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SUPERVISION AND DIRECTING HOME APPLIANCES WITH VOICE COMMAND USING SMART PHONES

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ABSTRACT

Now-a-days technology has been implemented in every fields using smart phone application. The latest technology which has been used frequently for implementing the smart phone application is Android. At present in the existing system the smart phone applications are used to control and monitor the home environment using an embedded micro-web-server with IP connectivity for accessing and controlling device. It offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. This can even include timer setting which can switch on/off the appliances automatically within particular time. This provides an ultimate home security system by enabling automatic door lock control and fire alarm system which can be invoked by voice commands over Android based smart phones. This presents a low cost and flexible home control system. It can be achieved by integrating devices such as light switches, temperature sensor and current sensor with home control system.

Index Terms—Security, home control, android, embedded system.

1. INTRODUCTION

In this competitive world everyone is busy with their own day to day life. Where there are possibilities to forget to take care of their home security, like whether the electronic devices are turned off or not and also the door has been locked properly are not. So it is important to ensure all these things right from your work place or wherever you located. This will be more helpful if you could control such works in your mobile device itself. Thus we provide a complete home control system with the help of Android device.

Most commonly used applications are developed by Android because Androids are open source in nature and they are cheaper to produce than any other operating system. Therefore, we decide to develop and implement the application in java programming language using the Android SDK. The important process is to hide several processes from the user while allowing full interaction with the application.

I. This paper presents a low cost and flexible home control and monitoring system using an embedded micro-web server, with IP connectivity for accessing and controlling devices and appliances remotely using Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. The Internet of Things (IoTs) technology can also be applied to create a new concept and wide development space for smart homes to provide intelligence, comfort and to improve the quality of life. Different devices and the appliances in the home such as lightings, air condition, home security and entertainment systems are now being connected to the Internet so that it can be controlled remotely using the Smart phones or Tablets.

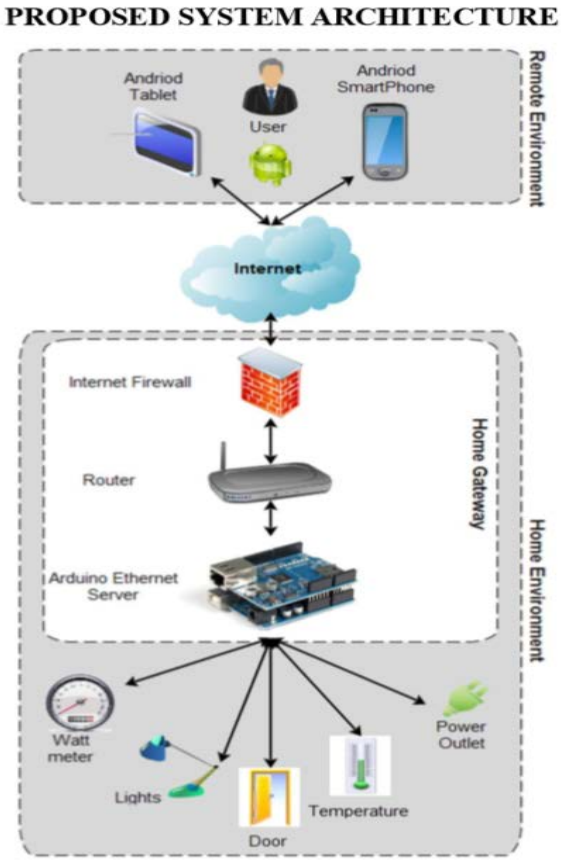
2. PROPOSED SYSTEM

So far the entire system was accessed through predefined buttons, where we have introduced such access with voice command. Which will be easy and convenient to handle. Also the entire process is enables with the help of Wi-Fi. It provides a complete control over the home appliances and also enables high security by providing door lock system and fire alarm. In addition it provides intelligence to home environment can provide increased quality of life for

the elderly and disabled people who might otherwise require caregivers or institutional care.

3. SYSTEM ARCHITECTURE

The proposed architecture and design is flexible and low cost for home supervision and directing system. The architecture is categorized into three layers such as Home Environment, Home Gateway and Remote Environment. The Remote Environment represents authorized users who can access the system on their Smart phone app using the Internet via Wi-Fi or 3G/4G network. Home Environment consists of Home Gateway and a hardware interface module. The primary function of the Home Gateway for the proposed architecture is to provide data translation services between the Internets. The main component of the Home Gateway is a micro web - server based on Arduino uno Ethernet. The main operation of the server is to manage, control and monitor system components, that enables hardware interface modules to successfully execute their assigned task using actuators and to report server with triggered events via sensors. Hardware interface modules are directly interfaced with sensors and actuators through wires. It has the capabilities to control energy management systems like lightings, power plugs, and security systems such as door locks. For monitoring Home Environment the system supports sensors such as temperature.



4. MODULES

The home supervision and directing system consists of three main modules such as the micro web server, hardware interface module and the software package (Android app). To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug and temperature sensor have been integrated with the proposed home control system. The system implementation is discussed detailed in the following sections.

A. Software Development for Home Gateway

Our supervision home control system uses two software such as server application software and microcontroller firmware. The server application software uses a library implementation of a micro web-server which runs on Arduino Uno using the Ethernet shield. This Ethernet shield has the capability to be used both, as a client or a server. For successfull communication between remote user and the Home Gateway, configuration stage and sensor/actuator control stage layers have been implemented on the Arduino Uno. The libraries are used to receive data on Arduino Uno and creates output messages in JavaScript Object Notation (JSON) format. Figure 2 shows the flowchart of connection establishment between the Arduino Uno and the Internet. The Home Gateway is connected to Internet over TCP/IP. Since Arduino Ethernet shield already supports a TCP/IP stack, we have focused on implementing software to connect it to the remote user. The Home Gateway once started enters the configuration stage. During the configuration stage the Ethernet module establishes connection with Local Area Network (LAN) using a static IP address. To optimize the process of connection, we have used static IP address rather than acquiring an IP via Dynamic Host Configuration Protocol (DHCP). Once the Home Gateway has been initialized, it enters into an idle state until any command is received from the remote user. Upon successful reception of commands as strings from the Smart phone app, it's decoded and appropriate control action is taken.

B. Home Gateway Application Framework

To establish a easy communication Web services has been used, which will be direct and interoperable. For communication purpose we use programming interfaces (APIs) which can be implement on every platform and developing environment. The Web services are open and interoperable way to provide access to remote services or to enable applications to communicate with each other. There are two classes of Web services: Simple Object Access Protocol (SOAP) and Representational State Transfer (REST). RESTful is a much more lightweight mechanism than SOAP offering functionality similar to SOAP based Web services. Therefore, in our approach we have used the RESTful based Web service utilizing standard operation such as GET and POST requests

that return JavaScript Object Notation (JSON) responses to communicate between the remote user and the micro Web server. JSON is a lightweight data-interchange format. It is easy for human beings to read and write. It is also simpler for machines to parse and generate messages than using XML.

The system works based on the information that are gathered by the respective sensor and the Arduino Uno device which is connected to the Wireless router. The devices is coded to integrate with the home appliances as well as the android app that has been installed in the user device.

C. Smartphone Application and Features

Most of the Smart phones support Android OS, therefore, we decided to develop and implement the application in JAVA programming language using the Android Software Development Kit (SDK). The most important feature of our Smartphone app is to hide several processes from the user while allowing full interaction with the application. By using the several software packages, we were able to customize the application to include a variety of user interface elements. The Smart phone app for Supervision and directing home Appliances provides the following functionalities to the user: 1) Remote connection to the Home Gateway. 2) Device control. 3) Device Monitoring. 4) Managing schedule. To successfully connect to the Home server, the user has to configure the IP address and the Port number of the micro Web-server in the app.

The Smart phone app sends the following message to the Arduino: http://arduinoip/?out = all and to acknowledge the command, the Web-server replies with the JSON message. Where the JSON message indicates the IP address of the remote home server, the Arduino IO ports where the device is connected to and the device type. To connect the new device and add it to the app, the user has to only program the home server. Each time a new device is programmed in the server, a new thread dedicated to the device is automatically created in the app. The Smart phone app sends the following to the home server: http://arduinoip/?out=1&status=1. The out indicates the I/O port on the Arduino and the status can be either 1 (ON) or 0 (OFF).

D. Hardware Implementation and Home Automation Devices

The Arduino Uno and Ethernet shield were used to implement the micro Web-server for the Home gateway. Home gateway connects to the Internet according to the details provided in Section 4.1. The Arduino Uno is an open-source microcontroller that uses ATMEGA 328, an Atmel AVR processor which can be programmed by the computer in C language via USB port. Arduino Uno also has on-board 5 analog pins and 13 digital pins for input and output operations, supporting SPI and I2C which can be used to interface with other devices. The Ethernet module acts as a bridge to connect the Home Gateway to the local proxy. A conventional light switch was integrated with the Arduino using relays to demonstrate the switching capability as illustrated in our previous work and an LM35 temperature sensor was used for temperature monitoring while a non-invasive 30A current sensor was utilized for power monitoring. Details provided in are used to successfully integrate the current sensor with the Arduino Uno. The hardware architecture presented is flexible and allows other home appliances and devices to be seamlessly integrated with minimal changes.

5. FLOW CHART

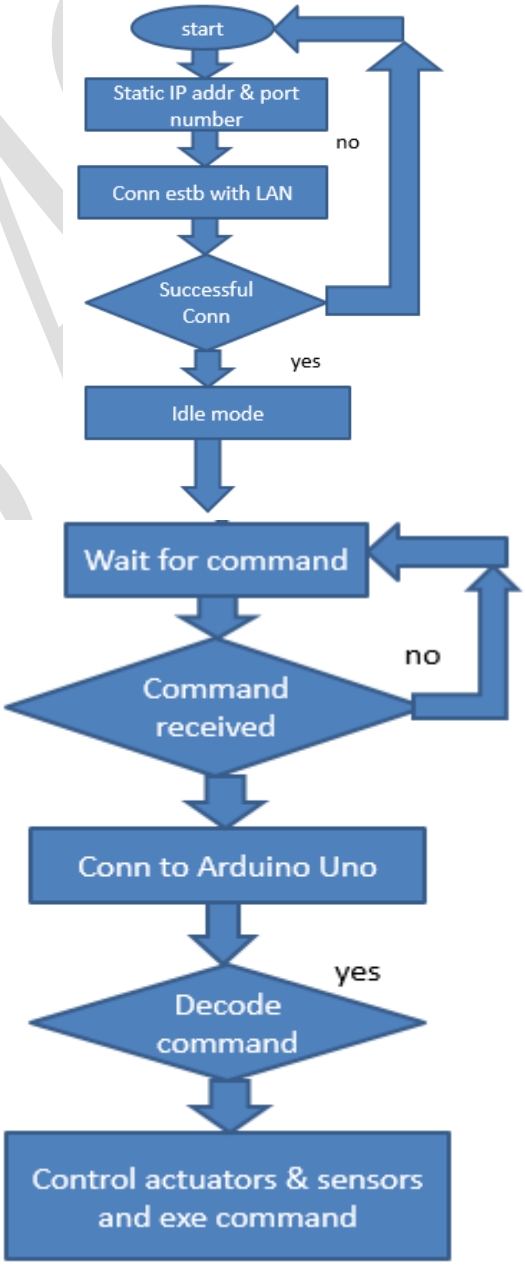


Fig.2.Connection Establishment

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6. SECURITY SYSTEM

The Security system provides a complete security over the home control. By performing two major tasks such as Door lock system and Fire alarm. The door lock system enable a complete control over the supervision and automation of the main door, which detects the status of the door lock and also allows to lock or unlock if needed. The fire alarm system works based on the room temperature detected by the sensor which sends fire alert to the user. Let us discuss both the operations in detail.

E. Door lock system

The development of a security system that integrates with an Android mobile device using Wi-Fi as a wireless connection protocol. Android OS is currently the lead on mobile market share while Symbian OS was already discontinued. This proposed system allows a user to lock or unlock a door from anywhere with the help of internet. The application was designed to allow the user to also check the status of the door. The mobile device requires a password to increase the security of the system. The hardware on the door uses a microcontroller to control a linear actuator that acts as the locking mechanism. The Internet protocol was chosen as a communications method because it is already integrated into many Android devices and is secured through the protocol itself.

1. In-home security control

Android smartphone or tablet with Bluetooth capabilities and a microcontroller security interface on the door to be secured .The in-home security interface of the door was made of several major components. An Arduino Mega 2560 microcontroller was chosen for this project for the ease of programming and ability to quickly prototype. Door position was determined by use of a magnetic switch similar to those found on window alarm systems that was connected to the Arduino board. In addition to using the Android device to lock or unlock the door, a switch that used a physical key was installed in the door jamb along with status lights of the system. The locking mechanism itself was a linear actuator, originally purposed or use in the power locking mechanism of a car, and a set of transistors to reverse the voltage polarity and lock/unlock the door.

2. Android SDK and Arduino firmware

Android uses a Java based language. To develop an Android app, a tool named Eclipse is required as well as Android's SDK, which is an add-on for the Eclipse program. When creating a new application for the Android, the platform version must be selected, e.g. 1.5, 1.6, 2.1, or 2.2. However, the version can differ on the Android device depending on which Android device is being used. The three main components required in the creation of the Android app are: the java file, which is a file that contains all code required for completion of desired tasks and functions; an xml file, which contains the layout for how the application will look to a user; and a resource folder, which contains all images, sounds, and graphics files needed for the application. For Arduino firmware, the IDE is provided as the open- source by the company]. The tool can run on multiple platforms, e.g. Windows, OS X, and UNIX. The language is a Wiring-based language which is similar to C/C++ style. Two programs were created for this project that had to be able to communicate with one another via internet. One was on the Android mobile device, and the other was on Arduino board, inside the in-home security controller. They needed to be able to communicate with each other in a secure manner over.

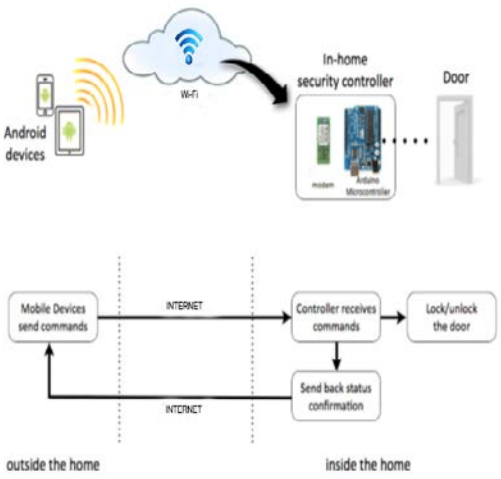

Fig.3.Automation of Door lock system

The Android app was created in two major development steps. The first step had the MAC address of the microcontroller directly coded into the app for initial testing, and the second was an improvement of the first in that it allowed a user to search for the device, which becomes the final design. The door side programming, Arduino firmware, was by comparison much simpler because there was no graphic user interface to work with. The entire user interface consisted of the door, a keyhole, and two LEDs. One LED was a power indicator, and the other was a door ajar indicator. This program continually monitored the door ajar switch when it did not receive any commands from the app. When a command was received and the door was confirmed as closed, the appropriate action would be taken.

F. Fire Alarm

The fire alarm system works based on the sensor that are fixed inside the home. Which detects the room temperature and intimates the user if the temperature exceeds the capable temperature. This information is sent via the Arduino Uno device that are attached to the wireless router. This router helps to send message alert to the registered user's mobile number. Which will prevent the user to overcome a serious problem by taking immediate action.

7. CONCLUSION

The ultimate aim of this paper is to create a home security system that enables the user to control and supervise the registered home appliances with the help of Android devices. The system should view the status of the home appliances and let the user to change its status either as on or off. And also provides a guidance to supervise the door lock system and control its function. In addition it also intimates the user with fire alarm alert with the help of sensor which detects the room temperature and sends the information to user device with the help of internet. Thus all these operations can be done anywhere away from the home if the user could access the internet in his Android device. The future work can include the burglar alarm which can detect and inform about the entry of suspicious person.

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