UJJAIN ENGINEERING COLLEGE, UJJAIN

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

2017-18

A Project Report submitted to Ujjain Engineering College, Ujjain towards partial fulfilment of the award of

BACHELOR OF ENGINEERING

In

Electronics and Communication Engineering

Project Title : IoT based Home Automation System

Guided By :

Prof. R.B. Gaikwad

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CERTIFICATE

This is to certify that the Minor Project entitled ‘IoT Based Home Automation’, submitted by Aaditya Phadnis, Prakhar Verma, Harshit Agarwal, Udit Sahu, Vikas Namdev and Vishnu Parmar of B.E. VI semester, Electronics and Communication Engineering Department, in the year 2017-18, is a satisfactory account of their work based on syllabus which is accepted in partial fulfilment of degree of *Bachelor of Engineering* in Electronics and Communication.

HOD:	**Guided By:**
Prof. Y.S. Thakur	Prof. R.B. Gaikwad

Principal :

Dr Umesh Pendharkar

RECOMMENDATION

This certifies that the ‘Aaditya Phadnis’, ‘Harshit Agarwal’, ‘Prakhar Verma’, ‘Udit Sahu’, ‘Vikas Namdev’ and ‘Vishnu Parmar’, are students of third year, B.E. (Department of Electronics and Communication) in the year 2017-18 and has completed their work on ‘IoT Based Home Automation System’ for minor project based on syllabus and has submitted a satisfactory account of their work in this project report which is recommended for the fulfilment of the degree of *Bachelor of Engineering* in Electronics and Communication.

HOD:	**Guided By:**
Prof. Y.S. Thakur	Prof. R.B. Gaikwad

Project Approval Sheet

The project entitled ‘IoT based Home Automation System’ submitted by Aaditya Phadnis, Harshit Agrawal, Prakhar Verma, Vikas Namdev and Vishnu Parmar is approved as a partial fulfilment for the award of terms of work and practical mark under the curriculum of Ujjain Engineering College, Ujjain.

Internal Examiner **External Examiner**

Date **Date**

Acknowledgement

Successful achievement of any target involves interests & efforts of many peoples, and thus project is no expectations. Therefore, we approach this important matter of project through these lines trying our best to give full credit where it deserves.

It is our proud privilege to have worked under the guidance of ‘Prof. R.B. Gaikwad’ who generously shared their wisdom and expertise with us and has provided us an excellence guidance and interest.

We would also like to thank our Head of Department, Prof. Y.S. Thakur, for providing us an excellent environment to work and learn.

We are also very thankful to respected principal Dr.Umesh Pendharkar, UEC, Ujjain for the continuous support and encouragement throughout the development of this project.

Lastly, we would like thank our families, without their support, this project wouldn’t have been possible.

Table of Content:

1. Abstract

The project 'IoT based Home Automation' system aims to provide simple and cheap way to automate home appliances via Wifi. The following project provides the user a web based interface to toggle the home appliances. A Wifi module and a microcontroller unit placed inside the house correspondingly toggles the switches in the house, thus automating the devices.

2. Project Overview

The process of controlling or operating various equipment, machinery, industrial processes, and other applications using various control systems with less or no human intervention is termed as automation. There are various types of automation based on the application they can be categorized as home automation, industrial automation, autonomous automation, building automation etc.

Home automation is the process of controlling home appliances automatically using various control system techniques. The electrical and electronic appliances in the home such as fan, lights, outdoor lights, fire alarm, kitchen timer, etc., can be controlled using various control techniques.

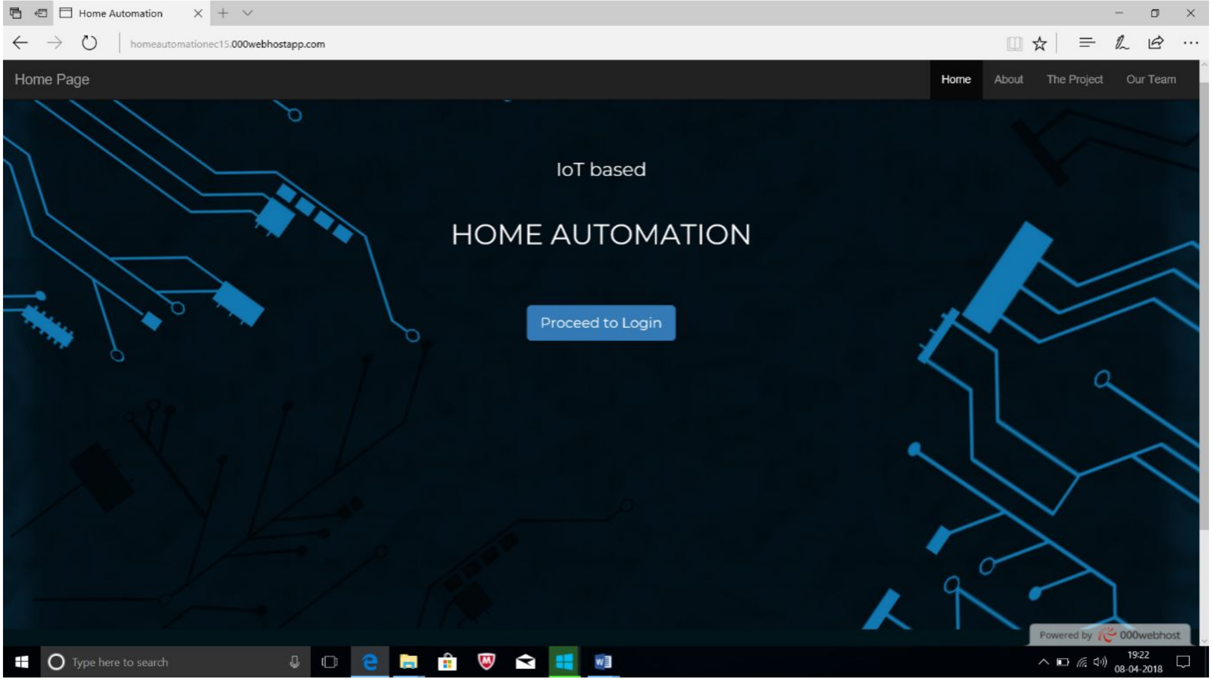
There are various techniques to control home appliances such as IOT based home automation over the cloud, home automation under Wifi through android apps from any Smartphone, Arduino based home automation, home automation by android application based remote control, home automation using digital control, RF based home automation system and touch-screen based home automation. Wireless home automation using IOT is an innovative application of internet of things developed to control home appliances remotely over the cloud.

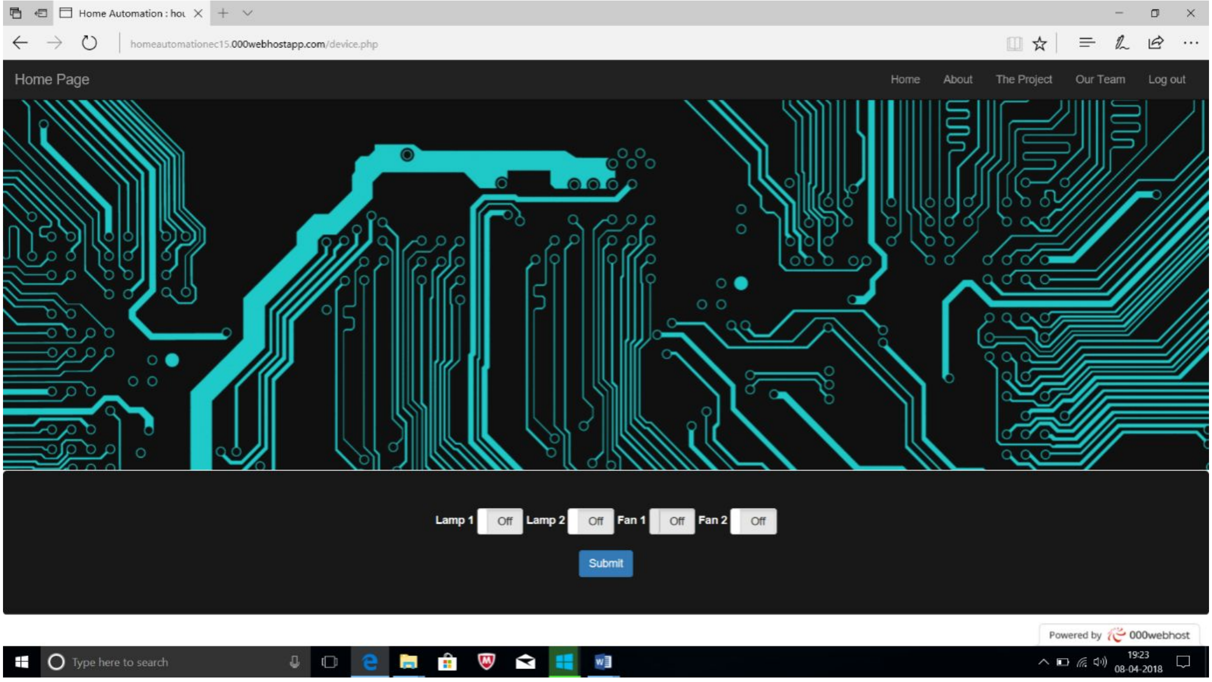
In our project we use combination of multiple automation techniques which includes:-

IOT based home-automation over a server, home-automation under Wifi through webpage and Arduino based home-automation. Here we use AVR ATMega328p, esp-8266 module, and other electrical components to operate 2 motors and 2 relays. All these components are mounted on a PCB whose fabrication process is carried out via etching process. A web page is also created by us, which can only be accessed by that person that has its login information; this makes only user to access the webpage and control the equipment in this project. Web Page is created by using HTML, CSS, JavaScript, and bootstrap. The information of web page is then sent to a database. MySQL is used for maintaining database and the interaction with contents of database is carried out with the help of PHP.

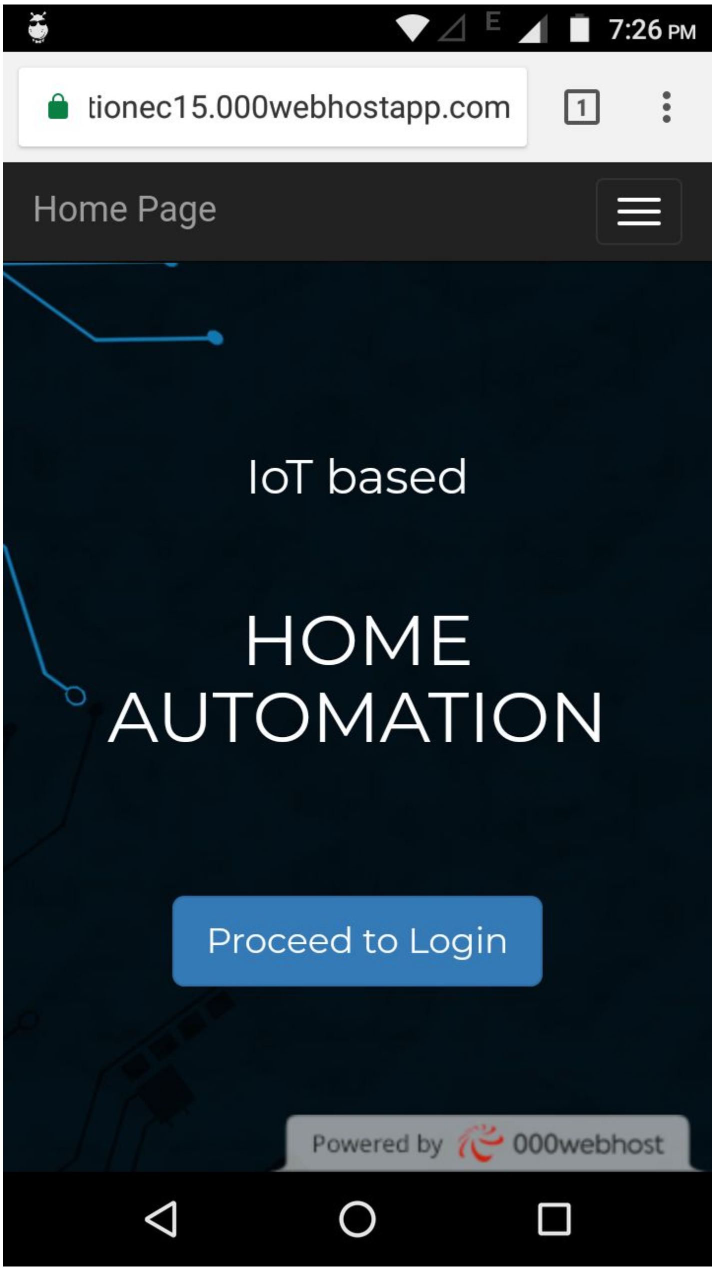
Web Interface:

Desktop view:





Mobile View:



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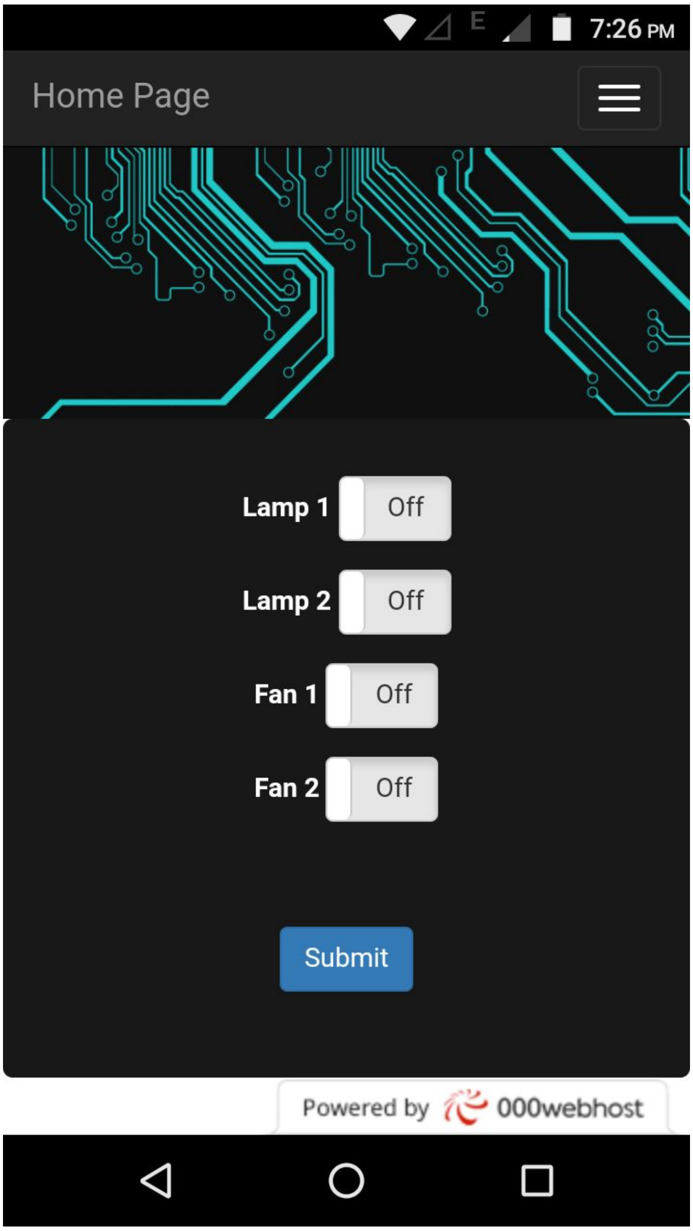
Home Page

IoT based

HOME AUTOMATION



Lamp 1 Off

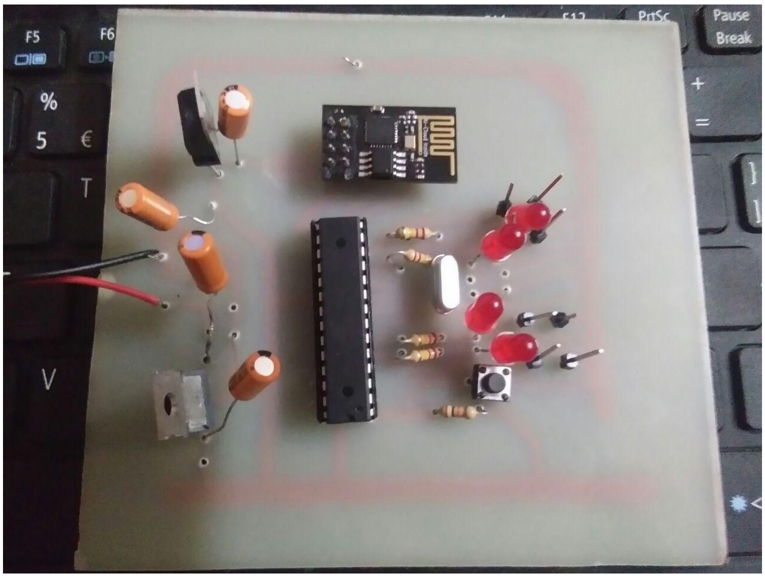
Lamp 2 Off

Fan 1 Off

Fan 2 Off

Using the web interface, the user toggles the buttons on the form to feed in the switch data. When the user presses the Submit button, the data is saved into a database, where it is read by the Wi-Fi module installed in the house.

Final Circuit Board:



In the circuit board, output ports are present which are available for the user to connect their home appliances. Once a device is connected to the output port, it can be controlled through WIFI.

3. Apparatus Used

Components used:

- 10 kΩ resistors (1/2 Watt)
- 220 kΩ resistors (1/2 Watt)
- 10 µF Capacitors (Electrolytic)
- 1 µF Capacitors (Electrolytic)
- LEDs
- Push Button Switch
- 16 MHz Crystal Oscillator
- IC 7805 Voltage Regulator
- IC LD33V Voltage Regulator
- AVR ATMega328P microcontroller
- ESP8266 WIFI module
- PCB (Copper)
- 28 pin IC stand

- 9V Battery
- Battery Cap

Additional Components:

- LM298 Motor Driver Module
- 9V DC motors
- Connecting Wires

Other Apparatus:

- Arduino Uno R3 Board
- Bread Board
- Multi-meter
- Soldering Iron

4. Apparatus Description:

Components:

Resistors:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

In this project resistors are used for two purposes, one, as a pull up resistors connecting reset pin of the AVR to Vcc and second, to reduce the current flowing through the LEDs.

Capacitors:

A capacitor is a passive two-terminal electrical component that stores potential energy in an electric field. The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit.

In this project, capacitors are used as a decoupling capacitor to reduce high frequency noise into the rest of the circuit.

LEDs:

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p-n junction diode that emits light when activated.When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

In the circuit, the LEDs are used as indicators for the output ports.

Push Button Switch:

A push-button (also spelled pushbutton) or simply button is a simple switch mechanism for controlling some aspect of a machine or a process. In the circuit, a push button is used to reset the circuit.

Crystal Oscillator:

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency.

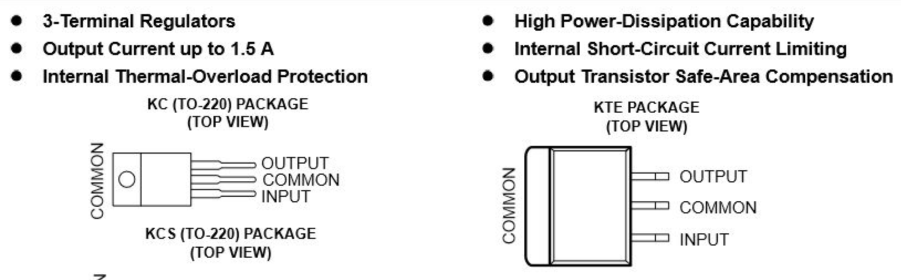
A crystal oscillator of 16MHz frequency is used to provide a clock signal to the AVR.

IC 7805 Voltage Regulator:

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

7805 IC Rating

- Input voltage range 7V- 35V
- Current rating I_c = 1A
- Output voltage range V_{Max}=5.2V,V_{Min}=4.8V

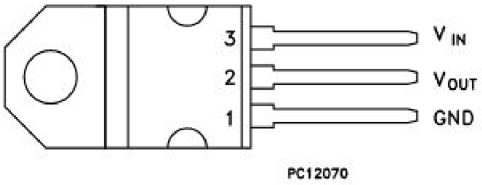


- **3-Terminal Regulators**
- **Output Current up to 1.5 A**
- **Internal Thermal-Overload Protection**
- **High Power-Dissipation Capability**
- **Internal Short-Circuit Current Limiting**
- **Output Transistor Safe-Area Compensation**

IC LD33V Voltage Regulator:

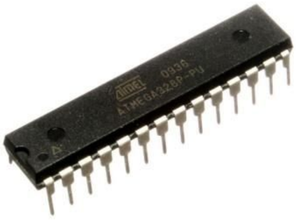
LD33V or LD1117V33 is a Low Dropout Voltage regulator belonging to the LD1117 series. It has a stable output of 3.3V with provision of an additional heat sink. Some of the features of the LD1117 series are:

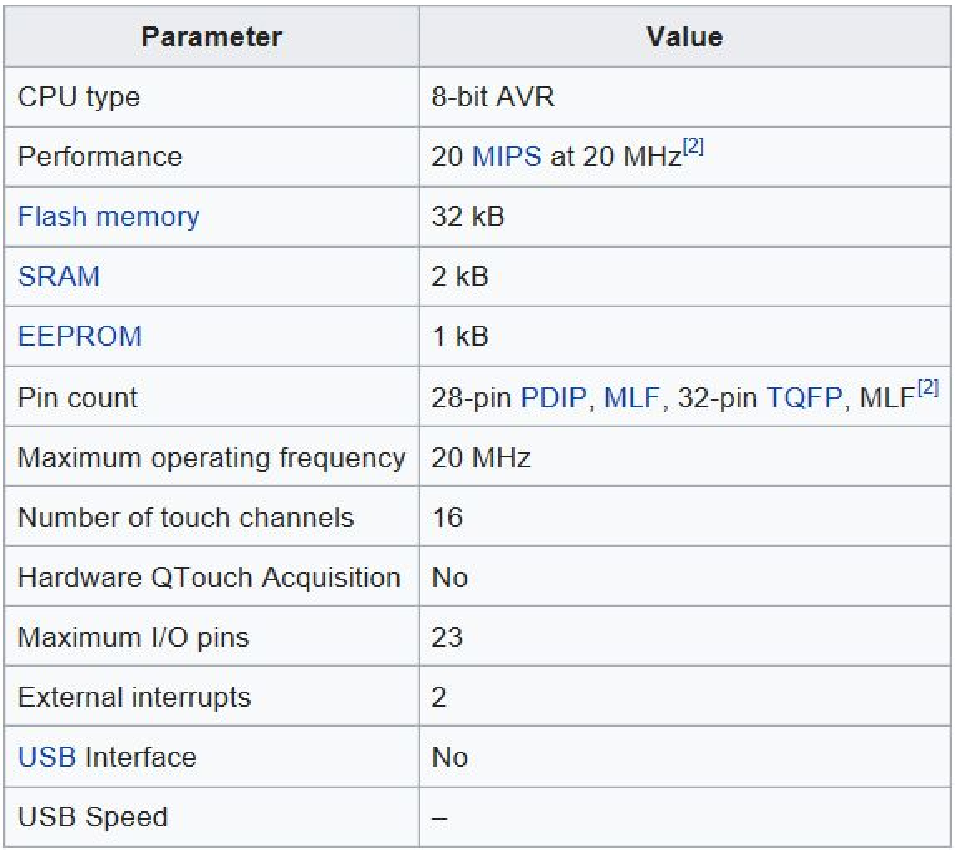
- Low dropout voltage (1v type.)
- 2.85v device performances are suitable for scsi-2 active termination
- Output current up to 800 mA
- Fixed output voltage of: 1.2v, 1.8v, 2.5v, 2.85v, 3.0v, 3.3v, 5.0v



AVR ATMega328P Microcontroller:

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

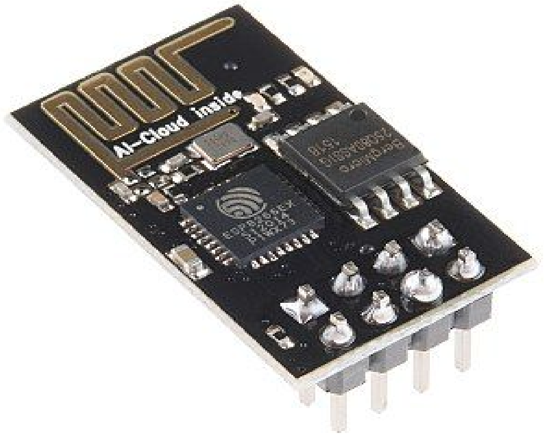




Parameter	Value
CPU type	8-bit AVR
Performance	20 MIPS at 20 MHz[2]
Flash memory	32 kB
SRAM	2 kB
EEPROM	1 kB
Pin count	28-pin PDIP, MLF, 32-pin TQFP, MLF[2]
Maximum operating frequency	20 MHz
Number of touch channels	16
Hardware QTouch Acquisition	No
Maximum I/O pins	23
External interrupts	2
USB Interface	No
USB Speed	–

ESP 8266 WIFI Module:

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif Systems.



The ESP8266 has the following features:

- Processor: L106 32-bit RISC microprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz
- Memory:
    - 32 KiB instruction RAM

  - 32 KiB instruction cache RAM
  - 80 KiB user data RAM
  - 16 KiB ETS system data RAM
  - External QSPI flash: up to 16 MiB is supported (512 KiB to 4 MiB typically included)
- IEEE 802.11 b/g/n Wi-Fi
- Integrated TR switch, balun, LNA, power amplifier and matching network
- WEP or WPA/WPA2 authentication, or open networks
- 16 GPIO pins
- SPI
- I²C (software implementation)
- I²S interfaces with DMA (sharing pins with GPIO)
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2
- 10-bit ADC (successive approximation ADC).

PCB:

A printed circuit board (PCB) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.Printed circuit boards are used in all but the simplest electronic products. They are also used in some electrical products, such as passive switch boxes.

IC Stand:

IC stand is an simple component that provides a housing for an IC on a PCB. A IC stand could be soldered into a PCB and then the IC can be mounted on it.

Battery:

A simple power source for the circuit. A 9V D size battery is used in this circuit

Battery Cap:

Provides an easy way to connect wires on to a battery

Additional Components:

LM298N Motor Driver Module:

Double H driver module uses ST L298N dual full-bridge driver, an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the con-nection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

Specifications are as follows -

- Driver: L298N
- Driver power supply: +5V~+46V
- Driver Io: 2A
- Logic power output Vss: +5~+7V (internal supply +5V)
- Logic current: 0~36mA
- Controlling level: Low -0.3V~1.5V, high: 2.3V~Vss
- Enable signal level: Low -0.3V~1.5V, high: 2.3V~Vss
- Max power: 25W (Temperature 75 cesus)
- Working temperature: -25C~+130C
- Dimension: 60mm*54mm
- Driver weight: ~48g
- Other extensions: current probe, controlling direction indicator, pull-up resistoer switch, logic part power supply.

DC Motors:

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

The project uses two 9v DC motors as a substitute for a home appliance connected to the circuit board.

Connecting Wire:

Insulated Copper wires which provide connection between any two nodes of the circuit.

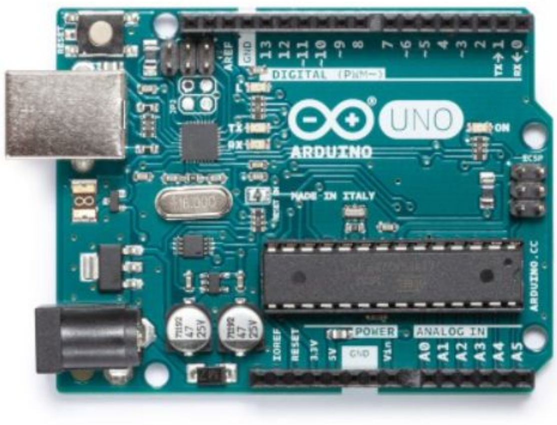
Other Apparatus:

Arduino Uno R3 Board:

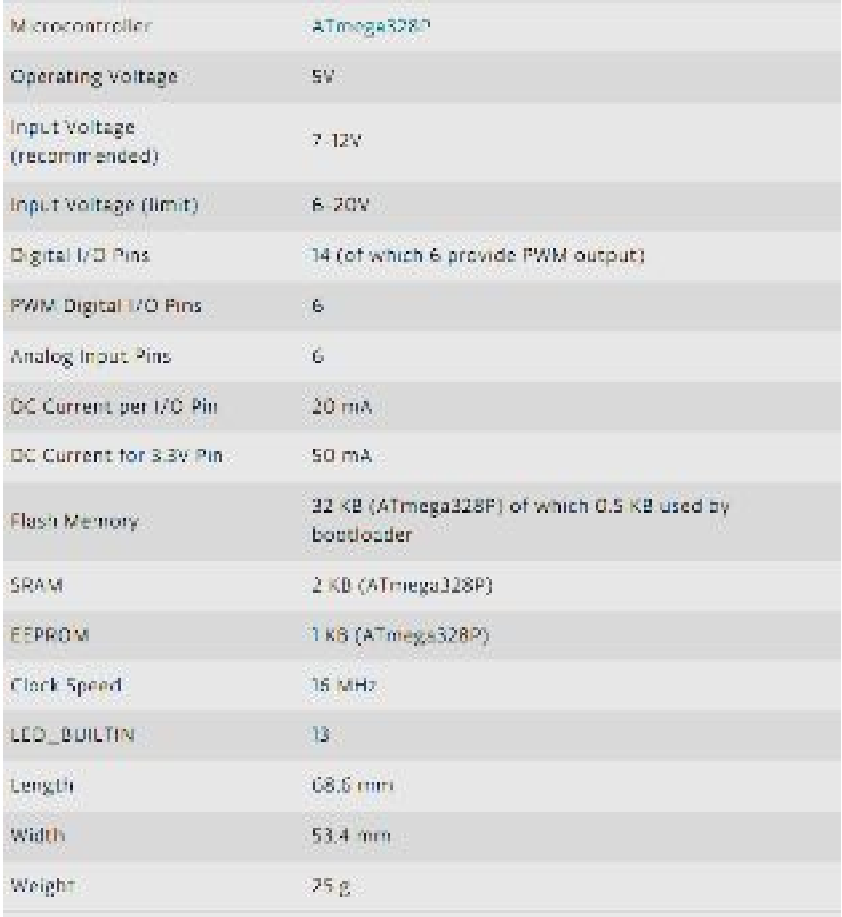
Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. One can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

The Arduino Uno Board was used to program both AVR chip and the ESP8266 WIFI Module.



Technical specifications:



Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Bread-board:

The purpose of the breadboard is to make quick electrical connections between components- like resistors, LEDs, capacitors, etc- so that you can test your circuit before permanently soldering it together. Breadboards have many small sockets on them, and some groups of sockets are electrically connected to each other. On the underside of the board there are many small metal strips which physically connect certain groups of sockets together and allow electricity to flow freely between them. These strips are probably not visible on the underside of your breadboard.

A breadboard was extensively used for prototyping the project before building the PCB for the project.

Multimeter:

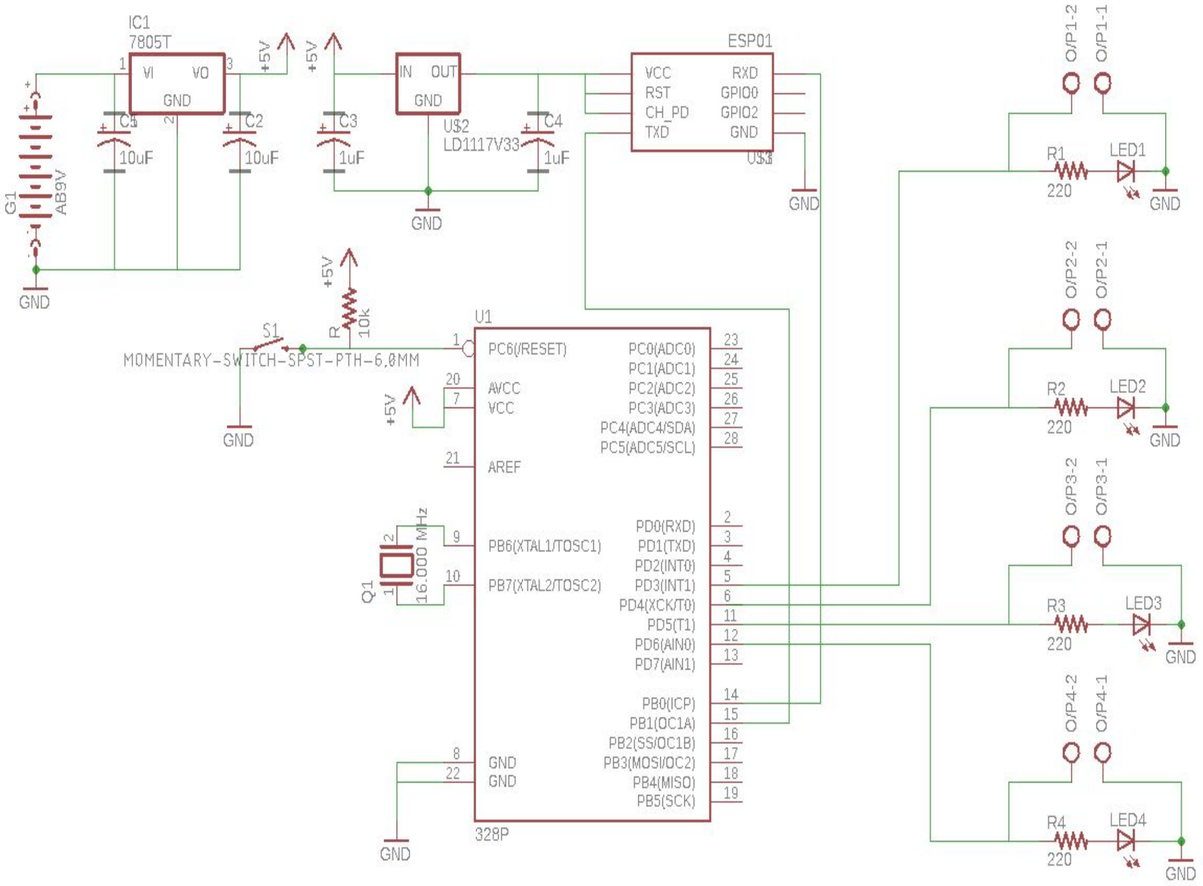
A multimeter or a multitester, also known as a VOM (volt-ohm-milliammeter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current, and resistance. Analog multimeters use a microammeter with a moving pointer to display readings. Digital multimeters (DMM, DVOM) have a numeric display, and may also show a graphical bar representing the measured value. Digital multimeters are now far more common due to their cost and precision, but analog multimeters are still preferable in some cases, for example when monitoring a rapidly varying value.

Multimeter is used for debugging the circuit.

Soldering Iron:

A soldering iron is a hand tool used in soldering. It supplies heat to melt solder so that it can flow into the joint between two workplaces. It is used to make permanent circuit connection by the process of soldering.

5. Circuit Diagram



6. Circuit Description

A 9v battery is used as a power supply to the circuit. The battery is connected to a 7805 voltage regulator IC. The output of the 7805 IC is a stable 5v. The IC is also connected with decoupling capacitors of 10µF each to provide a low impedance path to high frequency noise signal from the battery. The 5v output from the IC is used a V_{cc} for the rest of the circuit.

The AVR microcontroller is the heart of the project. It is supplied with supply voltage V_{cc} at its pin no. 7 and 20, and ground connection at pin no. 8 and 22.The reset pin (pin no. 1) is pulled at high through a pull up resistor of 10kΩ. The reset pin is also connected to the ground with a push button switch, effectively providing a reset switch for the circuit. The pins 9 and 10 are connected to a crystal for clock signal. Pins 5,6, 11 and 12 are the output pins and they are connected to output ports. Also connected to these pins are LED indicators through 220Ω resistance. The Tx pin (14) is connected to the Rx pin of ESP while the Rx pin (15) is connected to the Tx pin of the ESP.

The IC LD33V is used to generate a 3.3 V stable output for the ESP. Its input pin is connected to V_{cc} while its output pin is connected to V_{CC} pin of the ESP. The Reset pin and the CH_PD pins are tied high with 3.3V. The ground pin grounded to common. The Tx and Rx pins are connected as previously mentioned to the AVR.

7. Source Code:

Code for Website:

INDEX.PHP :

```
<?php
session_start();
if(isset($_POST["sub"]))
{
    $con=mysqli_connect("localhost","id5123334_aadi","123456");
    mysqli_select_db($con,"id5123334_home");

    $name=$_POST["uname"];
    $pass=$_POST["upass"];

    $_SESSION['name'] = $name;

    $qry = "SELECT * FROM user WHERE name = '$name' " ;



    $rs=mysqli_query($con,$qry)or die("Error while loading");

    if(mysqli_num_rows($rs)>=1)
```

```
   {
      $rw = mysqli_fetch_assoc($rs);
      if ($rw['name'] == $name)
      {


            if ($pass==$rw['password']  )
            {
                  header("location:device.php");
            }
            else
            {
                  echo "<script>alert('Wrong Password')</script>";
            }
      }
      else
      {
      echo "<script>alert('User Name Does Not Exits')</script>";
      }
   }

}
?>
<!DOCTYPE html>
<html lang="en">
   <head>
      <title>Home Automation</title>
      <meta charset="utf-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
```

```
   <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstr
ap.min.css">

   <link rel="stylesheet"
href="https://fonts.googleapis.com/css?family=Montserrat">

   <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.mi
n.js"></script>

   <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/js/bootstrap
.min.js"></script>

   <style type="text/css">

        .Cover{

             background-image: url("circuit8.png");

             height:100vh;

             background-attachment: fixed;

        background-position: center center;

        background-repeat: no-repeat;

        background-size: cover;

        padding-top: 128px;

        padding-right: 16px;

   padding-bottom: 128px;

   padding-left: 16px;

             font-weight: bold;

             font-family:
"Montserrat","Rockwell","Verdana",sans-serif;

             color: #fff;

        }

        .log{

             background-color: #00141a;

             color: white;

        }
   </style>
</head>
<body>
   <nav class = 'navbar navbar-inverse navbar-fixed-top'>
         <div class = 'container-fluid'>
               <div class = 'navbar-header'>
                     <a class = 'navbar-brand' href = "#">Home
Page</a>
                     <button type='button' class='navbar-toggle'
data-toggle='collapse' data-target='#menu'>
               <span class='icon-bar'></span>
               <span class='icon-bar'></span>
               <span class='icon-bar'></span>
         </button>
               </div>

               <div  class = 'nav navbar-right collapse
navbar-collapse' id = 'menu'>
                     <ul class="nav navbar-nav">
               <li class="active"><a href="#">Home</a></li>
               <li><a href="about.html">About</a></li>
               <li><a href="about.html#pro">The Project</a></li>
               <li><a href="about.html#team">Our Team</a></li>
               </ul>
               </div>
         </div>
   </nav>
   <div class = 'Cover'>
         <center>
               <div class = "container-fluid">
                     <h3 font-family:serif;">IoT based</h3>
                     <br>
```

```
                    <h1>HOME AUTOMATION</h1>

                    <br><br><br>

                    <button type="button" class="btn btn-primary
btn-lg" onclick = "location.href='#lgin'">Proceed to
Login</button>


               </div>

          </center>


     </div>

     <div class = "container-fluid jumbotron log">

               <center>

                    <h4 id = "lgin">Login Details</h4>

                    <form class= "form-inline" method="post"
action="">

                         <div class = 'form-group'>

                              <div class ="form-group">

                                   <label for
='uname'>Username:</label>

                                   <input type = 'text' name =
'uname' class = 'form-control'>

                              </div>

                              <div class = "form-group">

                                   <label for =
'upass'>Password:</label>

                                   <input type="password"
name="upass" class = 'form-control'>

                              </div>

                              <div class = "form-group">

                                   <input type="submit"
name="sub" class="btn btn-default" value="Login">

                              </div>

                         </div>
```

```
                        </form>
                    </center>
            </div>
        </body>
</html>
```

Device.php:

```
<?php
    session_start();
    $name = $_SESSION['name'];

     $con=mysqli_connect("localhost","id5123334_aadi","123456");
    mysqli_select_db($con,"id5123334_home");

    if (isset($_POST["sub"]))
    {
        if (empty($_POST["LED1"])){
                $d1 = 0;
        }
        else if ($_POST["LED1"] == 'on') $d1 = 1;

        if (empty($_POST["LED2"])){
                $d2 = 0;
        }
        else if ($_POST["LED2"] == 'on') $d2 = 1;

        if (empty($_POST["LED3"])){
                $d3 = 0;
        }
        else if ($_POST["LED3"] == 'on') $d3 = 1;
        if (empty($_POST["FAN1"])){
                $d4 = 0;
        }
        else if ($_POST["FAN1"] == 'on') $d4 = 1;
        $qry = "UPDATE user SET d1 = '$d1', d2 = '$d2', d3 = '$d3', d4
    = '$d4' WHERE name = '$name' ";
        $rs = mysqli_query($con,$qry);

        if (!$rs){
                echo "<script>alert('Error')</script>";
        }
        else{
                echo "<script>alert('Updated')</script>";
        }
    }
?>
<!DOCTYPE html>
<html lang="en">
<head>
    <title>Home Automation : <?php echo $name; ?></title>
    <meta charset="utf-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
    <link rel="stylesheet"
    href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstr
    ap.min.css">
    <link rel="stylesheet"
    href="https://fonts.googleapis.com/css?family=Montserrat">
    <link rel="stylesheet"
    href="https://gitcdn.github.io/bootstrap-toggle/2.2.2/css/bootstr
    ap-toggle.min.css">
    <script
    src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.mi
    n.js"></script>
```

```
   <script
   src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/js/bootstrap
   .min.js"></script>

   <script
   src="https://gitcdn.github.io/bootstrap-toggle/2.2.2/js/bootstrap
   -toggle.min.js"></script>

   <style type="text/css">

      .paddtop

      {

            background-color: rgba(24,24,24,1);

            color: #fff;

            border-radius: 5px;

      }

      .imgCover{

                  background-image: url("circuit5.gif");

                  height:70vh;

                  background-attachment: fixed;

            background-position: center bottom;

            background-repeat: no-repeat;

            background-size: cover;

            padding-top: px;

            }

      .body{

            background-color: #262626;

      }

      </style>

</head>

<body>

   <nav class = "navbar navbar-inverse navbar-fixed-top">

      <div class = 'container-fluid'>

            <div class ="navbar-header">
            <a class = 'navbar-brand' href = "index.php">Home
Page</a>
            <button type='button' class='navbar-toggle'
data-toggle='collapse' data-target='#menu'>
        <span class='icon-bar'></span>
        <span class='icon-bar'></span>
        <span class='icon-bar'></span>
   </button>
        </div>
        <div  class = 'nav navbar-right collapse navbar-collapse'
id = 'menu'>
                <ul class="nav navbar-nav">
            <li><a href="index.php">Home</a></li>
            <li><a href="about.html">About</a></li>
            <li><a href="about.html#pro">The Project</a></li>
            <li><a href="about.html#team">Our Team</a></li>
            <li><a href="index.php">Log out</a></li>
            </ul>
        </div>
   </div>
</nav>
<div class = 'imgCover'></div>
<div class="jumbotron paddtop">
   <center>
        <form method="post" action = "" class="form-inline">
            <div class = 'form-group'>
                <label for = "LED1" >Lamp 1</label>
                <input data-toggle = "toggle" name = 'LED1'
type = "checkbox">
            </div>
            <div class = 'form-group'>
                <label for = "LED1" >Lamp 2</label>
```

```
                    <input data-toggle = "toggle" name = 'LED2' 
type = "checkbox">
                </div>
                <div class = 'form-group'>
                    <label for = "LED1" >Fan 1</label>
                    <input data-toggle = "toggle" name = 'LED3' 
type = "checkbox">
                </div>
                <div class = 'form-group'>
                    <label for = "LED1" >Fan 2</label>
                    <input data-toggle = "toggle" name = 'FAN1' 
type = "checkbox">
                </div>
                <br><br>
                <div class = 'form-group'>
                    <input type="submit" name="sub" value="Submit" 
class="btn btn-primary">
                </div>
            </form>
        </center>
</body>
</html>
```

ESP.php:

```
<?php
  $con=mysqli_connect("localhost","id5123334_aadi","123456");
  mysqli_select_db($con,"id5123334_home");

  $name = $_GET["id"];

  $qry = "SELECT * FROM user WHERE name =  '$name'";
  $rs = mysqli_query($con,$qry);
  if ($rs)
```

```
   {
      $rw = mysqli_fetch_assoc($rs);
      echo "*". $rw['d1']. $rw['d2']. $rw['d3']. $rw['d4']."#";
   }
   else
   {
      echo "Error!";

   }
?>
```

ABOUT.html:

```
<!DOCTYPE html>
<html lang = "en">
<head>
   <title>About Us</title>
   <meta charset="utf-8">
   <meta name="viewport" content="width=device-width,
   initial-scale=1">
   <link rel="stylesheet"
   href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstr
   ap.min.css">
   <script
   src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.mi
   n.js"></script>
   <script
   src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/js/bootstrap
   .min.js"></script>
   <link rel="stylesheet"
   href="https://fonts.googleapis.com/css?family=Montserrat">
   <style type="text/css">
      .Cover{
                  background-image: url("circuit8.png");
                  height:100vh;
```

```
                 background-attachment: fixed;
           background-position: center center;
           background-repeat: no-repeat;
           background-size: cover;
           padding-top: 128px;
           padding-right: 16px;
      padding-bottom: 128px;
      padding-left: 16px;
                 font-weight: bold;
                 font-family:
   "Montserrat","Rockwell","Verdana",sans-serif;
                 color: #fff;
           }
      #pro{
           height : ;
           padding-top: 32px;
      }
      #team{
           height : ;
           padding-top: 32px;
           background-color: #afafaf;
      }
      .media > .media-object {
      max-width: none;
           }
      }
   </style>
</head>
<body>
   <nav class = 'navbar navbar-inverse navbar-fixed-top'>
      <div class = 'container-fluid'>
```

```
        <div class = 'navbar-header'>
             <a class = 'navbar-brand' href = "index.php">Home
Page</a>
        </div>
   </div>
</nav>
   <div class = 'Cover'>
        <center>
             <div class = "container-fluid">
                   <h1>About The Project</h1>
             </div>
        </center>
   </div>
   <div class = 'container-fluid' id = 'pro'>
        <div class="col-xs-12 col-lg-8" style="padding-left:
16px; padding-right: 16px;">
             <h1 style="font-family: 'Montserrat';">Home
Automation</h1>
             <br><br>
             <h4>
                   A simple model project for automation of home
appliances through application of IoT, designed and developed as
for the minor project of VI semester, Electronics and
Communication Department of UEC Ujjain.
             </h4>
             <br><br>
             <p style="color: #4f4f4f;">
                   The user can interface with the website to
toggle the devices. With the home wifi, the devices will toggle
automatically according to the input. The project uses esp 8266
wifi module for accessing wifi and an AVR ATMega328P
microcontroller as the central processing part of the chip.
Programming for the microcontroller as well as the esp module has
been done with the help an Arduino Uno R3 board. The website is
hosted through '000webhost' free website hosting service. The
website uses Bootstrap provided on GitHub.
```

```
                </p>
          </div>
          <div class = "col-lg-4">
                <center><img src = "home1.jpg" class =
"img-responsive" width="100%"></center>
          </div>
     </div>
     <div id = 'team'>
          <div class="container-fluid">
                <h1 style="font-family: 'Montserrat'">Our Team</h1>

                <div class = "col-xs-6 col-lg-4 media">
                      <div class = "media-left">
                            <img src = "Aadi.jpg" alt = "Avatar Icon"
class="media-object img-thumbnail img-responsive" width="64px">
                      </div>
                      <div class = "media-body">
                            <h4 class = "media-heading">Aaditya
Phadnis</h4>
                            <p>Front End Designer</p>
                      </div>
                </div>

                <div class = "col-xs-12 col-lg-4 media">
                      <div class = "media-left">
                            <img src = "prakhar.png" alt = "Avatar
Icon" class="media-object img-responsive img-thumbnail" width =
"64px">
                      </div>
                      <div class = "media-body">
                            <h4 class = "media-heading">Prakhar
Verma</h4>
                            <p>Testing and Debugging</p>
```

```
                   </div>
              </div>


              <div class = "col-xs-12 col-lg-4 media">
                   <div class = "media-left">
                        <img src = "vikas.png" alt = "Avatar
Icon" class="media-object img-responsive img-thumbnail" width =
"64px">
                   </div>
                   <div class = "media-body">
                        <h4 class = "media-heading">Vikas
Namdev</h4>
                        <p>Back End Designer</p>
                   </div>
              </div>


              <div class = "col-xs-12 col-lg-4 media">
                   <div class = "media-left">
                        <img src = "udit.png" alt = "Avatar Icon"
class="media-object img-responsive img-thumbnail" width = "64px">
                   </div>
                   <div class = "media-body">
                        <h4 class = "media-heading">Udit
Sahu</h4>
                        <p>Microcontroller Programmer</p>
                   </div>
              </div>


              <div class = "col-xs-12 col-lg-4 media">
                   <div class = "media-left">
                        <img src = "harshit.png" alt = "Avatar
Icon" class="media-object img-responsive img-thumbnail" width =
"64px">
```

```
                    </div>

                    <div class = "media-body">

                         <h4 class = "media-heading">Harshit
  Agarwal</h4>

                         <p>PCB Designer</p>

                    </div>

               </div>


               <div class = "col-xs-12 col-lg-4 media">

                    <div class = "media-left">

                         <img src = "vishnu.png" alt = "Avatar
  Icon" class="media-object img-responsive img-thumbnail" width =
  "64px">

                    </div>

                    <div class = "media-body">

                         <h4 class = "media-heading">Vishnu
  Parmar</h4>

                         <p>Hardware Developer</p>

                    </div>

               </div>

          </div>

     </div>

</body>

</html>
```

SQL:

```
-- phpMyAdmin SQL Dump

-- version 4.7.7

-- https://www.phpmyadmin.net/

--

-- Host: localhost:3306

-- Generation Time: Apr 08, 2018 at 03:27 PM

-- Server version: 10.2.12-MariaDB
-- PHP Version: 7.0.26

--

-- Database: `id5123334_home`

--


-- --------------------------------------------------------


--

-- Table structure for table `user`

--


CREATE TABLE `user` (

  `id` int(20) NOT NULL PRIMARY KEY AUTO_INCREMENT,

  `name` varchar(30)  NOT NULL UNIQUE,

  `password` varchar(30) NOT NULL,

  `d1` int(2) NOT NULL,

  `d2` int(2) NOT NULL,

  `d3` int(2) NOT NULL,

  `d4` int(2) NOT NULL

);


--

-- for table `user`

--


INSERT INTO `user` (`id`, `name`, `password`, `d1`, `d2`, `d3`,
   `d4`) VALUES

(1, 'house1', '123456', 1, 1, 1, 1),

(2, 'house2', 'abcdefg', 0, 0, 0, 0);
```

Code for AVR (Written in C in Arduino IDE):

```
#include <SoftwareSerial.h>

SoftwareSerial mySerial(8, 9); // RX, TX

int d1 = 3;
int d2 = 4;
int d3 = 5;
int d4 = 6;

void setup() {

  pinMode(d1,OUTPUT);
  pinMode(d2,OUTPUT);
  pinMode(d3,OUTPUT);
  pinMode(d4,OUTPUT);
  // Open serial communications and wait for port to open:
  Serial.begin(9600);

  Serial.println("Goodnight moon!");

  // set the data rate for the SoftwareSerial port
  mySerial.begin(9600);
}

void loop() {
  int i=0;
  String s;
  mySerial.flush();
  while(!mySerial.available());
  if(mySerial.available()) {
    s=mySerial.readStringUntil('\r');
  char ch[s.length()];
  s.toCharArray(ch,s.length());
  Serial.println(ch);
  if(ch[1]=='0')
  digitalWrite(d1,LOW);
  if(ch[1]=='1')
  digitalWrite(d1,HIGH);
  if(ch[2]=='0')
  digitalWrite(d2,LOW);
  if(ch[2]=='1')
  digitalWrite(d2,HIGH);
  if(ch[3]=='0')
  digitalWrite(d3,LOW);
  if(ch[3]=='1')
  digitalWrite(d3,HIGH);
  if(ch[4]=='0')
  digitalWrite(d4,LOW);
  if(ch[4]=='1')
  digitalWrite(d4,HIGH);
  }
}
```

Code for ESP Module (Written in C in Arduino IDE):

```
/*
 *  This sketch sends data via HTTP GET requests to
   homeautomationec15.000webhostapp.com service.
 *
 *
 */
```

```
#include <ESP8266WiFi.h>
const char* ssid     = "ADYYRTUzNjM"
const char* password = "1234567890";
const char* host = "homeautomationec15.000webhostapp.com";
const char* id = "house1";
String line;
char data[20];
void setup() {
  Serial.begin(9600);
  delay(10);
  // We start by connecting to a WiFi network
  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
  }
  Serial.println(WiFi.localIP());
}
void loop() {
  int i=0,j=0;
  delay(1000);
  // Use WiFiClient class to create TCP connections
  WiFiClient client;
  const int httpPort = 80;
  if (!client.connect(host, httpPort)) {
    return;
  }

  // We now create a URI for the request
  String url = "/esp.php?id=" + id;
  // This will send the request to the server
  client.print(String("GET ") + url + " HTTP/1.1\r\n" +
               "Host: " + host + "\r\n" +
               "Connection: close\r\n\r\n");
  unsigned long timeout = millis();
  while (client.available() == 0) {
    if (millis() - timeout > 5000) {
      client.stop();
      return;
    }
  }
  // Read all the lines of the reply from server and print them to Serial
  while(client.available()){
   line = client.readStringUntil('\r');
   for(i=0;i<line.length();i++)
   {
    if(line[i]=='*')
    {
     break;
    }
   }
  for(i=i;i<line.length();i++)
  {
    data[j]=line[i];
    j++;
  }
  }

  Serial.println(data);
}
```

8. Working of Project

- Wireless Home Automation system(WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home.

- Here, we use webpage as a controlling medium, webpage created with the help of HTML, CSS, Javascript and Bootstrap. Through that webpage we can control connected devices, webpage also contains a login page which shows up everytime when website is opened to control the connected devices. This login page is inserted with the help of Bootstrap. After selecting devices to be at on/off state and confirming our action the content of webpage gets transferred to database.
- The database is created with the help of MySql. Database contains the actions taken by user in binary form (I.e. 0 or 1 as value).

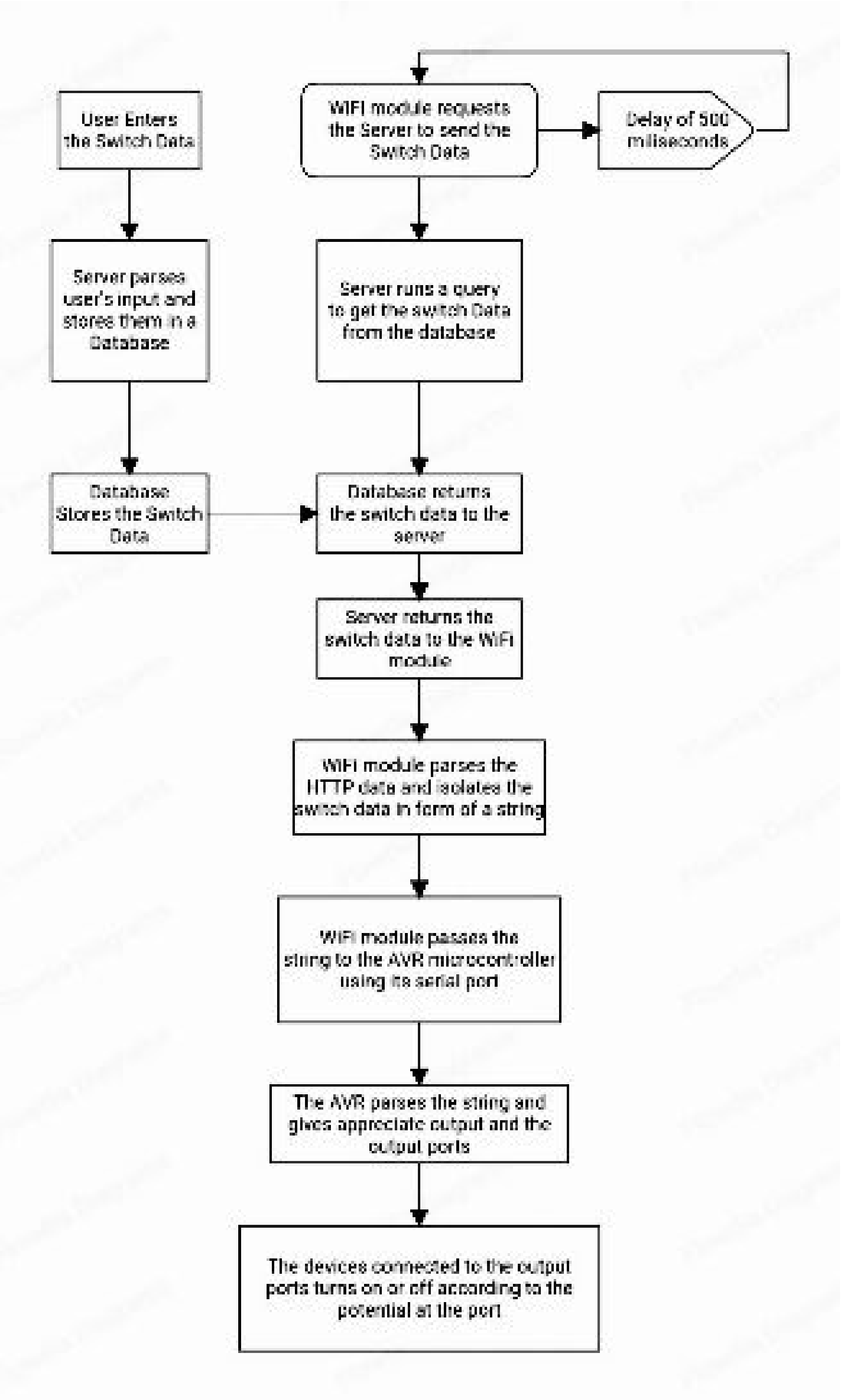
- The contents of the database is then transferred to a new webpage, this is done with the help of PHP in the new webpage program along with the HTML code. Because of the addition of PHP code the new webpage can now gathers information from the database and put this value between * and #. The reason behind the content of the database is inserted between * and # is that the ESP-8266 module can only reads value that lie between * and #, these two characters act as boundary line and values out of it are the HTTP headers for the webpage and can be considered as garbage value for our purpose which need not be read by Microcontroller. All those webpages is collected in a single website whose information is required for the programming of ESP.

- ESP-8266 gathers information from the webpage containing * and # characters. ESP-8266 works at 3.3 V which is provided by LD33V IC. This IC has 3 inputs and it works at input voltage of 5V and gives 3.3V at the output. This 3.3V is given to the input of ESP-8266. The programming of ESP is carried out with the help of same software that is used to program the AVR. Coding is done in such a way that the information gathered by ESP from * and # page is then given to AVR.

- The input voltage of LD33V is given with the help of another IC named LM7805 which is also a three pin IC and which works at voltage range of 6-12 V and through that voltage it gives 5V output. This 5V output is given to various components including AVR ATMega328p.

- The AVR is programmed with the help of software named Arduino 1.6.7. The programming of AVR is done in such way that for each bit given by the ESP module, it controls four of its output. The four output pins of the AVR are connected to the output ports on the circuit on which the user can connect any device they want to connect.

- For demonstration purpose, two output of AVR is connected to L298n motor driver, which is used to drive DC motor since the AVR itself cannot produce that much amount of current and voltage to run a motor. When the output ports are high, the motor driver connect the power supply(battery) with the motor, turning them on. Thus the motors are automated via the circuit.


User Enters the Switch Data
WIFI module requests the Server to send the Switch Data
Delay of 500 milliseconds
Server parses user's input and stores them in a Database
Server runs a query to get the switch Data from the database
Database Stores the Switch Data
Database returns the switch data to the server
Server returns the switch data to the WiFi module
WIFI module parses the HTTP data and isolates the switch data in form of a string
WIFI module passes the string to the AVR microcontroller using its serial port
The AVR parses the string and gives appreciate output and the output ports
The devices connected to the output ports turns on or off according to the potential at the port

9. **Advantages:**

- Electrical devices can be remote accessed from any part around the globe.
- Highly secure as only those can access webpage who has login ID and password.
- More convenient and less complicated than wired communication.

- Energy efficient. For example, you can have more precise control over the heating and cooling of your home with a programmable smart thermostat that learns your schedule and temperature preferences, and then suggests the best energy efficient settings throughout the day.
- Improved appliance functionality. Smart homes can also help you run your appliances better. A smart TV will help you find better apps and channels to locate your favourite programming. A smart oven will assist you with cooking your chicken to perfection -- without ever worrying about overcooking or undercooking it.
- Home management insights. There's also something to be said for your ability to tap into insights on how your home operates. You can monitor how often you watch TV (and what you watch) and etc.

10. Limitations:

- More Cost Most families are able to purchase smart home products, but that doesn't mean it won't leave a dent in your wallet. You can purchase the products one at a time and it won't seem like too much, $50 here, $300 there, but by the time you have the smart home system you want, you will likely have spent a larger sum than you would have if you had purchased non-smart products.
- Reliability –A smart home will be extremely reliant on your internet connection. If your connection drops you'll be left with a lot of smart products that won't work. Additionally, wireless signals can possibly be interrupted by other electronics in your home and cause some of your smart products to function slowly or not at all.

11. Applications:

- Lighting control
- Lawn irrigation control
- HVAC regulation
- Security system
- Smart applications

12. References:

- Beginning PHP, Apache, MySQL 6 : Web Development, Boronczyk and Naramore.
- Arduino Cookbook, Margolis
- w3cschool.org
- arduino.cc
- sparkfun.com
- wikipedia.org
- gitcdn.github.io/bootstrap-toggle