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IMPLEMENTATION OF SECURE DOOR AUTOMATION SYSTEMS USING INFRARED SENSORS

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ABSTRACT

Wireless home automation networks comprise wireless embedded sensors and actuators that enable monitoring and control applications for home user comfort and efficient home management. This article surveys the main current and emerging solutions that are suitable for WHANs , including ZigBee, Z-Wave, INSTEON, Wavenis, and IP-based technology. In the EXISTING SYSTEM, Control of Door is achieved using ZigBee, IR (Infrared sensor), Wi-Fi or by GSM (GLOBAL SYSTEM MOBILE MANAGEMENT). In the PROPOSED SYSTEM, Same is achieved using Easiest way without touching any sensors. MODIFICATION of the Project is our implementation, Authenticated users will register to the House Server with set of Questions and relevant Answer to it along with the Standard PIN Numbers for authentication. Android Application is deployed to verify all these User will have sent a Voice command for PIN number. IR sensor is deployed to detect Human, If a new user enters to the home IR is initiated and Camera picks a snap and emails to the all the members in the house. If anyone knows the person then he could share the PIN number and Session Key so that Door can be opened.

Keywords – Door Lock System; Pin code; Android; Arduino; Home Automation.

IINTRODUCTION

Android is an open source and Linux-based Operating System for mobile devices such as smart phones and tablet computers. Android was developed by the Open Handset Alliance, led by Google, and other companies. Android offers a unified approach to application development for mobile devices which means developers need only develop for Android, and their applications should be able to run on different devices powered by Android.

The first beta version of the Android Software Development Kit (SDK) was released by Google in 2007 where as the first commercial version, Android 1.0, was released in September 2008. On June 27, 2012, at the Google I/O conference, Google announced the next Android version, 4.1 Jelly Bean. Jelly Bean is an incremental update, with the primary aim of improving the user interface, both in terms of functionality and performance.

The source code for Android is available under free and open source software licenses. Google publishes most of the code under the Apache License version 2.0 and the rest, Linux kernel changes, under the GNU General Public

II RELATED WORK

Several works of control based home automation systems have been studied in order to actualize home automation itself. Various approaches have been deployed in

the implementation. SMS based solution was offered in [12]. The research work from H. El Kamchouchi and Ahmed El Shafee provided full functionality to control home appliances uses SMS technology to exchange data via GSM Network. But, SMS based technology lack of Graphical User Interfaces (GUIs). Also, wireless communication via Bluetooth based solutions for control home appliances have been explored in [10] [13]. The research work from R. Piyare and M. Tazil control home appliances via Bluetooth by using Symbian OS phone. This system unable to support Java based application because Symbian OS phone only support Python language scripts. These days mostly smartphone applications are developed in Java.

Another study already presented home automation using android application [3]. However, it was designed to control home appliances only with on off button without authentication. The method like on off button is not really secure to be implemented to the gate or door. Hence, this work utilizes more feature to control the door by adding authentication via speech command or pin. Through the GUI of android mobile application, the flexibility is in the hand. Additionally, the user will feel more secure because it has authentication and also the android mobile application is still user friendly to be used. Generally, a simplified secure architecture is provided in this work for realizing home automation.

III   SYSTEM DESIGN

Android applications are usually developed in the Java language using the Android Software Development Kit. Once developed, Android applications can be packaged easily and sold out either through a store such as Google Play or the Amazon Appstore. Android powers hundreds of millions of mobile devices in more than 190 countries around the world. It's the largest installed base of any mobile platform and growing fast. Every day more than 1 million new Android devices are activated worldwide. This tutorial has been written with an aim to teach you how to develop and package Android application. We will start from environment setup for Android application programming and then drill down to look into various aspects of Android applications.

Table 1. Android Versions, Codename and API

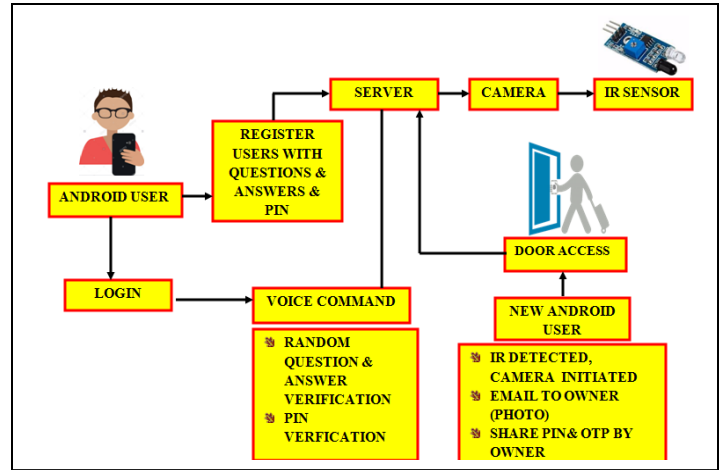| Version	Codename	API
1.5	Cupcake	3
1.6	Donut	4
2.1	Éclair	7
2.2	Froyo	8
2.3	Gingerbread	9 and 10
3.1 and 3.3	Honeycomb	12 and 13
4.0	Ice Cream Sandwich	15
4.1, 4.2 and 4.3	Jelly Bean	16, 17 and 18
4.4	KitKat	19

Fig 2 Architecture for Secure Door Automation System

A component is simply a piece of code that has a well-defined life cycle e.g. Activity, Receiver, and Service etc. The core building blocks or fundamental components of android are activities, views, intents, services, content providers, fragments and AndroidManifest.xml.

Activity

An activity is a class that represents a single screen. It is like a Frame in AWT.

View

A view is the UI element such as button, label, text field etc. Anything that you see is a view.Intent is used to invoke components. It is mainly used to:

- Start the service
- Launch an activity
- Display a web page
- Display a list of contacts
- Broadcast a message
- Dial a phone call etc.

Service

Service is a background process that can run for a long time. There are two types of services local and remote. Local service is accessed from within the application whereas remote service is accessed remotely from other applications running on the same device.

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Content Provider

Content Providers are used to share data between the applications.

Fragment

Fragments are like parts of activity. An activity can display one or more fragments on the screen at the same time.

AndroidManifest.xml

It contains information's about activities, content providers, permissions etc. It is like the web.xml file in Java EE.

Android Virtual Device (AVD)

It is used to test the android application without the need for mobile or tablet etc. It can be created in different configurations to emulate different types of real devices

A. *Hardware Architecture*

In the proposed system, control of door is achieved using easiest way without touching any sensors. In this project, authenticated users will be registered to the home server with set of questions and relevant answer to it along with the standard PIN Numbers for authentication. Android Application is deployed to verify all the users. Those users will send a voice command for PIN number. IR sensor is deployed to detect human. If a new user enters to the home, IR is initiated and camera picks a snap and emails to the all the members in the house. If anyone knows the person then he could share the PIN number and session key so that door can be opened.

B. *SoftwareDesign*

The software is also needed to manage how the system run. The hardware will not run without the software design. The software is helping to control the component. This research work uses two softwares: Arduino Integrated Development Environment (IDE) and MIT App Inventor web based.

The Android application ,is used for user interface as the key of the door. Application is created with MIT app inventor web based. This door automation project is controlled using Android smart phone application. So, it is needed to make an android application that will correlate with the hardware system to control the door. There is a convenient web based tool to develop the android application, MIT App Inventor. The app inventor uses the blocks-based tool to create the program code. Its application is more simple drag and drop.

Then, the Arduino program to set the hardware of door automation rules isused ArduinoIDE1.8.5.Arduino Integrated Development Environment is a desktop software that is usedto program the Arduino as microcontroller in this research work. This Arduino programming language consists of functions for computations and control, variables that comprises constants and data type, then the structure which contains C++ code. Entire programming for proposed system is done in Arduino IDE tool. Baud rate is set to 9600 bits per second for serial communication between Arduino board and smart phone.   Before compile and upload the program, the proper board in tools bar is chosen to correspond with the board of Arduino Nano hardware.

IV   IMPLEMENTATION ANDDISCUSSION

This research work makes a system for unlocking the door by android phone. Two methods are tested for door automation system, speech command authentication and pin authentication. Users can choose one of them from the android application which is preferred to be used for control to unlock the door.

A. *PIN Authentication*

1) *Android Application*

Another work besides speech authentication, the application gives another choice to unlock the door by pin authentication. Same as in the speech command interface, the GUI of the android application is made first. When a new project started, the view of MIT app inventor web based will be in the designer tab. Layout and user interface can be drag from palette column and drop to the screen viewer in the middle. The properties also can be set through the properties column. Not only layout and user interface which can be dragged and dropped, but there are also many other components. In this door automation project, the android application has connectivity of Bluetooth client in order that the smartphone can search the nearest other active Bluetooth in the range. The purpose is connecting the android smartphone with the Bluetooth module in the door automation hardware. When it is connected, the door can control from the application via android smartphone.

There are also other components like Tiny DB for storage, Notifier for notification or warning, and many more that can be picked from palette column, adjust the usability. The button pin can be gotten from column palette user interface. The shape of the button can be changed in the properties column. Password text box is also needed to save the number touched. The android application door

automation system has two modes, is change pin mode and open door mode, also in the button display.

After design the GUI in the designer tab, the code of how the program run is made in the blocks tab. MIT app inventor is different with android application development environment in general which is using script based. To arrange the program, MIT app inventor use blocks code program. It is easier to understand and more interesting for new learner android programming.

The Bluetooth connection between android smartphone and the door automation hardware is very important. When the android smartphone Bluetooth is turn on, the Bluetooth client function of the program start to make list all paired Bluetooth and save the address and name. It can be saved using Tiny DB component. From that paired Bluetooth list, the address and the name of Bluetooth hardware is selected in order to make connection between the both. There will appear warning text if the connection failed.

The modes of pin authentication can be changed by touch the mode button in the figure 3. Change pin mode and open door mode have each different protocol to make the both easier to distinct and process in the next, especially in the hardware implementation. If change pin mode is selected, the new input pin is saved. Same as in the speech command authentication, change pin mode is set as 1, while open door mode is set as 0. Those two number serve as distinguish protocol.
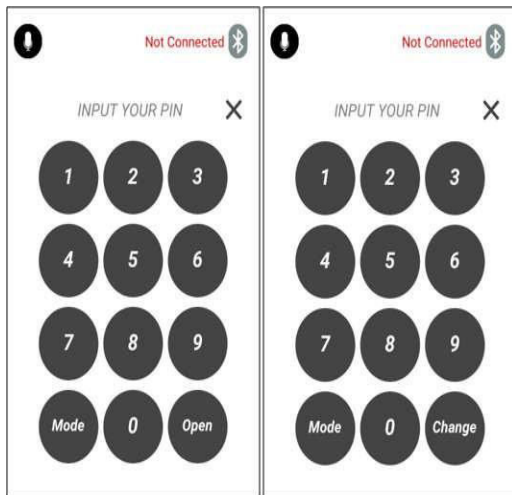

Figure 3. User Interface for PIN Authentication

2) Hardware Implementation

The pin data, which is sent by the android application via smartphone Bluetooth, will be received by the Arduino microcontroller via Bluetooth module which has been installed on it. Arduino microcontroller has non-volatile memory storage, EEPROM. This memory is used to save the pin password in order to the stored memory will not be lost even when there is no power supply given.

The protocols are defined correlated with the android application. The corresponding received data is identified by the header data, using #. Data with different protocol will not be processed. Data with the # header will continue to the next authentication. The next flag is used to distinguish the speech data or pin data. As explained before, speech authentication uses 0 as flag, while pin authentication uses 1 as flag. The password setting is sent through protocol 1 after #1. While the open the door function is sent with 0 after #1. So, the protocol of pin authentication will be like #1 then 0/1 followed with the pin. The whole algorithm of door automation with pin authentication is shown in the figure4.

PIN Authentication Algorithm

1. Initialize 4 digits pin code in the Android Application
2. Send the pin data via Bluetooth
3. Receive the pin data in the Arduino microcontroller
4. Check the protocol, if the first input character is #,the data is true for the system
5. If not, do nothing
6. If true continue check, the next flag must be 1 to indicate the use of pin authentication
7. Then continue check, if the next flag serial setting is 1, it is the command to set/update the pin code, then update the received 4 digits pin code in the next serial data as a saved pin in the EEPROM
8. If the next flag serial setting is 0, it is the command protocol to open the door.
9. Do the authentication, If the 4 received digit pin are exactly same with the 4 digits pin saved, the relay turn HIGH to control the solenoid to open the door
10. If not, shows the warning in the android application

Figure 4. PIN Authentication Algorithm

The pin only can be sent when the Bluetooth is connected. If the Bluetooth is still not connected, the warning will appear in the screen to notice. If the connection success, the data of protocols and pin will be

received by the Bluetooth in the hardware. After the header authentication, the received pin as the key to open door will be checked the sequence of the pin digits, is that the same with the stored pin or not. For the pin setting, it is need parsing the serial received data to be stored in the micro controller of every new digit pin, which next is used to be recognized as a new pin for authentication.

V   CONCLUSION

This project presents a new method for intelligent surveillance utilizing the capabilities of a smartphone along with infrared sensor. The network and computational powers of the smartphone is utilized for surveillance. The energy usage is reduced by activating the camera only when the movement detected by the infrared sensor. A real-time notification feature notifies the user about the intrusion through SMS.

VI FUTURE WORK

For the next research work, the implementation of the prototype can be modified in the authentication. The authentication can be integrated by voice user recognizer. So, the security of the door automation system will be more unique and more interactive.

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