**CONTENTS**

Abstract1

List of figures2

**1. Introduction3**

* 1. Motivation3

1.2 Problem definition4

1.3 Objective of Project4

1.4 Limitations of Project4

**2. Literature Survey5**

2.1 Introduction5

2.2 Existing system and its disadvantages5

2.3 Proposed System5

**3. Design6**

3.1 Introduction6

3.2 Block Diagram and description7

3.3 Circuit Diagram and description 9

**4. Implementation11**

4.1 Method of Implementation11

4.2 PCB design11

**5. Testing15**

5.1 Introduction15

5.2 Testing15

**6. Conclusion18**

**References19**

**Appendix-120**

**Appendix-227**

**ABSTRACT**

Popularity of home automation devices has increased greatly in recent years due to higher affordability and simplicity through Smartphone and tablet connectivity. For the purpose of this experiment, we have developed the Smart socket: a stand-alone communication unit, used to connect home outlets to the internet. The Smart socket controls simple appliances throughout the home, remotely, using wireless commands from the web. Here, we control home appliances through Wi-Fi connected smart phones.

**LIST OF FIGURES**

|  |  |  |  |
| --- | --- | --- | --- |
| Sl.no | Fig number | Figure name | Page No |
| 1 | Fig 3.2 | Block diagram | 7 |
| 2 | Fig 3.3 | Schematic diagram | 9 |
| 3 | Fig 4.1 | Pcb layout | 11 |
| 4 | Fig 5.1 | Product | 16 |
| 5 | Fig 5.2 | Circuit board | 17 |

**1. INTRODUCTION**

The Wi-Fi controlled socket is a simple technique with which we can automate the socket used. Home automation is a relatively new area of technology. In the field of home automation, the focus is to integrate electrical devices in the home with each other, utilizes different techniques. Currently, many devices exist in the market, some standard and some proprietary. The diversity constitutes a problem, as these devices are limited to their cost and incompatibility with each other This poses a dilemma to business owners and homeowners regarding which technology to choose, and the market fragmentation contributes to a slow widespread and evolution of home automation. However, our initiative is based on a simple, but dedicated vision of using wireless commands from web. The major advantage is that people who are not updated to the latest technologies can also use this facility by understanding simple working procedures.

**1.1 MOTIVATION**

Our motivation was to build cost effective automated system .Home automation has been something of a science fiction fantasy for decades. Never before has it been as technically feasible as it is today.. Home systems offer users a range of functionality for their home through a unified interface. Such an example is a leading home automation. A flexible home automation system can be easily installed by the end user having basic knowledge about working procedures. By lowering costs, and offering a system which can easily be extended over time, home automation becomes an affordable and realistic option for many households

**1.2 PROBLEM DEFINITION**

In day to day life, we come across a number of electrical equipments. To design a system without using direct contact with the equipment was our prior concern, which is the basic principle behind automation. A number of techniques were under our concern, but the problem behind is its cost. Most techniques involve heavy expenses for it to be manufactured. As a solution, we came across a simple, but efficient technique to automate the sockets using Wi-Fi and smart phone.

**1.3 OBJECTIVE OF PROJECT**

Design a flexible system to support the vast range of existing hardware and software for the home, as well as future devices The system must allow a means of flexibly combining the functionality of these devices at a higher level and secondly, the design of advanced offline detection mechanisms. As there are high chances of conflicts between user written rules (policies) for the home, these must be detected and reported to the user at the time of writing and saving a policy.

**1.4 LIMITATION OF PROJECT**

The mobile Wi-Fi on/off and proximity controls manage power at the output level. If you shut things off when you walk away, any other people in the house will have to go to the wall socket to turn things on again. If they happen to try the appliance's power switch to turn it on and it doesn't work, they may leave it in the off position. That will negate your app's control until you flick the switch again. It can control only one appliance at a time.

**2. LITERATURE SURVEY**

**2.1 INTRODUCTION**

The Wi-Fi controlled socket is a simple technique with which we can automate the socket used. Home automation is a relatively new area of technology. In the field of home automation, the focus is to integrate electrical devices in the home with each other, utilizes different techniques. Currently, many devices exist in the market, some standard and some proprietary. The diversity constitutes a problem, as these devices are limited to their cost and incompatibility with each other This poses a dilemma to business owners and homeowners regarding which technology to choose, and the market fragmentation contributes to a slow widespread and evolution of home automation. However, our initiative is based on a simple, but dedicated vision of using wireless commands from web. The major advantage is that people who are not updated to the latest technologies can also use this facility by understanding simple working procedures.

**2.2 EXISTING SYSTEM AND IT ’S DISADVANTAGES**

Many home automation systems are available. But most of them are expensive in its development as well as installation stages. Moreover, it requires technical knowledge to operate those. Automation using Wi-Fi socket is a cost effective product, which can be used without any prior knowledge about technology. The users just need to have an idea about the procedure in operating it.

**2.3 PROPOSED SYSTEM**

This project is implemented using a Wi-Fi module with esp8266 MCU and a solid state relay with MOC 3021 and TRIAC BT-136. Here using Wi-Fi connected smart phones, we can give wireless commands to the equipments. By this, we can control the overall working of those appliances. We can ensure cost effective automated socket.

**3. DESIGN**

**3.1 INTRODUCTION**

The design of our project was done by undergoing several stages beginning from the idea itself up to the final product which is the actual design prototype. Looking into the development of the design there are four separate stages were followed in order to build a working system.

1. Identifying the problem.

2. Plan a solution based on relevant studies.

3. List out the materials and components necessary to implement the system.

4. Gather the information about the materials to be used.

And here we are designing a flexible system to support the vast range of existing hardware and software for the home, as well as future devices The system must allow a means of flexibly combining the functionality of these devices at a higher level and secondly, the design of advanced offline detection mechanisms. As there are high chances of conflicts between user written rules (policies) for the home, these must be detected and reported to the user at the time of writing and saving a policy.

**3.2 BLOCK DIAGRAM AND DESCRIPTION**

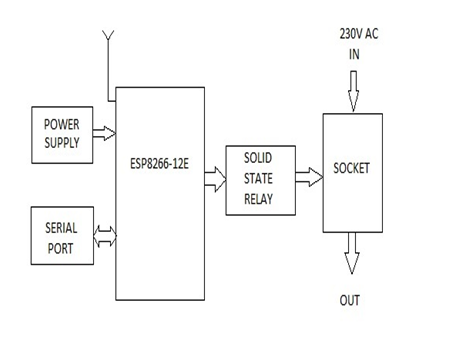


Fig 3.2 Block diagram

The block diagram consists of power supply, serial port, Wi-Fi module ESP8266 And solid state relay. Power supply is something that convert one form of electrical energy to another. Similarly, in this case, power supply is used to provide necessary supply to circuits.

The microcontroller needs to be programmed with which it functions with respect to requirements. So we need a communication interface through which information is to be transferred. Serial port serves this function in this diagram. It is used to write programs to the microcontroller.

The Wi-Fi module ESP8266 is the major component in the development of wireless socket, which offers a complete and self contained Wi-Fi networking solution. The programmed Microcontroller receives commands through Wi-Fi and depending on those commands, the appliances are controlled. Next, solid state relay using triac is used to control 230v supply to socket.

The microcontroller needs to connect to the user interface android application. When an event occurs, our code tells the microcontroller to send a DC signal from one of its GPIO pins to the relays once a certain event is detected. In this way, the microcontroller serves as the brains for the whole project.

The relays act as voltage controlled switch with a DC control portion and an AC pass-through portion. Each relays receives a 3.3VDC signal supplied from the microcontroller’s GPIO pins which signals the relay to close the path for 230VAC to pass through. 230VAC supplied by the input source gets passed through the dedicated relay and turns on a connected appliance. Most of the relative advantages of solid state and electromechanical relays are common to all solid-state as against electromechanical devices. Slimmer profile, allowing tighter packing, Totally silent operation, SSRs switch faster than electromechanical relays; the switching time of a typical optically coupled SSR is dependent on the time needed to power the LED on and off - of the order of microseconds to milliseconds, Increased lifetime, even if it is activated many times, as there are no moving parts to wear and no contacts to pit or build up carbon, Output resistance remains constant regardless of amount of use ,No sparking and Inherently smaller than a mechanical relay of similar specification.

**3.3 CIRCUIT DIAGRAM AND DESCRIPTION**

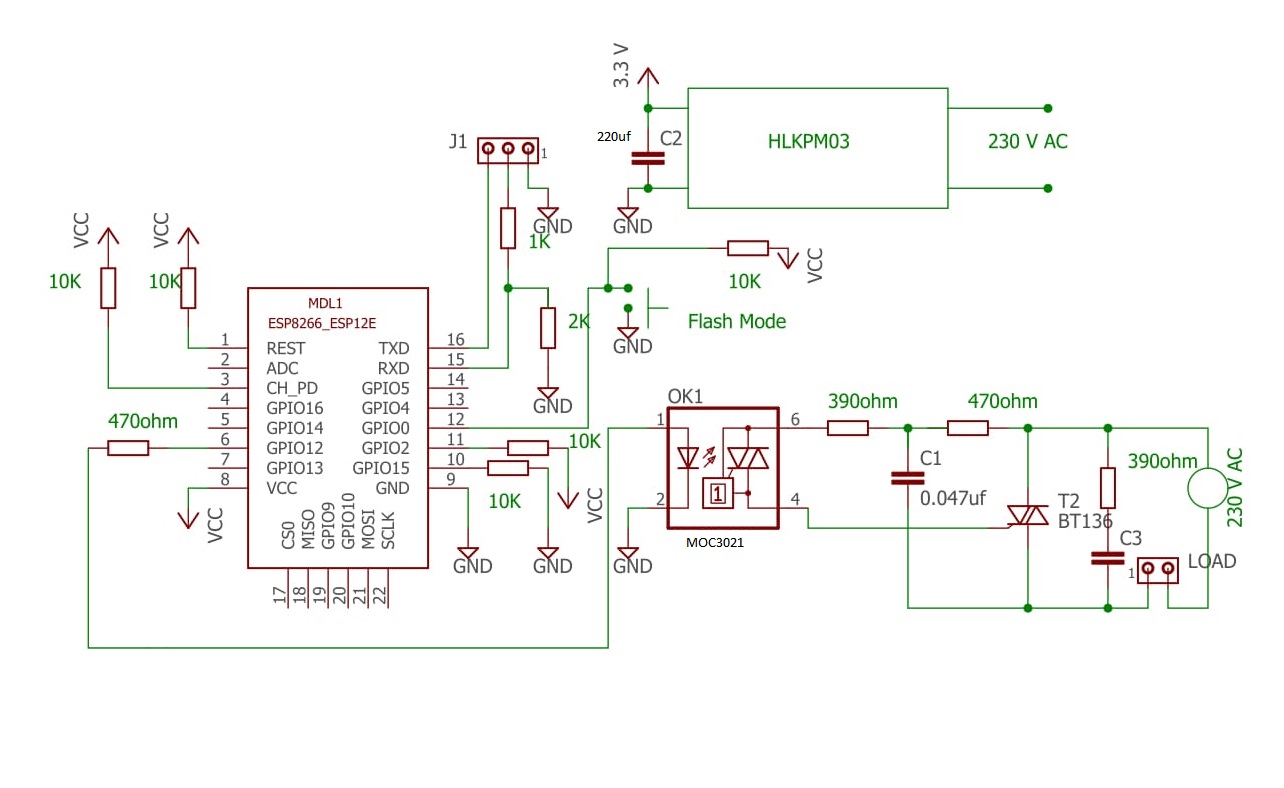
Fig 3.3 Schematic diagram

Fig: - (3.3a) shows the circuit diagram for Wi-Fi controlled socket. The ESP8266 system on chip (SoC) allows microcontroller to connect to a Wi-Fi network and make TCP/IP connections using simple commands. ESP8266 receive commands from browser or android app, MCU programmed to work according to command received. It has powerful on-board processing and storage capabilities that allows it to be integrated with its application specific devices through its GPIOs. It's on chip integration allows for minimal external circuitry. ESP8266EX is embedded with Tensilica L106 32-bit micro controller (MCU), which features extra low power consumption and 16-bit RSIC. The CPU clock speed is 80MHz. It can also reach a maximum value of 160MHz.

A GPIO (General Purpose Input/output Interface) pin is connected to input of a solid state relay (SSR) using triac. A solid state relay is basically an electronic switching device that switches on or off when a small external voltage is applied across its control terminals. It may be designed to switch either AC or DC to the load. In our circuit, we use the solid state relay using MOC3021, which functions as the triac driver and triac BT136. The relay switches the socket to on state when a HIGH appears across its GPIO pin. SSRs switch faster than electromechanical relays; the switching time of a typical optically coupled SSR is dependent on the time needed to power the LED on and off -of the order of microseconds to milliseconds.

HLK-PM03 from Hi Link is an isolated power supply module with input range of 100 volt to 240 volt AC and output of DC 3.3 volt and power rating of 3 watt. Its ultra compact size makes it perfect to use in places where size is a constraint. It is a compact PCB mountable plastic enclosed power supply module. HLK-PM03 Power Supply Module replaces lots of parts from the traditional power supply like diodes, voltage regulator, and transformer. HLK-PM03 internally contains SMPS circuit. A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such as a personal computer,while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time. In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight.

**4. IMPLEMENTATION**

**4.1 METHOD OF IMPLEMENTATION**

At first all the components ESP8266,triac driver, etc are tested. Then the required C++ program is written and uploaded to ESP8266 and the connections are done as per the block diagram. Inputs to the ESP8266 were given as per the circuit diagram. And then ESP8266 was connected to the system through the USB cable. Then the code was uploaded and the program was run.

**4.2 PCB DESIGN**

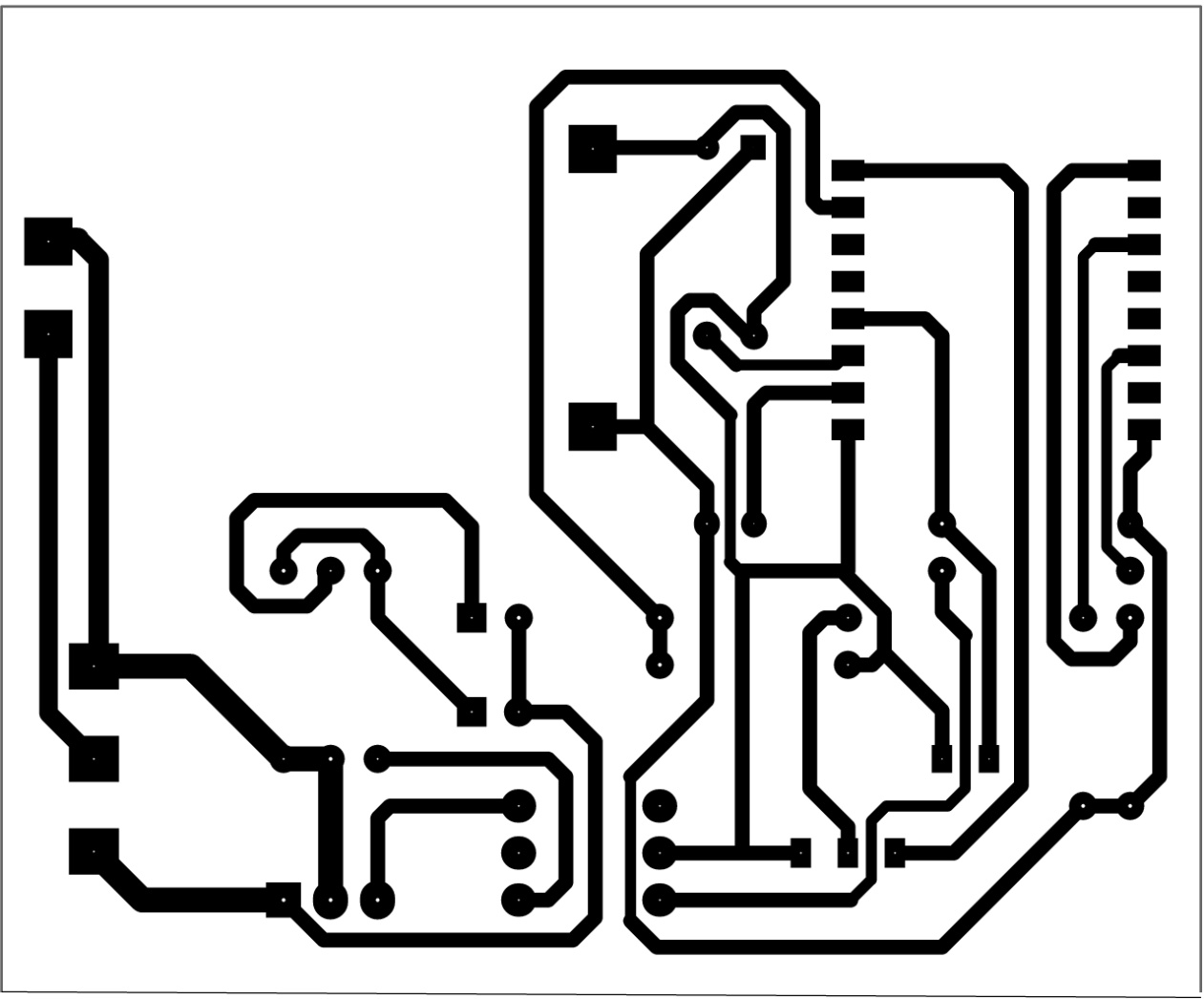
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Fig 4.1 Pcb laylout

A PCB is used to connect electronic components electrically. This is done by making conductive path ways for circuit connections by etching tracks from copper sheet laminated onto a non-conductive substrate. A PCB consists of a conducting layer that is made up of thin copper foil. The insulating layer di-electric is laminated together with epoxy resin prepare. The most commonly used PCB type is the FR-4. Boards may be single sided or double sided. Double sided PCB can be used to connect electronic components on both sides through through-hole plating. This is done by copper plating the walls of each hole so as to connect the conductive layers of the PCB.

**Advantages of PCB over Bread-board**

1. You can get a much higher density board with PCB.
2. You will find the PCB design to be more reliable than the one made on a bread board. The circuit will look neat without any wires popped up and will not fall apart.
3. You can have very precise control over the circuit component you are using, and you can comfortably fit in odd shaped components that are difficult to fix on a bread board.
4. For production of large volume of circuit boards, the costs become less and the soldering can be done by fully automated machines.

Once you have decided which electronic circuit is to be made on a PCB, you will have to make the design for the board on your PC. You can use different PCB designing CAD software’s like EAGLE and DIPTRACE. The most important point to note is that everything has to be designed in reverse because you are watching the board from above. If you need the circuit to be designed on a PCB, the layout must have a 360 degree flip.

The next step is to print out the layout using a laser printer. You must take special care in the type of paper that you are going to use. Though a little expensive, photo basic glossy or transparent papers are known to be the most suitable for the process.

You must also make sure that you are able to fit all your components on to the print. First take a copy of the print on ordinary paper and lay down all the IC’s and other components. The size of the layout must also fit the size of the PCB. Try to get the highest resolution when you are printing i on the paper. Always use black ink to take the layout. Increase the contrast and make the print more dark and thick. Do not take the print as soon as it comes out. Wait for some time for the ink to dry out.

**PCB Etching Process**

All PCB’s are made by bonding a layer of copper over the entire substrate, sometimes on both sides. Etching process has to be done to remove unnecessary copper after applying a temporary mask, leaving only the desired copper traces. Though there are many methods available for etching, the most common method used by electronics hobbyists is etching using ferric chloride or hydrochloric acid. Both are abundant and cheap. Dip the PCB inside the solution and keep it moving inside. Take it out at times and stop the process as soon as the copper layer has gone. After etching, rub the PCB with a little acetone to remove the black colour, thus giving the PCB a shining attractive look. The PCB layout is now complete.

**PCB Drilling**

The components that have to be attached to the multi-layered PCB can be done only by VIAS drilling. That is, a pated-through hole is drilled in the shape of annular rings. Small drill bits that are made out of tungsten carbide is used for the drilling. A dremel drill press is normally used to punch the holes. Usually, a 0.035 inch drill bit is used. For high volume production automated drilling machines are used.

Sometimes, very small holes may have to be drilled, and mechanical methods may permanently damage the PCB. In such cases, laser drilled VIAS may be used to produce an interior surface finish inside the holes.

**Conductor Plating**

The outer layer of the PCB contains copper connections (the part where the components are placed) which do not allow solder ability of the components. To make it solder able, the surface of the material has to be plated with gold, tin, or nickel.

**Solder Resist**

The other areas which are not to be solder able are covered with a solder resist material. It is basically a polymer coating that prevents the solder from bringing traces and possibly creating shortcuts to nearby component leads

**PCB Testing**

In industrial applications, PCB’s are tested by different methods such as Bed of Nails Test, Rigid Needle adaptor, CT scanning test, and so on. The basic of all tests include a computer program which will instruct the electrical test unit to apply a small voltage to each contact point, and verify that a certain voltage appears at the appropriate contact points.

**PCB Assembling**

PCB assembling includes the assembling of the electronic components on to the respective holes in the PCB. This can be done by through-hole construction or surface-mount construction. In the former method, the component leads are inserted into the holes drilled in the PCB. In the latter method, a pad having the legs similar to the PCB design is inserted and the IC’s are placed or fixed on top of them. The common aspect in both the methods is that the component leads are electrically and mechanically fixed to the board with a molten metal solder.

**5. TESTING**

**5.1 INTRODUCTION**

Testing is the process of evaluation of both software and hardware items to detect the difference between given input and expected output. It includes verification and validation process that determines the quality of products

**5.2 TESTING**

Firstly the power supply was tested. The voltage was measured using multimeter, output was 3.31V. Just like how we previously experimented, the whole system was perfectly assembled inside a beautiful compact case. Then the system was tested by connecting a lamp to the socket and controlled by an android application which was designed by our self

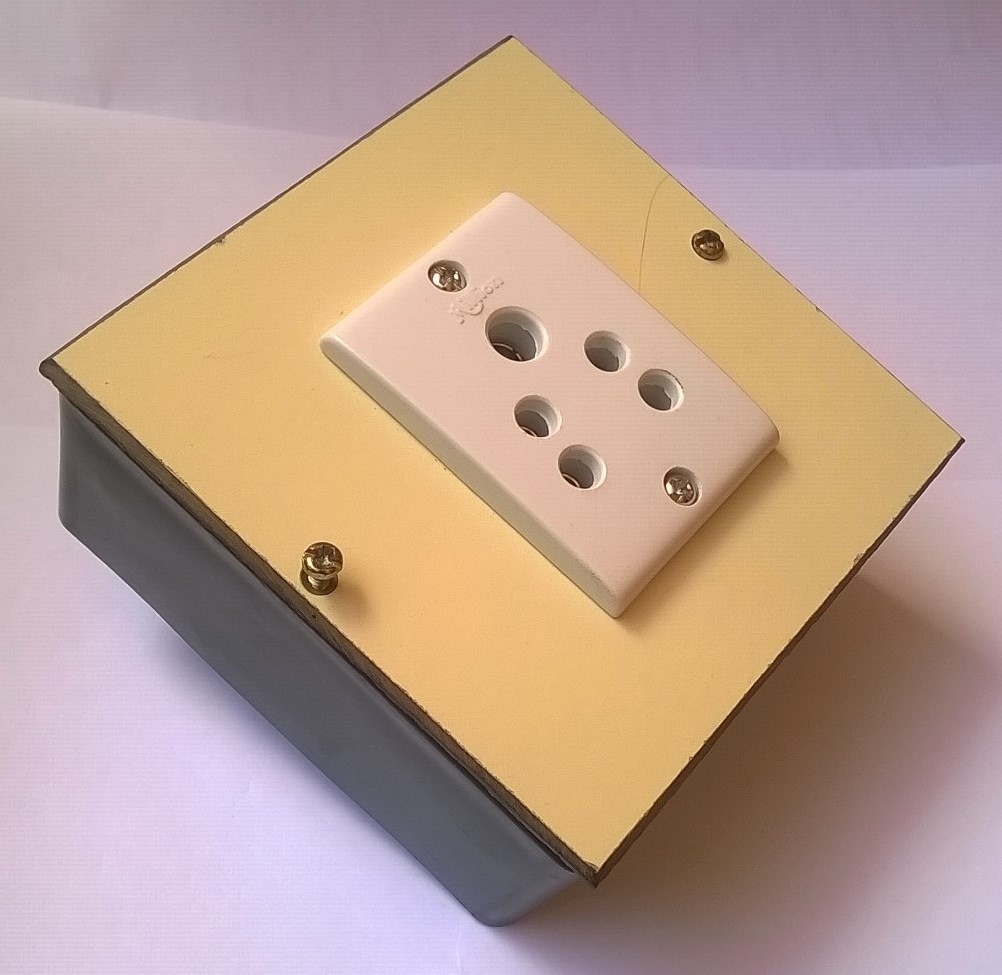


Fig 5.1 Product

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Fig 5.2 Circuit board

**6.CONCLUSION**

Here our motivation was to build cost effective automated system .Home automation has been something of a science fiction fantasy for decades. A flexible home automation system can be easily installed by the end user having basic knowledge about working procedures. That is what here we have done. By lowering costs, and offering a system which can easily be extended over time, home automation becomes an affordable and realistic option for many households by our product.

Here we designed a flexible system to support the vast range of existing hardware and software for the home, as well as future devices.The system must allow a means of flexibly combining the functionality of these devices at a higher level and secondly, the design of advanced offline detection mechanisms.

**7. REFERENCES**

**TEXT BOOKS**

1.Marco Schwartz , Internet of Things with ESP8266,Packt Publishing Limited

**URL ADDRESSES**

1.GitHub, Inc [US]

Link: <https://github.com/esp8266/arduino>

2 .ESP8266 Community Forum

Link: http://www.esp8266.com/

3. Hackster.io

Link: http://[www.hackster.io](http://www.hackster.io)

4. Philips semiconductors

Link: <http://www.datasheetcatalog.com>

5. Motorola semiconductor technical data

Link: <http://www.datasheetcatalog.com>

**APPENDIX-1**

**1.ESP8266-12E**

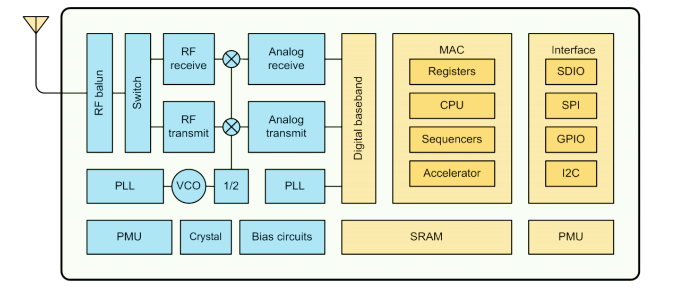


Fig 1 ESP8266 block diagram

Espressif Systems’ Smart Connectivity Platform (ESCP) is a set of high performance, high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed WiFi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.ESP 8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an external ﬂash. In has integrated cache to improve the performance of the system in such applications. Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any micro controller based design with simple connectivity (SPI/SDIO or I2C/UART interface).

ESP8266EX is among the most integrated Wi-Fi chip in the industry; it integrates the antenna switches, RF balun, power ampliﬁer, low noise receive ampliﬁer ,ﬁlters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

ESP8266EX also integrates an enhanced version of Tensilica’s L106 Diamond series 32-bit processor, with on-chip SRAM, besides the Wi-Fi functionalities. ESP8266EX is often integrated with external sensors and other application speciﬁc devices through its GPIOs; sample codes for such applications are provided in the software development kit (SDK). ESP8266EX has been designed for mobile, wearable electronics and Internet of Things applications with the aim of achieving the lowest power consumption with a combination of several proprietary techniques. The power saving architecture operates mainly in 3 modes: active mode, sleep mode and deep sleep mode.

By using advance power management techniques and logic to power-down functions not required and to control switching between sleep and active modes, ESP8266EX consumes about than 60uA in deep sleep mode (with RTC clock still running) and less than 1.0mA (DTIM=3) or less than 0.5mA (DTIM=10) to stay connected to the access point. When in sleep mode, only the calibrated real-time clock and watchdog remains active. The real-time clock can be programmed to wake up the ESP8266EX at any required interval. The ESP8266EX can be programmed to wake up when a specified condition is detected. This minimal wake-up time feature of the ESP8266EX can be utilized by mobile device SOCs, allowing them to remain in the low-power standby mode until Wi-Fi is needed. In order to satisfy the power demand of mobile and wearable electronics, ESP8266EX can be programmed to reduce the output power of the PA to fit various application profiles, by trading off range for power consumption.

**Applications**:

* Home Appliances
* Home Automation
* Smart Plug and lights
* Mesh Network
* Industrial Wireless Control
* Baby Monitors
* IP Cameras
* Sensor Networks
* Wearable Electronics

**Features**

• 802.11 b/g/n

• Integrated low power 32-bit MCU

• Integrated 10-bit ADC

• Integrated TCP/IP protocol stack

• Integrated TR switch, balun, LNA, power ampliﬁer and matching network

• Integrated PLL, regulators, and power management units

• Supports antenna diversity

• Wi-Fi 2.4 GHz, support WPA/WPA2

• Support STA/AP/STA+AP operation modes

• Support Smart Link Function for both Android and iOS devices

• SDIO 2.0, (H) SPI, UART, I2C, I2S, IR Remote Control, PWM, GPIO

• STBC, 1x1 MIMO, 2x1 MIMO

• A-MPDU & A-MSDU aggregation & 0.4s guard interval

• Deep sleep power <10uA, Power down leakage current < 5uA

• Wake up and transmit packets in < 2ms

• Standby power consumption of < 1.0mW (DTIM3)

• +20 dBm output power in 802.11b mode

• Operating temperature range -40C ~ 125C

• FCC, CE, TELEC, Wi-Fi Alliance, and SRRC certiﬁed

**2. TRIAC**

TRIAC, from triode for alternating current, is a [generic trademark](https://en.wikipedia.org/wiki/Generic_trademark) for a three terminal [electronic component](https://en.wikipedia.org/wiki/Electronic_component) that conducts [current](https://en.wikipedia.org/wiki/Electric_current) in either direction when triggered. Its formal name is bidirectional triode thyristor or bilateral triode thyristor. A thyristor is analogous to a [relay](https://en.wikipedia.org/wiki/Relay) in that a small voltage and current can control a much larger voltage and current. The illustration on the right shows the circuit symbol for a TRIAC where A1 is Anode 1, A2 is Anode 2, and G is Gate. Anode 1 and Anode 2 are normally termed Main Terminal 1 (MT1) and Main Terminal 2 (MT2) respectively.

TRIACs are a subset of [thyristors](https://en.wikipedia.org/wiki/Thyristor) and are related to [silicon controlled rectifiers](https://en.wikipedia.org/wiki/Silicon_controlled_rectifier) (SCRs). TRIACs differ from SCRs in that they allow current flow in both directions, whereas an SCR can only conduct current in a single direction. Most TRIACs can be triggered by applying either a positive or negative voltage to the gate (an SCR requires a positive voltage). Once triggered, SCRs and TRIACs continue to conduct, even if the gate current ceases, until the main current drops below a certain level called the [holding current](https://en.wikipedia.org/wiki/Silicon_controlled_rectifier#Modes_of_operation).

Glass passivated triacs in a plastic envelope, intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

PIN CONFIGURATION AND SYMBOL

T1

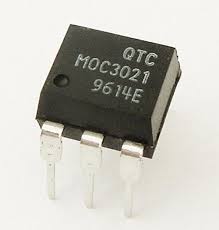
T2

G

1 2 3

tab

**3. TRIAC DRIVER-MOC3021**

Fig 2 Triac driver

TRIAC drivers also known as a Phototriac Coupler, a TRIAC Driver is a specific type of optocoupler that is used exclusively to provide an optically-isolated gate drive current to a TRIAC. The MOC3020 Series consists of gallium arsenide infrared emitting diodes, optically coupled to a silicon bilateral switch.

**Recommended for 115/240 Vac(rms) Applications:**

* Solenoid/Valve Control
* Static ac Power Switch
* Lamp Ballasts
* Solid State Relays
* Interfacing Microprocessors to 115 Vac Peripherals
* Incandescent Lamp Dimmers
* Motor Controls

**4.POWER MODULE(HLK-PM03)**



Fig 3 Power module

A power module or power electronic module provides the physical containment for several power components, usually power semiconductor devices. These power semiconductors (so-called dies) are typically soldered or sintered on a power electronic substrate that carries the power semiconductors, provides electrical and thermal contact and electrical insulation where needed. Compared to discrete power semiconductors in plastic housings as TO-247 or TO-220, power packages provide a higher power density and are in many cases more reliable

HLK-PM03 from Hi Link is a isolated power supply module with input range of 100 volt to 240 volt AC and output of DC 3.3 volt and power rating of 3 watt. Its ultra compact size makes it perfect to use in places where size is a constraint. It is a compact PCB mountable plastic enclosed power supply module. HLK-PM03 Power Supply Module replaces lots of parts from the traditional power supply like diodes, voltage regulator, and transformer.

**Features:**

* Meet UL,CE requirements,
* Ultra-thin, ultra-small
* All voltage input (AC: 90 ~ 264V)
* Low ripple and low noise.
* Output overload and short circuit protection
* .High efficiency, high power density.
* The product is designed to meet the requirements of EMC and Safety Test.
* Low power consumption, environmental protection, no-load loss <0.1W.
* 100% load aging and testing.

**APPENDIX-2**

#include <ESP8266WiFi.h>

/\* Set these to your desired credentials. \*/

const char \*ssid = "AuCo";

const char \*password = "123456789";

//start web server at port 80

WiFiServer server(80);

void setup() {

delay(1000);

Serial.begin(115200);

Serial.println();

Serial.print("Configuring access point...");

/\* You can remove the password parameter if you want the AP to be open. \*/

WiFi.softAP(ssid, password);

IPAddress myIP = WiFi.softAPIP();

Serial.print("AP IP address: ");

Serial.println(myIP);

pinMode(12, OUTPUT);

digitalWrite(12, 0);

server.begin();

Serial.println("HTTP server started");

}

void loop()

{

WiFiClient client = server.available();

if (!client) {return }

// Wait until the client sends some data

Serial.println("new client");

while (!client.available()) {

delay(1);

}

// Read the first line of the request

String req = client.readStringUntil('\r');

Serial.println(req);

client.flush();

// Match the request

char val;

if (req.indexOf("/gpio/2") != -1)

{

digitalWrite(12, 0);

val = 0;

}

else if (req.indexOf("/gpio/3") != -1)

{

digitalWrite(12, 1);

val = 1;

}

else {

Serial.println("invalid request");

client.stop();

return;

}

client.flush();

// Prepare the response

String s = "HTTP/1.1 200 OK\r\nContent-Type: text/html\r\n\r\n<!DOCTYPE HTML>\r\n<html>\r\nSOCKET is now ";

s += (val) ? "high" : "low";

s += "</html>\n";

// Send the response to the client

client.print(s);

delay(1);

Serial.println("Client disonnected");

}