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# Microcontroller Based Touch and Wi-Fi Enabled Electrical Switch

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**Abstract**

Internet of things (loT) appears to be the next vast thing. The extent of loT is continually developing while at the same time overwhelming advances like smart grids, smart homes, smart cities and so forth. The idea of a smart home with integrated sensors, actuators, wireless network and a graphical UI is extremely exciting. In this paper, we presented a novel model for smart switch. This smart switch has easy to use interface to work physically too it can be available remotely through Wi-Fi. Keeping in mind the end goal to give easy to understand interface, we utilize resistive touch screen as immediate substitution of existing switchboard. To communicate over the Wi-Fi, we utilize Adruino. Adruino is low cost with Wi-Fi shield. Touch panel and web application all together worked by Arduino. Being ease, resistive touch panels and Arduino, smart switch turn out to be simple substitution of existing cumbersome brilliant switches.

**Keywords:** IoT, Home Automation, Wi-Fi, Arduino Node MCU

## Introduction

### Overview

It is very normally observed that remote access to home appliances is not secure and effectively accessible. To check, observe and operate an electrical devices progress toward becoming need of current quick moving era. By controlling wired gadgets utilizing the remote gadgets have accomplished more noteworthy adaptability and extensibility, since its operation is all the more simple, it can be connected to any electrical apparatus at home and you won't require specific staff for operation and establishment. The main objective is to develop low cost, easy to use and simple to utilize smart board and smart switch for electrical appliances. In the time of versatile gadgets, why switch load up ought to be static?

### Benefits of Home Automation

In current period of digitization and wireless communication, successful control over the house holds devices become more users friendly. There are many advantages that can be accomplished utilizing wireless communication.

1) Less installation costs:

Since it is a wireless communication, it has less installation cost and less maintenance cost.

2) Highly Scalable

Any number of devices can be included after installation or it is easy to remove the node at run time without affecting the whole network.

3) Other advantages:

Usability, access from anyplace at any time is the biggest advantage of Home Automation system.

**Review of Literature**

**Ranjith B** et al [1] developed a system which controls Home automation and provide security. They used Raspberry Pi to developed their system. This system is helpful to monitor and control the electrical devices at real time. Authors declare that their system can be used in multiple location such as multiplex, bank, hospital , shopping complex etc. This system is currently operate household devices and ready for future enhancements.

**Faizan Amin Malik** et al [2] have developed the IoT based enthusiastic automation system. Two tier security architecture is major innovation that Authors presented. Among 2 tiers, 1st tier is at user level and 2nd tier is present at server side. Since architecture is of 2 tier, it promises that smooth, secure and confirm operations.

Jignesh Patoliya et al [3] proposed a system which utilizes nodes as alternative to existing switch. By doing so, existing home promoted to smart Home. Authors claims that this system is cost effective solution which replaces existing switches. According to authors, proposed scheme is to use nodes as an alternative to existing Switch boards in traditional home, hence existing home can be effectively upgrade to Smart Home. This scheme has unique feature that, it can be customized at run time.

[4] Vivek G.V et al[4]

Authors used ZigBee protocol to developed IoT Based HomeAutomation. Authors place the zigbee nodes at multiple locations to reada data. At the end of day, they have gathered data from multiple location.Data anaysys is done on collected data at sever side

**Problem Statement**

Switchboards and switches have not seen any cost-effective innovation in decades. It is difficult to identify which appliances/device is operated by which switch. The problem increases in commercial buildings, hotels, hospitals etc. Switchboards are typically hidden as they typically do not participate in the ambiance or interior of the room.

Also it is not possible to monitor, manage or remotely the operation of switches. Most of electricity users have no media to observe how much electric power utilized by each devices in a home. In many cases users are mostly away from home and does not have mechanism to connect or disconnect their devices remotely

Moreover low quality switches and regulators can cause grave risk of electrical shocks and short-circuits. Inflexible solution for the modern integrated homes and offices for example if a fire alarm goes off or a short circuit takes place; you are not supposed to turn on/off electrical appliances.

**System Architecture**

Resistive Touch Screen:

Resistive touch screens are touch- sensitive screen prepared by two adaptable sheets enclosed with resistive material and separated by an air crevice or microdots.. Two unique metallic layers are available in resistive touch screen. In first layer striped cathodes are present. This layer is called as Matrix. Glass or plastic facing each other is an example of Matrix. The second layer is made up of normal cathodes. This layer is called as Analogue. There are level and vertical lines on these two sheets. When user pushes the screen, both layers are pushed simultaneously. Using levels and vertical line, touch screen predict the exact area where used touches.



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**NodeMCU**

NodeMCU is microcontroller having inbuilt Wi-Fi chip. NodeMCU is a device which makes our system Wi-Fi enabled. The NodeMCU is a low-cost device. NodeMCU takes input from remote devices and produces out put on specific GPIO. It has 16 GPIO pins. Output pin of NodeMCU is connected to Arduino.

**Arduino**

Arduino is micro controller having 16 GPIO. Arduino is also low cost device. It is used in IoT systems. Arduino takes Analogue as well as Digital inputs. Arduino produces digital output. Using replays we can operate 230V electrical appliance via Arduino.

**Router**

A router is a specialized networking device. Router circulates data packets between networks nodes. Routers main task is to conduct the traffic directing functions on the Internet. A data packet is sent from one router to another through the networks that compose of the internetwork until it reaches its destination network node.

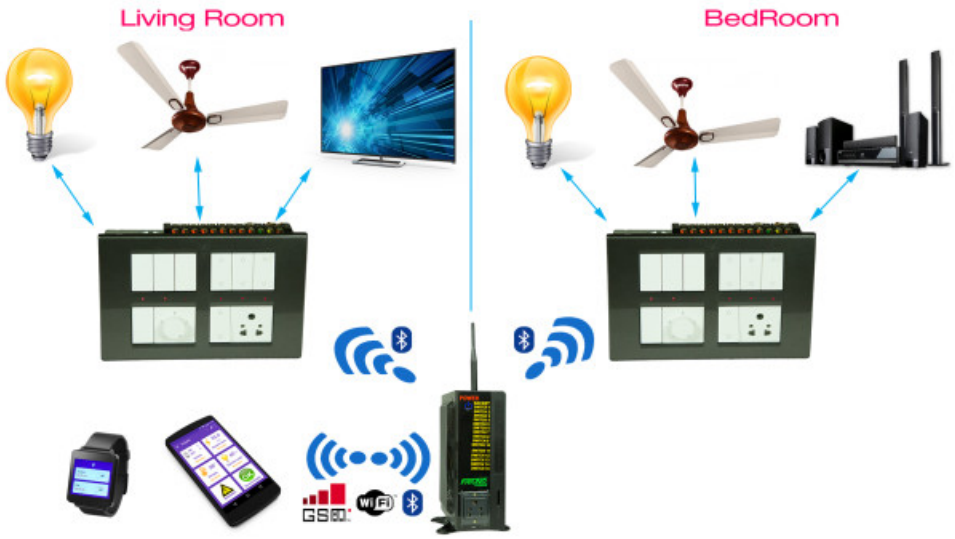


**Figure 1: Overall system for home smart switch board**

A: Touch screen sends the location of touched area to the Arduino. According to touch input Arduino controls output pin.

B: Serial communication happen between NodeMCU and Arduino at baud rate of 9600.

C: NodeMCU send and receive the signals from smart devices via router.

D: Arduino controls the relay as per given signal from either touch screen or NodeMCU.

E: Relay controlling physical electrical devices based on output pin value of Arduino.

V. PROPOSED SYSTEM

A Smart switch shall replace existing switch board. Output pins of Arduino is connected to relay. Relays are connected to real electrical line. Relay operates electrical devices. A photograph of a room ,which covers all the electrical equipments, is followed by touch screen. Calibration of touch screen should be done in accordance with photograph to locate the co-ordinates. The Four wire output of touch screen is connected to analog input pins of Arduino . A program shall be



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flashed on Arduino which process the co-ordinate and operate relays. Arduino and NodeMCU communicate serially over Rx-Tx Link. Baud rate is set to 9600. Arduino also listen the commands from NodeMCU as well as update the status to NodeMCU whenever user operate touch Panel. Commands can be send via smart cell phones or personal computer over the internet to the NodeMCU.

**A. Algorithm of proposed system**

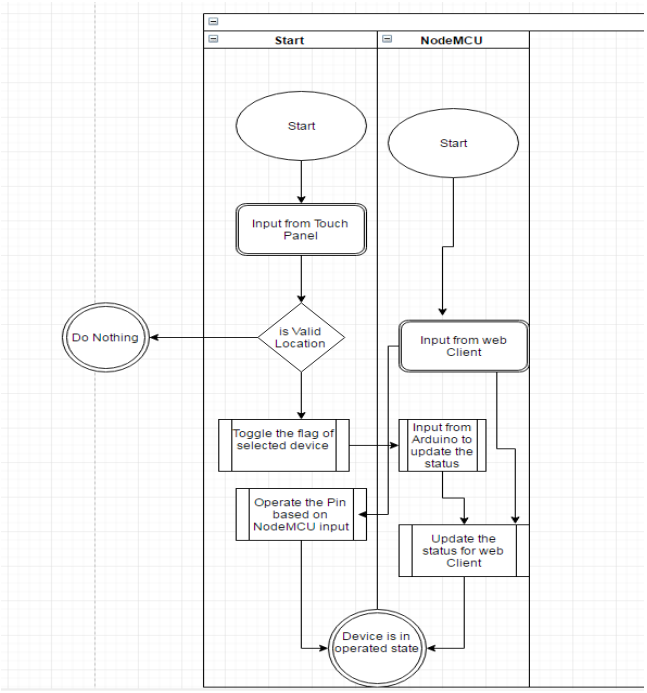


Figure 2: Flow Chart for Proposed System Workflow

**Arduino**

Arduino is always on to listen commands.

Step1: Command received at Arduino.

Step2: Check whether command from NodeMCU or Touch Screen.

Step3: If commands are from Touch Panel then Validate Co-ordinates.

Step3a: if Co-ordinate is invalid then do nothing

Step3b: If co-ordinate is valid then process the input with flashed algorithm and operate the relay.

Step3b1:rend signal to NodeMCU to update the status for WiFi users.

Step4: If commands are from NodeMCU then process the input with flashed algorithm and operate relay.

Step5: Based on Relay's status, actual electrical devices works

**NodeMCU**

NodeMCUis always on to listen commands.

Step1: Command received at NodeMCu.

Step2: Check whether command is from Web Client or Arduino.



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Step3: If commands are from Web Client, sent the command status to Arduino to operate relay.

Step4: If commands are from Arduino, update the status of respective devices for web client.

**B. Mathematical model of proposed system**

Let us consider our system as S

where, S={ T,W,SCA, R}

Here, System includes:

T = {$t_1$; $t_2$; $t_3$; ; ; ; $t_n$} Touch screen input

W = {$w_1$;$w_2$;$w_3$; ; ; ;$w_m$} input via Wi-Fi

SCA = f{T;W} switchboard command algorithm

R <— SCA

**C. Expected Result**

A resistive touch screen shall replace the existing touch screen. A screen should sense the finger press and should toggle the device which user pointed. This smart switch board should connect to router and should listen all the commands send via Wi-Fi. A web application or mobile application should be capable of communicating to NodeMCU.

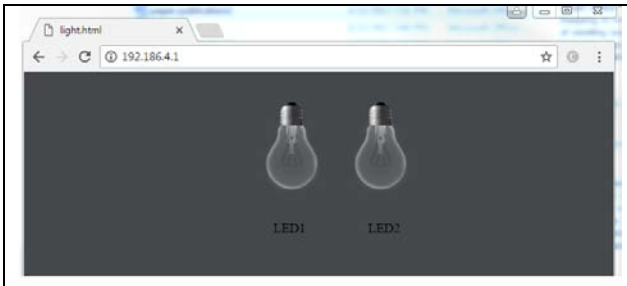
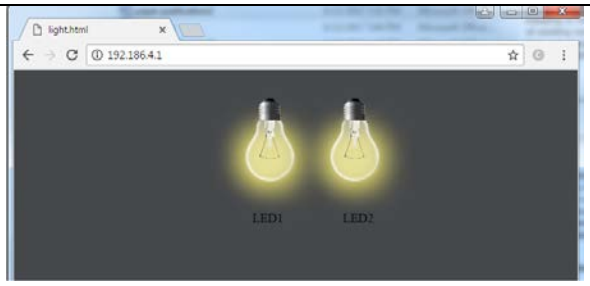
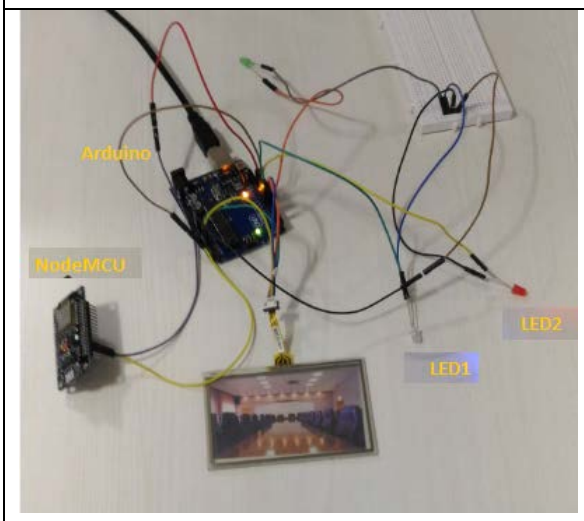
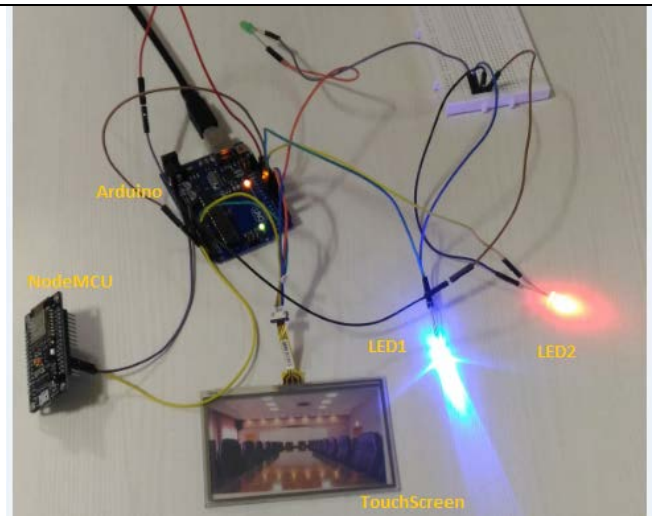



Fig: Both Bulb Is Off




By Pressing Each Bulb Both Get On




**Conclusion**

This paper explains the development of switchboard. The smart switch board which will change a look and feel of existing switch board. This smart switch board has resistive touch screen for direct user interface. We are also developing



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a firmware which communicates between NodeMCU and other smart devices via internet. This communication helps to operate the electrical device remotely.

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