


Home Automation and Security System Using Android ADK

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Home Automation and Security System Using Android ADK

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Abstract—Today we are living in 21st century where automation is playing important role in human life. Home automation allows us to control household appliances like light, door, fan, AC etc. It also provides home security and emergency system to be activated. Home automation not only refers to reduce human efforts but also energy efficiency and time saving. The main objective of home automation and security is to help handicapped and old aged people which will enable them to control home appliances and alert them in critical situations.

This paper put forwards the design of home automation and security system using Android ADK. The design is based on a standalone embedded system board Android ADK(Accessory Development Kit) at home. Home appliances are connected to the ADK and communication is established between the ADK and Android mobile device or tablet. The home appliances are connected to the input/output ports of the embedded system board and their status is passed to the ADK. We would develop an authentication to the system for authorized person to access home appliances. The device with low cost and scalable to less modification to the core is much important. It presents the design and implementation of automation system that can monitor and control home appliances via android phone or tablet.

Keywords-Home Automation and Security; Arduino; Embedded Systems; Android ADK; Android phone; Tablet

I. INTRODUCTION

Home automation is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, and other systems, to provide improved convenience, comfort, energy efficiency and security. The concept of home automation has been around for a long time and products have been on the market for decades, though no one solution has broken through to the mainstream yet. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care. It can also provide a remote interface to home appliances or the automation system

itself, via telephone line, wireless transmission or the internet, to provide control and monitoring via a smart phone or web browser. This paper will describe the approach which we are implementing to control various home appliances with Android smart phone.

II. LITERATURE SURVEY

As per our survey currently there exists no system at cheaper rates. Various systems are hard to install, difficult to use and maintain. Current systems are generally proprietary and closed, not very customizable by the end user.

N. Sriskanthan [1] explained the model for home automation using bluetooth via PC. But unfortunately the system lacks to support mobile technology.

Muhammad Izhar Ramli [2] designed a prototype electrical device control system using Web. They also set the server with auto restart if the server condition is currently down.

Hasan [5] has developed a telephone and PIC remote controlled device for controlling the devices pin check algorithm has been introduced where it was with cable network but not wireless communication.

Pradeep G [4] proposed home automation system by using bluetooth which saves lot of power and time using mechanism to save the preloaded list by not making it to setup connection all the time when required.

Al-Ali and Al-Rousan [3] presented a design and implementation of a Java-based automation system through World Wide Web. It had a standalone embedded system board integrated into a PC-based server at home.

Amul Jadhav [6] developed an application in a universal XML format which can be easily ported to any other mobile devices rather than targeting a single platform.



Figure 1.Home automation system block diagram by R. Piyare[8]



Figure 2. Cell Phone GUI for controlling the home appliances by R Piyare[8]

R.Piyare [8] have introduced design and implementation of a low cost, flexible and wireless solution to the home automation.

Jitendra R. [7] showed that with the ZigBee network how to eliminate the complication of wiring in case of wired automation. There is also considerable amount of power saving possible, operating range is more than Bluetooth.

Google and Microsoft have recently entered the home automation domain. At 2011 I/O conference, [9] Google announced Android@Home. Google's first standard for Android devices to communicate with external hardware. The Android Open Accessory Standard and the Accessory Development Kit (ADK) is the key for communicating with hardware and building external accessories for Android devices. Android powers hundreds of millions of mobile devices in more than 190 countries around the world. [10] It's the largest installed base of any mobile platform and growing fast every day another million users.

Microsoft is similarly working on a project called HomeOS, [11] an operating system for the home.

III. IMPLEMENTATION

A. Android

For this home automation and security system we are targeting Android platform since it has huge market and open source. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. The Android OS is based on Linux. Android Applications are made in a Java-like language running on a virtual machine called 'Dalvik' created by Google. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Accessory mode is a feature of Android OS since version 2.3.4 Gingerbread and 3.1 Honeycomb and above.

B. Software Design

As discussed earlier we are developing Android application. The application consists of main function like Light controlling, Door controlling, Smoke detection and Temperature sensing. When the application starts user is first authenticated, if user is authorized he will be navigated to main screen. The main screen has a list of all functions among which user can select any one function which he want to control. After selecting a function he would be able to see a current

status of a particular device. If user wishes, he can enable or disable intended device.

The system is smart enough to activate alarm when smoke is detected or it is programmed to auto on/off lights during late night hours. If room temperature goes very high or low it can automatically adjust fan/AC as per the temperature. It has voice navigation which is specifically beneficial to blind people.

C. Android ADK

ADK stands for Accessory Development Kit. Android accessory is a physical accessory that can be attached to your Android device. [12] These particular devices perform specific actions. For USB accessories to be supported on a particular device, there must be support for the accessory-mode, a special means of connecting over the USB port. This allows data transfer between devices and external peripherals.



Figure 3 Arduino Mega ADK

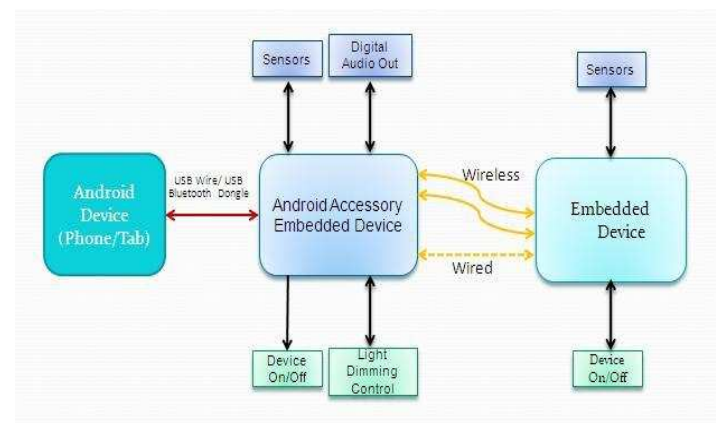


Figure 4 Block Diagram of Home Automation and Security System using Android ADK

The Android Open Accessory Development Kit (ADK) is a reference implementation of an Android Open Accessory, based on the Arduino [15] open source electronics prototyping platform. The accessory's hardware design files are provided as part of the kit to help hardware builders get started building their own accessories.

The Arduino ADK [15] is a microcontroller board based on the ATmega2560. It has a USB host interface to connect with Android based phones, based on the MAX3421e IC. The main hardware and software components of the ADK include 'Arduino Mega ADK', which was designed to work with Android. The 'Arduino Mega ADK' board is a derivative of the 'Arduino Mega 2560'. The host chip allows any USB

device to connect to the Arduino which we will later implement as an Android USB accessory. The ADK board provides input and output pins that you can implement through the use of attachments called "shields." With an Android device and the 'Mega ADK', you can use whatever sensors and actuators you require to create your own accessories. This may include a LED outputs, and temperature and light sensors.

D. Android Open Accessory Protocol

Android Open Accessory [13] support allows external USB hardware (an Android USB accessory) to interact with an Android-powered device in a special accessory mode. When an Android-powered device is in accessory mode, the connected accessory acts as the USB host (powers the bus and enumerates devices) and the Android-powered device acts in the USB accessory role. Android Open Accessory Protocol, [14] allows to detect Android-powered devices that support accessory mode. Accessory mode is ultimately dependent on the device's hardware and not all devices support accessory mode.

Android Open Accessory support is included in Android 3.1 (API Level 12) and higher, and supported through an Add-On Library in Android 2.3.4 (API Level 10) and higher. Android 4.1 and higher has support for audio output over a USB connection or Bluetooth. An Android USB accessory must adhere to Android Accessory Protocol, which defines how an accessory detects and sets up communication with an Android-powered device. [14] In general, an accessory should carry out the following steps:

1. Wait for and detect connected devices
2. Determine the device's accessory mode support
3. Attempt to start the device in accessory mode if needed
4. Establish communication with the device if it supports the Android accessory protocol.

The Android Open Accessory Protocol 2.0 [16] adds two new features: audio output (from the Android device to the accessory) and support for the accessory acting as one or more Human Interface Devices (HID) to the Android device.

IV. BLOCK DIAGRAM

Android Device - It is the device through which application interacts with sensors.

USB Connector - It is the hardware port in the kit through which the USB device is attached to the embedded kit.

Android Accessory Development Kit(ADK) - ADK allows Android Phone to act as USB Device where as the "Arduino-Mega2560 ADK" will act as USB Host. This allows communication between Android Powered Devices (like phone, tablet) and external Hardware like industrial controls.

Embedded Device - It consists of individual embedded kits along with respective sensors.

V. APPLICATIONS

Following are the applications of Home Automation and Security System

- Medical alert / teleassistance.
- Precise and safe blind control.
- Detection of fire, gas leaks and water leaks.

- Smoke detector can detect a fire or smoke condition, causing all lights in the house to blink to alert any person of the house to the possible emergency.
- The system can call the home owner on their mobile phone to alert them, or call the fire department or alarm monitoring company.
- In terms of lighting control, it is possible to save energy when hours of wasted energy in both residential and commercial applications by auto on/off light at night time in all major city office buildings, say after 10pm.
- Control and integration of security systems and also the potential for central locking of all perimeter doors and windows.
- Security cameras can be controlled, allowing the user to observe activity around a house or business right from a Monitor or touch panel.
- Security systems can include motion sensors that will detect any kind of unauthorized movement and notify the user through the security system or via cell phone.
- An intercom system allows communication via a microphone and loud speaker between multiple rooms.

VI. FUTURE WORK

Looking at the current situation we can build cross platform system that can be deployed on various platforms like iOS, Windows. Limitation to control only several devices can be removed by extending automation of all other home appliances. Security cameras can be controlled, allowing the user to observe activity around a house or business. Security systems can include motion sensors that will detect any kind of unauthorized movement and notify the user. Scope of this project can be expanded to many areas by not restricting to only home. It will be flexible to support various wired as well as wireless technologies like Bluetooth, Zigbee, Wi-Fi, World Wide Web.

VII. CONCLUSION

This is an ongoing project. Our prime objective is to assist handicapped/old aged people. This paper gives basic idea of how to control various home appliances and provide a security using Android phone/tab. This project is based on Android and Arduino platform both of which are FOSS(Free Open Source Software). So the overall implementation cost is very cheap and it is affordable by a common person. Looking at the current scenario we have chosen Android platform so that most of the people can get benefit.

The design consists of Android phone with home automation application, Arduino Mega ADK. User can interact with the android phone and send control signal to the Arduino ADK which in turn will control other embedded devices/sensors. We have discussed a simple prototype in this paper but in future it can be expanded to many other areas.

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