Home Automation Based on Android Application

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Abstract – Android based E-home is an application of embedded system which integrates Android operating system, Arduino controller and GSM for the implementation of Smart Home. Any Android device can act as a transmitting device. The user can control any appliance through a user friendly mobile application built in Android platform. A unique code for controlling each appliance installed with the system is assigned in the program and it is transmitted from the Android phone to the CPU installed in receiver, through the application, as Text messages. The GSM receiver in the CPU receives the text messages from the transmitting device and transfers it to the controller. The Controller decodes the message based on the decoding algorithm stated in the program and based on the command from the user, the controller sends signals to the switching circuitry. The Switching circuitry is the device which is in direct contact with the home appliances through wires and it controls the devices connected to it. Thus, by controlling the Switching circuitry, it is possible to control the various devices. Backward communication is also enabled when an event occurs in the mechanical switch. In this case, the GSM shield acts as a transmitter and sends a message to the user. Thus , 'Android based E-Home' provides a cost efficient, long range solution for the implementation of a smart home using less complex circuits and also provides an user friendly environment through the android app. There is no need for an extra hardware as the Android smart phone itself acts as a transmitter which in turn contributes to the cost efficiency, ease of access and efficient operation of the system.

Index Terms – Global system for mobile communication, arduino controller, automation, security.

1. INTRODUCTION

Smart homes are becoming more popular, every day a new home appliance can be controlled digitally. New wireless technologies also help the integration of remote controls into regular mobile devices so that users can control all the different appliances using a single device. Ease of access and use, is the main purpose of many remote controllers we now use for our devices. Many devices are already being remote controlled but individually. Now that every single part of our homes can be controlled remotely, we must think of a single remote control for all of the possible actions we want to take in the house.

Smart Home is not a new term for science society but is still far more away from people's vision and audition. This is because the design and implementation of smart home is not so User-friendly and cost efficient. With the development of low cost electronic components home automation migrated from being an industrial application to home automation. The home automation, our point of concern deals with the control of home appliances from a central location. Market researches claim that most of the homes will be equipped with home automation systems in the very near future.

2. RELATED WORKS

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.

Chao-Lin Wu, Chun-Feng Liao, and Li-Chen Fu, in 2007 proposed aService-Oriented Smart-Home Architecture Based on OSGi and Mobile-Agent Technology [1](IEEE transactions on systems, man, and cybernetics—part c: applications and reviews, vol. 37, no. 2, march 2007) to deal the dynamic environment based on service-oriented architecture.The architecture of a conventional smart home is usually server-centric and thus causes many problems. Mobile devices and dynamic services affect a dynamically changing environment,which can result in very difficult interaction. In addition, how to provide services efficiently and appropriately is always an important issue for a smart home. To solve the problems caused by traditional architectures, to deal with the dynamic environment, and to provide appropriate services, we propose a service-orientedarchitecture (SOA) for smart-home environments, based on Open Services Gateway Initiative (OSGi) and mobile-agent (MA) technology. This architecture is a peer-to-peer (P2P) model based on multiple OSGi platforms, in which service-oriented mechanisms are used for system components to interact with one another,and MA technology is applied to augment the interaction mechanisms.

Khusvinder Gill, Shuang-Hua Yang, Fang Yao, and Xin Lu,in May 2009, proposed A ZigBee Based Home Automation System[2] (IEEE Transactions on Consumer Electronics, Vol. 55, No. 2, MAY 2009), which enabled Accessing of homeappliances within a particular range. The journal proposes the idea of using a mobile application to control home appliances.This technology offers new and exciting opportunities to increase the connectivity of devices within the home for the purpose of home automation. Moreover, with the

rapid expansion of the Internet, there is the added potential for the remote control and monitoring of such network enabled devices. However, the adoption of home automation systems has been slow. This paper identifies the reasons for this slow adoption and evaluates the potential of ZigBee for addressing these problems through the design and implementation of a flexible home automation architecture. A ZigBee based home automation system and Wi-Fi network are integrated through a common home gateway. The home gateway provides network interoperability, a simple and flexible user interface, and remote access to the system. A dedicated virtual home is implemented to cater for the system's security and safety needs. To demonstrate the feasibility and effectiveness of the proposed system, four devices, a light switch, radiator valve, safety sensor and ZigBee remote control have been developed and evaluated with the home automation system.

Amir Rajabzadeh, Ali Reza Manashty, and Zahra Forootan Jahromi, in 2010, published a Journal named 'A Mobile Application for Smart HouseRemote Control System'[3].In this paper they have presented an overview of the Smart House subsystems necessary for controlling the house using a mobile application efficiently and securely. The sequence diagram of the mobile application connecting to the server application is presented. The challenges faced in designing the mobile application and illustrating the updated house top plane view in that application, are discussed and solutions are adapted for it. Finally the designed mobile application was implemented and the important sections of it were described, such as the interactive house top view map which indicates the status of the devices using predefined icons. The facilities to manage the scheduled tasks and defined rules are also implemented in this mobile application that was developed for use in Windows Mobile platform. This application has the capability of connecting to the main server using GPRS mobile internet and SMS. This system is expected to be an important step towards a unified system structure that can be used efficiently in near future regular houses. They have finally explained the design of the mobile application and the data records needed for transferring the data and home top view plane from the server to mobile application and also the main parts of the implementation of this smart house remote control mobile application in the Windows Mobile platform.

Rita Yi Man Li, in 2013,in her journal on 'The usage of Automation System in Smart Home to provide a Sustainable Indoor Environment: A Content Analysis in Web 1.0'[4] (International Journal of Smart Home Vol. 7, No. 4, July, 2013) reviews the advantages of home automation from industry perspective with the help of content analysis. The Conclusion from this paper is as follows: The global climate change forces us to reconsider the important elements inside our home. Recent advances in technologies foster the rapid development of automation devices for smart home users. This paper finds that the major advantages of smart home include comfortable

housing and cost reduction. Energy saving device remain the major elements in smart homes. As compared to Australia, smart home suppliers in Hong Kong mainly focuses on energy saving and have not yet included water management.

Rajeev Piyare, in his journal 'Internet of Things: Ubiquitous Home Control and Monitoring System using Android based Smart Phone'[5] (International Journal of Internet of Things 2013, 2(1): 5-11) introduces the android operating system in the Home automation field. 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. To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug, temperature sensor and current sensor have been integrated with the proposed home control system. Any Android based Smart phone with built in support for Wi-Fi can be used to access and control the devices at home. When a Wi-Fi connection is not available, mobile cellular networks such as 3G or 4G can be used to access the system.

3. PROPOSED MODELLING

Android based E-home is an application of embedded system which integrates Android operating system, Arduino controller and GSM for the implementation of Smart Home. Any Android device can act as a transmitting device. The user can control any appliance through an user friendly mobile application exclusively made for this purpose. A unique code for controlling the appliances is transmitted to the Central Processing Unit (CPU) installed in one's home, through the application, as Text messages. Based on the command from the user, the controller sends signals to the switching module, which in turn, controls the devices connected to it.
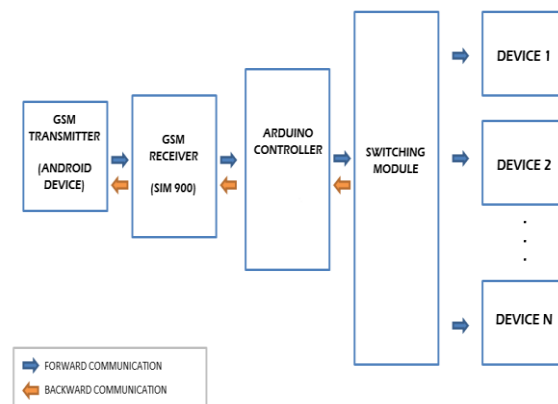

Fig 1: Block diagram of the Proposed Method

Android Os:

The Android operating system (OS) is widely used within several types of embedded & mobile platforms, including mobile phones and tablets, and the industry is exploring the ability of Android within other embedded platforms

The Android OS is an operating system primarily designed for mobile platforms by Google. It is an open source OS based on LINUX kernel (version 2.6) that enables developers to write applications primarily in Java with support for C/C++ as well. Android is finding widespread acceptance in the mobile and portable computing market, and this study examines, form the first time, its performance & reliability in more demanding embedded real-time applications. OS have developed a lot in last 15 years. Starting from black and white phones to recent smartphones or mini computers, mobile OS has come far away. One of the most widely used mobile OS these days is android.

Android does a software bunch comprise not only operating system but also middleware and key applications. After original release there have been number of updates in the original version of Android. It is the software stack of mobile devices. Android SDK provides the API's that is necessary to begin developing applications on the Android platform using the Java programming language. Android includes an embeddable browser built upon Web Kit. It uses a permission based model to limit the behavior of an application. An application declares the permissions that it requests in its AndroidManifest.xml file. The user is presented with the list of permissions that an application requests when the application is to be installed. The user gets to make the choice whether or not to install the application based on the list of permissions it requires. The user cannot selectively allow or disallow individual permissions since installation is done on an all or nothing basis. Once an application is installed, the permissions that it has remains static.

4. RESULT AND DISCUSSIONS

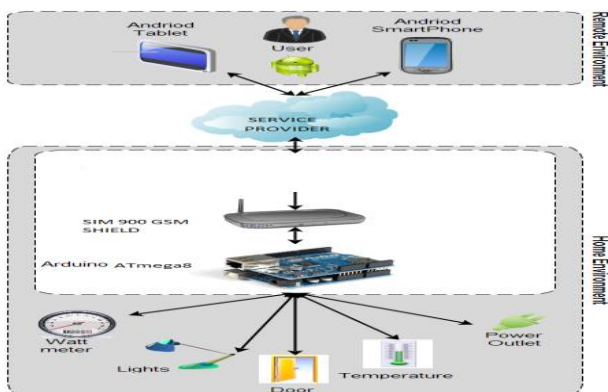**Working Of The Proposed Method:**

Fig 2: working of the proposed method

The proposed method consist of forward communication and backward communication. The android application is the key for forward communication.
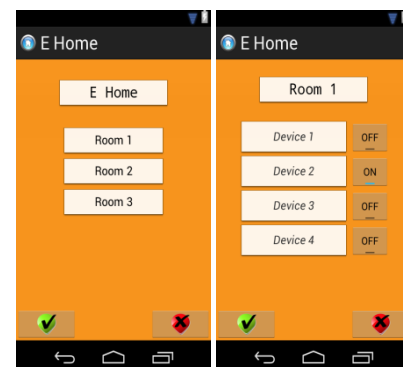
Forward Communication:

The working of the proposed method begins with the Transmitter side of the system. In the Transmitter section, an Android device is used as the Transmitter. The device is installed with the application designed to control the CPU of the system. The User should log in with his password and can command CPU to switch ON or Switch OFF any device connected to it, by interacting with the various widgets provided in the application. Pressing (Touching) a button, is the most common way of getting a command. The Command from the User is sent to the CPU as text messages. The working of the system proceeds further in the CPU.

The Hardware Components used in the CPU are

- SIM 900 GSM Shield
- Arduino ATmega8 Controller
- Switching Circuitary.

The SIM 900 GSM Shield is used as a static GSM transceiver, which can send text messages to the user based on the current status of the installed devices and receive text messages from the user. Thus, two way communications is enabled. SIM 900 is configured to receive messages from the authorised user and to make the received message available at its output port using AT commands. A Unique code for switching ON and switching OFF of a particular device is assigned in the program code of the Arduino ATmega8 Controller.

When the GSM shield receives a text message from the user, it decodes the message and outputs a corresponding signal to the 'Arduino ATmega8 Controller'. This Controller reads the message and sends appropriate control signals to the switching circuitry, which is connected to the output port of the controller. The Control signals from the controller drives the Switching Circuitry which switches ON or switches OFF the corresponding device. Thus, the forward communication is established.

Backward Communication:

The Backward communication occurs when an event occurs in the mechanical switch. The ON and OFF condition of a device is illustrated using binary codes. When a device is switched ON using the mechanical switch, the Arduino controller drives the GSM shield to send a message to the user's mobile. This message is used to update the status of the devices in the Android app**.** Thus the backward communication is established.
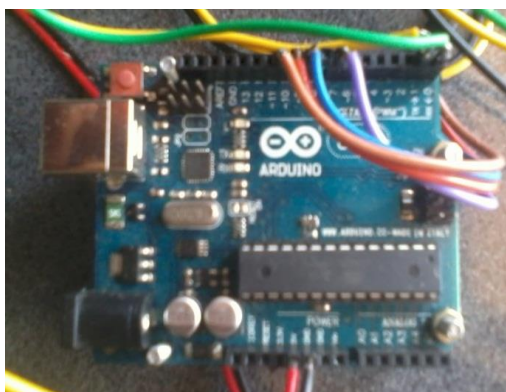

Fig 3: Top view of a model Home.

A User-friendly application serves the purpose of sending unique codes to the GSM Shield. In case of backward communication, the application gets updated. Thus it provides a user-friendly environment.

Cpu Of E-Home:
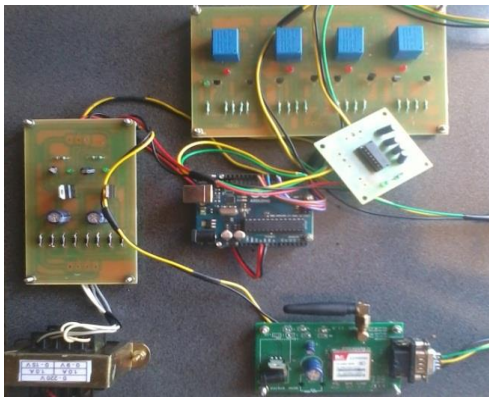
Arduino Uno Controller:

5. CONCLUSION

Thus , 'Android based E-Home' provides a cost efficient, long range solution for the implementation of a smart home using less complex circuits and also provides an user friendly environment through the android app. Since, Android is the most widely used smart phone OS as 70% of the world's smart phones uses it, there is no need for an extra hardware as the Android smart phone itself acts as a transmitter which in turn contributes to the cost efficiency, ease of access and efficient operation of the system.

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