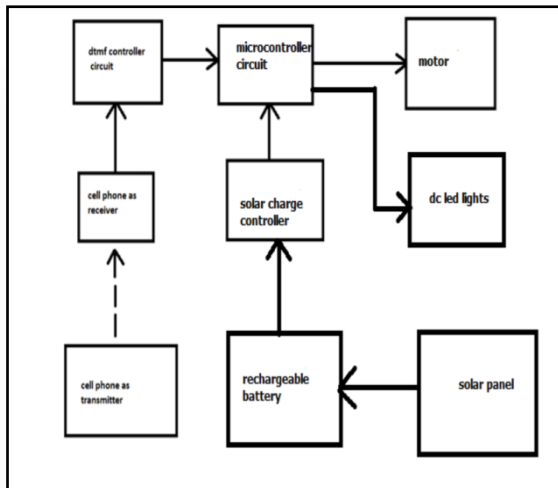
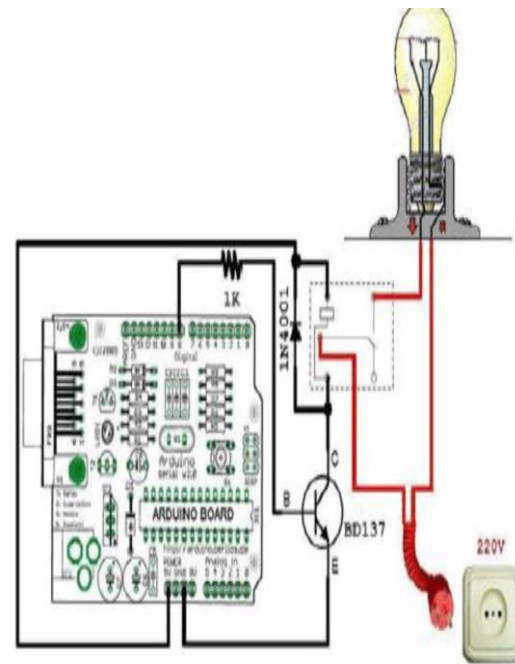


Fig 1 : DTMF based home automation system

DTMF means dual tone multifrequency, in this type of system the mobile phone's keypad tones are used to switch on/off the system but the main disadvantage of this system is usage of one extra mobile that will be permanently attached to the switchboard side and it has to be charged time and again. Also we need to call the specified number and then turn on or off the

system. Owing to the stated disadvantages this system was not launched in market.

B. Bluetooth based home automation system



Bluetooth based home automation system Bluetooth system uses a Bluetooth module connected to a hardware system attached to the switchboard where mobile user has an app that is compatible with Bluetooth system and user inputs are provided through the app. The biggest disadvantage is that it can work only in a limited range and hence is not a feasible model for markets hence these systems although launched in market but weren't popular among the users and slowly became obsolete.

III. Methodology

Figure below shows the basic block diagram of the project which has a controller, demonstrations is done using four relays but more number of relays can be used to connect more devices. The commands to turn on or off are done using graphic user interface (GUI) of a button which is placed on the screen of app.

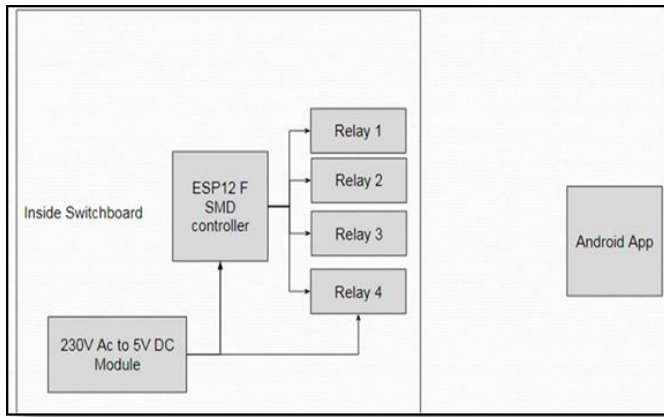


Fig: Block diagram of module

Working

The input is taken from user which is given through app and as WIFI is available it can connect with inbuilt wifi, the app and hardware module gets connected with each other. Input taken from user is received by the controller module which will then decode the signal received and accordingly turn on or off the electrical device like light or fan. This module is automated using relay which gets the signal from controller and it switches between two states i.e., ON and OFF. As there are four relays in the hardware module, four buttons are provided in app to control its switching.

Hardware

WEMOS

An important component which can help to control the switching operation and understand the input signals sent by the user through app is the controller board which has an inbuilt wifi module attached to it. ESP8266 is the IC configuration which is used in this board. This board performs two functions i.e. connecting with the wifi network to receive commands from the users, process those commands and send signals to relay module for switching mechanism of these devices.

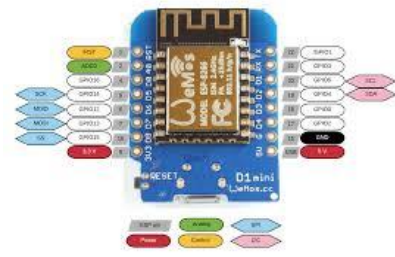


Fig: WEMOS D1 mini board

Relay module

A four channel relay module is used in this project whose four inputs are connected to four pins of controller which helps to turn ON or OFF the module. The second connections are done with the loads like lights and fans between common, NO and NC. The terminal gets switched from common and normally close to make contact with another i.e. Normally open and common terminal.

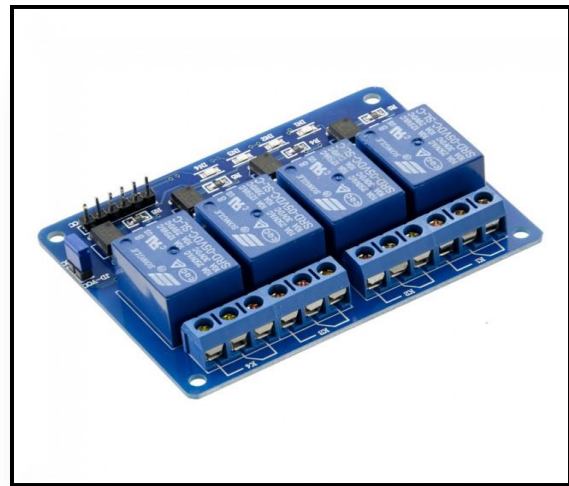


Fig: 4- channel relay module

Power supply

The components connected in this module do not operate on AC voltage and high voltage range hence a voltage regulation should be made available for these components and generally five volt supply should be used. The controller boards are provided with inbuilt voltage regulator and the components which do not have this provision will have to be fed through the regulated power supply.

Connections with Switchboard



Fig: module connected with switchboard

The figure shows an implemented module connected with switch board where four switch control mechanism is undertaken as there are four relays used in this module. The app designed shall provide with input signals and the connected four devices shall respond to the switching commands provided to the controller.



Fig: Circuit connections with 4 relays.

Software

Three softwares are used in this project mentioned below

- EasyEDA: For designing of PCB.
- MIT App Inventor: To design app
- Arduino IDE: For programming of controller.

EasyEDA:

PCB designing process is very important as the connection between components must not be loose or else the best designs of module can fail. PCB design is done on EasyEDA tool which will help to select the size of boards and also select the components to be placed on the board. Once the components are placed, connecting lines are chosen to connect the various inputs and outputs. Once the circuit is designed it will be then printed on a copper clad and further processes can be completed. This software also allows for simulation of hardware projects so that it can be tested virtually before working on hardware.

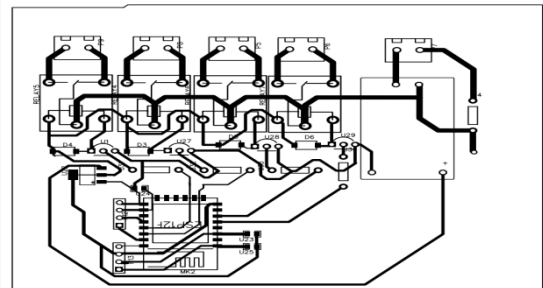


Fig PCB design of hardware module

MIT App Inventor:

Applications are generally designed with professional softwares that make use of Java as a language but there are a variety of softwares and websites which help to design apps through block programming for the ones who are not professional programmers and intend to design an app on their own.



Fig: Backend programming for app
WiFi Automation

- iv. Verify it and after connecting the board to laptop/ PC, select the board from Tools and upload the program to the board.
- v. The board can be first tested with LED blinking program
- vi. Once the programming is done it will continue in loop every time the system is turned ON.



Fig: Arduino IDE

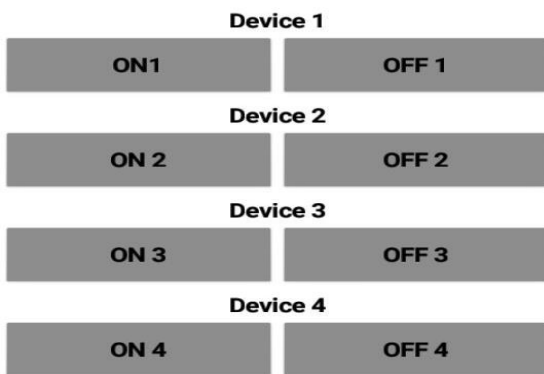


Fig: Mobile screen app GUI

IV. Results and Conclusion

Arduino IDE:

The controller has to be programmed to make it understand its functionality in the project. Arduino has provided an open source platform to program the controller board.

Steps to program Wemos board:

- i. Install the arduino IDE.
- ii. Select and install the Wemos board.
- iii. Write the program

The hardware designed module with an app is a novel approach for automation at small scale keeping in mind the economic factor as well as behavioral feasibility of users. The system is implemented in our college at departmental level to indicate its feasibility of practical implementation. This system is further tested to take into consideration any critical points that might have been ignored while implementation phase and we thank our Guide Dr, Sayyad Naimuddin Sir for his guidance at all stages of this project. An important point that can be stated is the use of routers at places where internet connection is poor but it does not comes as a restriction in our project as internet is majorly available at all places and routers

are as it is used in schools and colleges already. The design module facilitates the automation of devices without totally replacing the devices and just with an addition of this module to switchboards, switching mechanism can be controlled without changing infrastructure.

V. REFERENCES

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