SMART VISUAL HOME AUTOMATION

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Abstract-This study aims to develop and design a prototype that can be used, together with an android phone as centralized switch for simple home appliances via Local Area Network or Internet . It is automation of the home, housework or household activity. HOME AUTO-MATION may include centralized control of lightning, heating, air conditioning etc, in order to provide convenience, comfort, energy efficiency and security. There is an increasing demand for smart homes where appliances react automatically to changing environmental conditions and can be easily controlled through a common device that is mobile phone through its Bluetooth interface. 

Index-terms:- Arduino, Switch control, Ethernet Shield, Pwm Controller, Web Server, Mobile Application, Relay circuits.

I. Introduction

The scenario enables you to leave the house appliances switched OFF/ON or else regulate it at the touch of the button. All with the power of one finger. The automation setting enables you to launch pre-configured settings behaviour of all aspects of your surroundings including lights, climate control, and all other devices. It provides convenience and time saving other than all it provides flexibility. Home Automation is a sequence of frames which includes Graphical interface consisting of home page, status display and also an interface that can regulate and modify intensity of any gadget. There is an increasing demand for smart homes where appliances react automatically to changing environmental conditions and can be easily controlled through a common device that is mobile phone through its Ethernet/ Bluetooth interface /Wi-Fi.

Owner visualizes the room. Then, the devices are identified and a map is constructed which includes devices and appliances. Programmer performs coding on components and a connection is established via Ethernet/Bluetooth/Wi-Fi appliances. An IP address is required so as to communicate with the appliances. By the valid IP address we can enter into the home page. Application provides GRAPHICAL INTERFACE to the programmer or user. Application sends list of pop-ups to user. User selects one of the pop-ups such as on/off, regulate the speed as well as perform. Thereby owner can access as well as control on appliances. And it generates automation.

1.1 Aim and Objective of the proposed model:

- The goal of this project a home automation system that gives the user complete control over all remotely controllable aspects of his/her home.
- The automation system will have the ability to be controlled from the central device(i.e Mobile applications)
- Energy savings convenience
- Home entertainment
- Portable
- The advantages and benefits of the invention is described in following:-
Efficient & Profitability.
Safety & Security
Save time
Portable.
Environment friendly.
Modernization, valuable investment

Scope:
This prototype can be used at various platform:-

Home:
For household purpose, it can be interfaced with home appliance like fan, lightening, refrigerator, air-conditioner etc.

Official use:
For official purpose surveillance camera can be used as a source of security and as we are using Ethernet it can be kept a watch to the site for 24*7.

Solar plants:
Taking under consideration of green economy, it can also be used in solar panel.

II. Problem Overview and Solution

Application is based on expandable list view and it only controls the ON/OFF activity using Bluetooth connectivity. It increases the complexity as the user has to memorize each and every device numbers in order to activate or deactivate the device, so it becomes more intricate.

Here application is based on GRAPHICAL VIEW as well as it also controls the on/off activities, speed, temperature.

III. Integrated technologies

1. Hardware

a) Arduino

"ARDUINO" is a tool for making computers that can sense and control more of the physical world.

It’s an open source physical computing platform based on a simple microcontroller board and the development environment for a writing a software for the 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.
b) PWM Controller

- Pulse–width modulation (PWM) is a modulation technique used to encode a message into a pulsing signal.
- Switching Frequency: 500kHz; Output Current: 1000mA; Output Voltage: 5V; Input Voltage: 30V
- Power Supply Voltage Range: 12-25V.

Fig. 1: Arduino Uno

Fig. 2: PWM Controller

c) Ethernet/Bluetooth module/Wi-Fi

- Ethernet is a link layer protocol in the TCP/IP stack describing how networked devices can format data for transmission to the other network devices on the same network segments and how to put the data out of the network connection.
- It can be remotely accessed from any corner of the world.
- Wi-Fi is a facility allowing computer or other devices to connect to the internet or communicate with one another within particular area.
- It accessibility is less than Ethernet and more than Bluetooth.

Fig. 3: Ethernet Shield

d) System Design

Fig. 4: Pictorial view of system

e) Mobile Application

A mobile application is an application for mobile devices like smartphone or tablet. It varies from simple application to sophisticated application that contains a lot of functions. In order to develop an application, an Integrated Development Environment (IDE) is needed. The proponents developed the mobile application using Basic Android IDE that uses Basic Programming Language instead of Java Programming Language.

f) Web Server

A web server is a computer that runs a website. Using the HTTP protocol, the web server delivers web pages to browsers as well as other data files to web-based applications [17]. The server can be easily accessed via LAN. The server can also be accessed outside the network using port forwarding. The device will work just like a CCTV which also needs port forwarding.

g) Channel Relay Module
A relay functions as a switch that has the capability of switching multiple circuits which can either be individually, simultaneously, or in sequence. The proponents used an 8-channel relay (shown in Figure 3) to accommodate 7 output devices. Arduino Ethernet’s output pins are connected to each of the input pins of the relay module.

![Figure 5: Channel Relay](image)

h) Relay Circuit

![Figure 6: Relay schematic diagram](image)

Figure 6 shows the schematic diagram of a relay channel. In the prototype, the relay circuit used is active LOW which means each relay needs GND or 0V to switch. During Arduino’s boot/reset sequence, each digital pin is at HIGH state which will switch the relay if it is not active LOW which will cause problems when a power outage happens and then comes back immediately.

2. Software

For the software part, the proponents write a source code to make the Arduino Ethernet Board works like a web server and determine and monitor the states of the output devices in each relay channel. Then they develop an Android application that has the capabilities to switch/monitor the states of output devices.

a) Arduino web server sketch

The Arduino Ethernet Board is able to host a web server that monitors the states of each of the digital I/O pins that is also connected to the relay. It also handles user requests.

```cpp
void setup()
{
  Ethernet.begin(mac, ip);
  server.begin();

  for (byte index = 0; index < sizeof(ledPins); index++)
  {
    digitalWrite(ledPins[index], HIGH);
    pinMode(ledPins[index], OUTPUT);
  }
}
```

![Figure 7: setup() function of the sketch](image)

Figure 7 shows the setup() function which is called when the sketch starts. It is important to note that the digital I/O pins that is used is needed to be initialized as HIGH before setting them to OUTPUT. This part gave the active LOW relay circuit a 5V to avoid it from switching.

3. Android application development

![Figure 8: Home Automation app loading](image)
Fig. 9: Login activity

Figure 8 shows the starting activity of the application. The user is being requested to input the password to access the main program. It is added to provide security and avoid not permitted access. When the application is first installed the initial password is the default password. The proponents also added a feature for changing the password.

Below Figures shows the switching OFF the bulb and then switching on the TV.

In drawing section, Block Diagram, Sequence diagram, Flow chart of a process and Activity diagrams are shown.

Fig. 10: Bulb OFF

Fig. 11: TV switched on

Fig. 12: Block diagram

Fig. 13: SEQUENCE DIAGRAM USING (VISUAL STUDIO)
4. EXPERIMENTS AND ANALYSIS

To easily understand and analyse the results of the tests, the proponents tabulated them or put them on a chart. The table follows the following:

0. Off or Failed
1. On or Successful

A. Hardware functionality testing

Hardware component of the system (Arduino, Relay Circuit) should be functional to carry out their respective task for the system.

Table 1 shows the functionality of the system hardware components. In twenty (20) trials that the proponents conducted, the result shows that the components work properly together 100% of the time during the tests. It shows that the Arduino can drive the output to make the relay function appropriately.

<table>
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<th>ACTUAL OUTPUT</th>
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Table 1 Test on functionality of the system (Hardware)
V. CONCLUSION:

- Home automation is undeniably a resource which can make a home environment automated. People can control their electrical devices via these Home automation devices and setup controlling actions through mobile.
- In future this product may have high potential for marketing.
- The scenario enables you to leave the house appliances switched OFF/ON or else regulate it at the touch of the button. All with the power of one finger. The automation setting enables you to launch pre-configured settings behaviour of all aspects of your surroundings including lights, climate control, and all other devices. It provides convenience and time saving other than all it provides flexibility.
- The conclusion is the application that is HOME AUTOMATION provides a graphical representation to the existing system which consists of many features and is more upgraded compared to existing feature.

- Although the existing system included the pop-ups like ON/OFF, speed regulation but it is all handled when the pop-ups are associated with individual device numbers, which makes the application a bit intricate. The user has to keep in mind the device numbers by which the particular device can be activated or deactivated.
- But when it comes to graphical view, a map of the room or individual device is envisioned, then a systematic coding is programmed by the programmer. Here the complexity is reduced as the hardships of memorizing each and every device numbers is abolished. Even the upgradeability is increased because of the graphical outlook. The graphics view looks more enlightened compared to existing model.

5. ACKNOWLEDGMENTS

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REFERENCES

