

## Plug & Play Based Smart Switch

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**Abstract**— Analog switches are fixed on switch boards that are mounted on the walls. To operate them user should go near switch board and press the switch to turn ON or OFF any device or appliance. This hassle of manually operating switch is replaced by a smart technique which involves operating switch using the android application in smart phones. The smart switch is a plug and play switch in which, user can plug device or appliance and can operate it from anywhere just by using an android application in smart phone. Even this smart switch facilitates scheduling mechanism where in , user can schedule the time period for which the device or appliance should remain ON using the same android application. The device will automatically turned OFF after the scheduled time period is finished. The switches are interfaced with few electronic components like Arduino Uno, Wi-Fi Module and Relay. Smart switches already exist in the market today, but they are very expensive and require additional devices like hubs/Routers for their working.

**Keywords:** Smart Home, Smart Switch, Wi - Fi technology, Internet of things

### I. INTRODUCTION

Home automation is a part of “Internet of Things”, also known as IOT. The devices and appliances can be connected together to provide us with seamless control over aspects of our homes and other equipments. A home automation system will control the lights, climate, entertainment systems, and many appliances. It may also include home security appliances or applications such as access control and alarming systems. When it is connected with the Internet, home devices play an important part of the Internet of Things. The paper deals with designing a system that can operate the devices plugged into the switch. User can turn the devices ON or OFF using android application in smart phone. If user wishes to turn OFF the device after specific time, the user can schedule the time after which the device will turn OFF automatically

### II. LITERATURE SURVEY

Home automation is rapidly emerging field today. The rapidly growing internet has raised the level of home automation to a new level.

A security system that interfaces with an Android mobile device is discussed in “Exploiting Bluetooth on Android Mobile Devices for Home Security Application” [1] by Josh Potts and Somsak Sukittanon. Here the mobile device and security systems communicate via Bluetooth because a short-range-only communications system was desired. The Commands to lock, unlock, or check the status of the door to which the security system is installed can be sent quickly from the mobile devices via a simple, easy to use GUI. This type of security system can also tell the user if the door is open/not.

The overall design of Home Automation System (HAS) with low cost and wireless remote control is discussed in “Smart Home System Using Android Application”[2] by R.A.Ramlee, M.A.Othman, M.H. Leong , M.M.Ismail and S.S.S.Ranjit. This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled persons in home. The main control system implements wireless Bluetooth technology for providing remote access from PC/laptop or smart phones.

Salma and Dr. Radcliffe presented a new architecture for home automation in “Novel Protocol Enables DIY Home Automation” [3]. They have used Novel Network Protocol which provided the user to buy widely available commercial devices and directly control them using a Laptop or mobile. The use of microcontroller was omitted but for remote access an additional network device was used to reduce the cost of home automation.

The task of manually operating a switch is replaced by a smart technique that involves operating these switches using the web browser present in mobile phones, laptops or any other electronic gadgets is discussed in “Internet of Things Enabled Smart Switch”[4] by Vishwateja Mudiam Reddy, Naresh Vinay, Tapan Pokharna and Shashank Shiva Kumar Jha. The switches are interfaced with few electronic components such as logic gates, a 555 timer, flip-flops, processors etc. The user communicates with the processor through the use of Web App.

“A Smart Switch to Connect and Disconnect Electrical Devices at Home Using Internet”[5] by J. E. G. Salas, R. M. Caporal, E. B. Huerta, J. J. Rodriguez and J. J. R. Magdaleno presents the development of a firmware for a Smart Switch, which can control the on-off of any electrical device at home by using internet. The Smart Switch is connected to internet via Wi-Fi, through a computer, smartphone, tablet or any device with internet access. IP pre-program is written into the Smart Switch in a web browser in order to perform these connections

In summary, the types of switching systems examined all fail to meet the criteria that is needed for successful use of the products by every individual. These include installation that does not require experts and is helpful in decreasing costs and delays. Notably none addressed the plug-n-play requirement; this leads us to suggest that a new architecture is needed to overcome these problems.

### III. NEW SYSTEM ARCHITECTURE

Fig 1 illustrates the overall functioning of our proposed system.

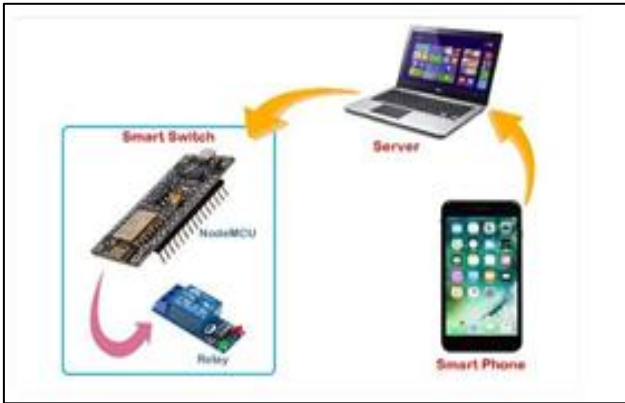


Fig. 1: System Architecture

In order to improve the standard of living in home, this system provides two different types of physical control methods to the Main Control Board. These controls are provided in the smartphone itself, the first control is the on/off of the particular switch by simple GUI in android, the second control is scheduling i.e. by scheduling the time or number of hours in the switch.

The switch status reading is real-time monitored by the main control board. Any changes on the status or reading will be transmitted to the GUI on the android device. The connections are done from smartphone to the Wi-Fi module in nodeMCU with the mediator of the web application to the Wi-Fi module and the establishment of connections to the nodeMCU board, from the circuitry the connections move to the relay to trigger the main controls of the switch.

#### A. Hardware Design

The easy installation is taken into account for this system. The system is designed to directly install in the electrical switch board on the wall. This installation of system eliminates the complex wiring installation and overhead wiring on the wall. Fig 2 describes the use of the plug and play type of switch. This kind of switch will be compact and compressed with the circuitry and will be controlled by the relay.



Fig. 2: Plug and play type of switch

NodeMCU is an open source IoT platform which includes firmware developed for ESP8266 wi-fi module. Since it is open source platform, their hardware design is open for edit/modify/build. NodeMCU was designed shortly after ESP8266 developed. The ESP8266 is a low-cost Wi- Fi module.

NodeMCU is a development board that is featured with the wi-fi capabilities, analog pins, digital pins and some serial communication protocols.

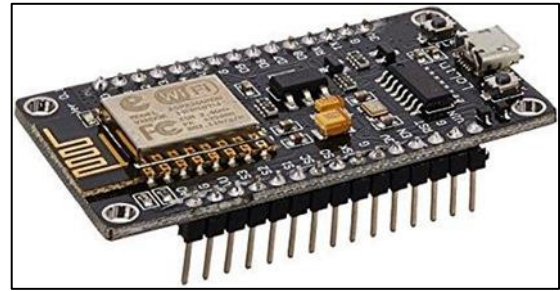


Fig. 3: NodeMCU

The Relay Board is often used to turn the devices on / off while keeping them isolated from your microcontroller. The Relay Board allows you to control high-power devices up to 10 A.

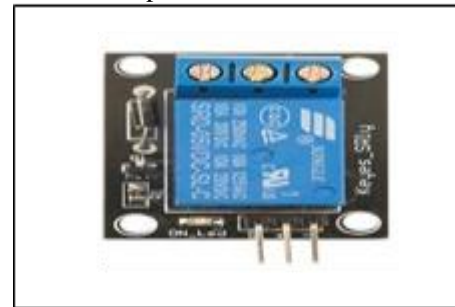


Fig. 4: Relay

#### B. Software Design

Software design section includes the main functions of the system design in the microcontroller and the GUI (Android application).

Our Android application will contain a login/registration page for the users, next as they login they will get a main page with three controls those are on/off - designed with push buttons and the scheduling – for which text as well as calendar entries will be included. GUI is designed for a user- friendly interface. User can simply click on the green/red power buttons to turn on/off the switch. When the both connections are established, web app will act as the server between main board and phone and the relay will trigger the switch.

The application will be designed in latest version of Android version with low API level. The application designed in low API level so that the devices with higher version are compatible with it. The interface will be simple to use, user can simply touch on the icon to turn on/off the appliances after connected to it.

#### IV. DESIGNED SYSTEM RESULTS

The main aim of this project is to operate as well as schedule the device plugged into switch board using android application and smart phone. Server is used to establish connection between Smart Switch and smart phone, and to store user login details. To establish connection, smart phone, server and Smart Switch must be connected to same Wi-Fi network.

New user needs to register in the android application to connect with the server. Once registered, user id and password will get saved in the server and latter can directly login.



Fig. 5: Login page and registration page

Once logged in, you will be provide three buttons. On clicking on green button device plugged to Smart Switch will be turned ON and while clicking on red button device will be turned OFF. On clicking on third button user will be able to schedule the device according to time and date.

Fig. 6: Logged in pages and Scheduling



Smart Switch is plugged into switch board and the devices are connected to Smart Switch.



Fig. 7: Proposed System kit

Plugged device can be operated through android application.



Fig. 8: Proposed Result

## V. FUTURE SCOPE

For future work, the Android GUI can be implemented with Speech recognition voice control such as Google Assistant. All the voice signal inputs to the smart phone will be transmitted for signal processing. Also, the push buttons implemented can be replaced by capacitive sensing switches. All the future work is expected without spend extra cost, even one rupee from the current system.

### A. Applications

This system will help in the applications like reduction in overnight charging of phones which we forget and continuously the power remains on, for controlling farming appliances like motors etc., charging of the electrical vehicles in the parking and many more.

## VI. CONCLUSION

For this paper we have reviewed the currently available home automation solutions and have identified a key area that has hindered the adaptation of such technology. That key area is the expense involved in purchasing and

implementing the system. Smart switches are manufactured by different Chinese vendors but are as mentioned before, really expensive. Prices vary between 2000 and 3500 per switch and an extra central hub will be required to control the switches. Very few of these solutions are direct replacements for conventional switch boards. Our proposed system will be cost effective while comparing with others.

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