Wi-Fi Based Smart Home Automation Using Android Application

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Abstract: -- In the recent years drastic changes were occurred in the mobile communications and embedded systems. Now we incorporate mobile technology in automation systems. We propose a mobile based home automation system that consists of a mobile phone with android capabilities and a home wi-fi connection. The home appliances are controlled by the android application through wi-fi which operates according to the user commands received from the mobile phone via the wi-fi modem. In the proposed system the home wi-fi is built upon the graphical user interface through the smart phone android application and a micro controller, allowing a user to control and monitor any variables related to the home by using any android capable cell phone. The design and implementation of modem driver, text based command processing software and power failure resilient output of a micro controller to facilitate in sending and receiving data via the cell module together with the design of android application to enable the cell phone to send commands and receive the status of home appliances. Now we can control home appliances on our figures with long distance range. So that it provide time saving, power saving, alerts etc. And, also you can just imagine how simple would it be to implement such a system in your home that too at a very reasonable cost by using cost-effective devices.

Key Words---- Wi-Fi, Android Application, Relays, Buzzer, Embedded C, Keil Software, ARM7 Microcontroller Temperature Sensor, LPG and IR Sensor.

I. INTRODUCTION

The current scenario is such that people have to manually operate various kinds of appliances which at times is not feasible for busy families and individuals with physical limitations. Also there is no effective means of controlling various accidents due to gas leakage and burglary. This system will provide proper notifications to users whether light, fan is in ON/OFF and live temperature status on their android application which is available in the smart phone. The main objective of this project is to design and implement a cheap and open source home automation system that is capable of controlling and automating most of the home appliances. Nowadays home automation system[2] is an emerging technology that operates the electrical appliances and loads remotely by using advanced controllers with communication technology. This is an advancement of the conventional mechanization process wherein human efforts are needed to operate the electrical devices or appliances. Control capability is more sophisticated with this automation ranging from low to high level control. Home automation is the controlling and operating the home appliances such as lighting equipments, kitchen appliances, air conditioning and heating etc. in either automatic or manual modes conveniently and efficiently. This system uses different types of sensors to sense or detect the parameter status and with the use of centralized controllers it appropriately actuates the loads for prescribed limits or conditions. In addition to the controlling it also provides energy saving, graphical user interface and security to the homes.

A. System Architecture:

Power Supply Block: This block supplies power to the entire circuit by stepping down, rectifying, filtering and regulating the available AC power to a regulated-DC-power supply which is sufficient to operate the microcontroller and other control devices like relay coils. The lamp loads are connected to the direct AC mains through relay contacts.

Android Application (TCP/IP): TCP/IP is free open source software used in this project. TCP/IP stands for Transfer control protocol allows the operations of remote controlled devices.

Wi-Fi Module: The project is based on low-cost ESP8266 Wi-Fi module[3]. It acts as a interface between remote devices and home sector appliances, through MAX232 it sends the input and output signals to ARM7 Microcontroller. It is a low power consuming, cost-effective and high performing wireless transceiver device that provides two-way communication. Alternately, serving as a Wi-Fi adapter wireless internet access can be added to any microcontroller based design with simple connectivity through UART interface.

ARM7 Microcontroller: The microcontroller used to decode the controls taken from WiFi module. These controls are used for switching the home appliances[7]. The microcontroller receives the controlling signals from a user phone via the Wi-Fi modem and based on the program, it controls the loads. It is programmed using embedded C language in Keil software. It has inbuilt MAX232 module. Since there is no need to plays threshold translator between Wi-Fi module and the controller. ARM family microcontrollers work on the power supply range from 3.3v to 9v DC. The main advantage of this microcontroller is it supports number of peripherals at the output.

Relay Driver, Relays, Fan and Lamp: A lamp and fan is connected to the microcontroller via relays through a relay-driver IC. It is also possible to add other loads on home to this relay, but for demonstration purpose, we have used lamps as loads. Here, the relay-driver IC acts as an intermediate controller to energize different relay coils based on the signals from the microcontroller.
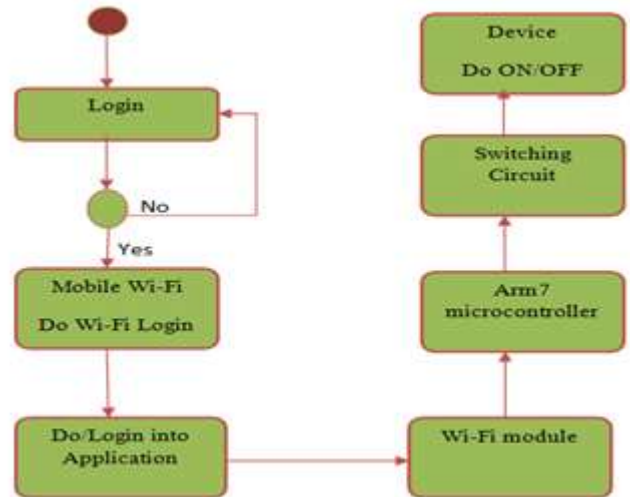
B.   Activity Diagram:

Fig-1: Activity diagram of system

The above shows that our system is basically have a security system, which gives access to the system through password authentication. Then Wi-Fi is switched on with the Wi-Fi modem. The dimmer circuits are used to control the speed of the appliances like fan. With the dimmer circuit a device can be switched on and off also.

C.   Android Remote Control for Home Automation:

As we know that Android is a popular smart phone technology. So, to turn a smart phone or tablet as a universal remote control in place of conventional remotes is a good idea as this is the most effective and flexible automation. This makes every appliance at home as a accessory for smart phones. Android remote control based home automation consists of Android OS operated Graphical User Interface (GUI) with wireless communication module on different home appliances. Here in this system we are using the Wi-Fi as a wireless communication module. In this system, different sensors and load controllers in the home are connected to sensors and an I/O control module which has the capability to communicate with a user-controlled device. At the user controlling side, the smart phone with an android-application-based GUI-controller allows the user to send the desired control signals such as switching a lamp or fan off and on, room temperature maintenance, etc. Building of this android-based home automation is a simple concept as you can implement this in your home by using cost-effective products like microcontroller and sensors. So let us

understand this in brief using wi-fi communication to control home appliances.

For remote operation – before operating this circuit, the smart phone or android mobile is paired to the WI-FI attached to the microcontroller. Once both are paired, the controlling signals corresponding to the load to operate it can be sent from an Android remote control or phone. From the touch panel of a GUI interface-based application, if any alphabet is pressed, the application sends the corresponding signals to the remote Wi-Fi modem. Then, at the receiver side, the Wi-Fi modem receives these signals and processes them according to the code, and finally sends the control signals to the relay-driver IC. This driver IC energizes the respective coils to switch the appropriate loads.

Fig-2: Android application

II.   EXISTING SYSTEM
A. *Home automation system by using Bluetooth*:

Bluetooth: It is a Bluetooth stack 2.0 compatible devices which has built-in 2.4 GHz antenna. It is a low power consuming, cost-effective and high performing wireless transceiver device that provides two-way communication and also supports both USB and SPI protocols. Bluetooth communication should only be used on occasions where there is a need for quick short-lived network communication with little concern for security. Bluetooth looks like an attractive communication technology for creating smart homes. It is cheap, easy, and quick to set up. People are already familiar with the technology. The hardware required for establishing Bluetooth communication is readily available. And the technology also provides the necessary bandwidth for the operation in a home. But they also have serious flaws. The paper discusses remotely controlling and updating home devices along with fault diagnostics and detection. The work also talks about providing an electronics user manual on the phone using Bluetooth and Internet.
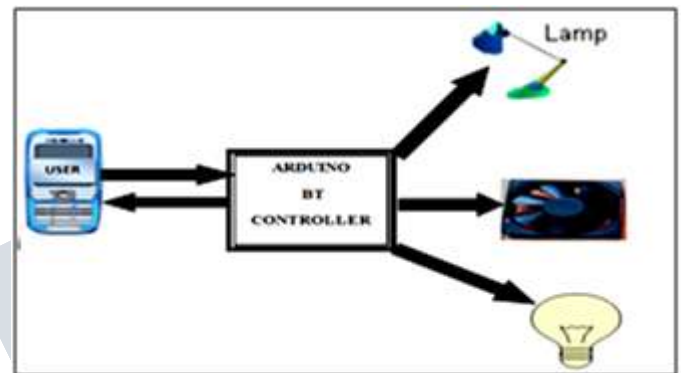
Bluetooth Home Automation:

Fig -3: Bluetooth Home Automation:

The design and implementation of a bluetooth based home automation[1] uses a host controller implemented on a PC, which is connected to a microcontroller-based sensor and device controllers. The researchers even built a new protocol on top of the Bluetooth software stack, called Home Automation protocol (HAP), to make the communication between devices possible. The device controller is connected to electronic devices through the I^2C Bus. The system allows more than one device controller to be connected to the host controller. Home automation system using Bluetooth that can be accessed remotely through GPRS. The researchers use a cell phone equipped with Bluetooth connectivity as a host controller and a GSM modem that provides Internet connectivity. Home devices are fitted with Bluetooth communication adapters[6] so that they can communicate with the host controller phone via Bluetooth.

III.   PROPOSED SYSTEM

The above systems has their own disadvantages, hence we proposed a new system using Android application via Wi-Fi technology to control home appliances. Our system will provide proper notifications to users whether light, fan is in ON/OFF status on their android application which is in the mobile phone. Smart home[5] has various benefits such as providing increased comfort, safety and security to people.

The main objective of this project is to design and implement a cheap and open source home automation system that is capable of controlling and automating most of the home appliances. This application is an easy and manageable web interface for user to run Home Automation System.
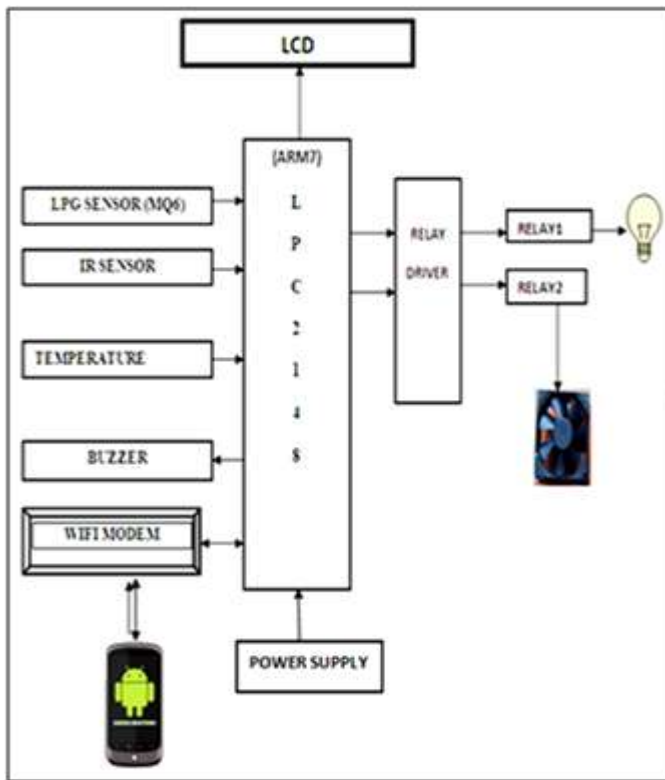
Block Diagram:

Fig -4: Block Diagram of Home Automation

IV.   RESULT AND ANALYSIS

A Sincere attempt has been made to this project Remote Controlled Smart Home Automation Using Android Application through Wi-Fi Connectivity. The scope of the system can be extended to suit various home appliances. The system is capable of providing status of the home appliances whether it is ON or OFF and also provide the live temperature which is display in the android mobile.

Smart Home Automation Kit

Fig -5: Smart Home Automation Kit

Now in the android application, type the IP number as 192.168.4.1 and port number as 80 for communicate with home section as shown below figure,If we type capital "**A**"or "**a**" or "**B**" or "**b**" in the menu on the android app then displayed in LCD and status on our andriod app as shown in below **figure 6;**

Fig -6: Light control on Android App

Fig -7: Home Section control through android app

In addition to the feature like IR sensor is embedded to sense if any unauthorized person entered into the home the buzzer will make sound and a message like **"SOMEONE ENTERED"** will display on the LCD as shown in below **figure;**

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Fig -8: Status of home security displayed on LCD

V. CONCLUSION

We proposed this project is to assist handicapped/old aged people. This project gives basic idea of how to control various home appliances and provide a security using Android phone. This project is based on Android and ARM7 platform both of which are Free Open Source Software. So the overall implementation cost is very cheap and it is inexpensive by a common person.

VI. FUTURE SCOPE

We have discussed a simple application in this project but in future it can be controlled the appliances from anywhere by implementing IOT technology.

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