Research Article
Wireless USB Home Security System using Internet Technology

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Abstract: Home security is major problem nowadays due to rapid change in living styles. In this study a Home Security System is proposed which is based on Wireless USB network and Internet technology. In addition, Central Home Servers Control (CHSC) which performs the control operations of the whole system. The functionality of the system can be accomplished by developing the proposed algorithm, which will manage and control the basic operations. By making this system, owner of the house can be informed about the intruder while he/she is away by sending a text message on his cellular phone.

Keywords: Home security system, internet, wireless USB

INTRODUCTION

Due to increase in technological advancements and Internet usage it is considered that people make use of these technologies to control and automate their home appliances (Nunes and Delgado, 2000; Takabayashi *et al*., 2002). In Regard to this, Home security system is one approach; it is constructed in case of evolving mishaps such as fire, leakage of gas or detection of an intruder. Existing systems have some drawbacks in the sense that those systems do not inform immediately about the scene of crime when the owner is not at home. Although many wired and wireless network technologies have evolved which include wireless LAN (802.11), USB (Universal Serial Bus) (Axelson, 2005), Bluetooth, Ethernet (802.3), PLC (power line communication) etc., (Kim and Lee, 2007). USB offers several advantages like low cost, auto-configuration and plug and play facility (Hsu *et al*., 2009). In contrast to the advantages, it has certain flaws like low speed and short lengths but most of these issues have been resolved by the introduction of wireless USB device which is one of the advancements in USB technology.

This study makes use of a Wireless USB to propose a home security system. Due to the wide spread usage of cellular phones and computers it is easier to construct a system that makes use of these devices. In case of invasion, the user of the house can be immediately informed by sending a text message on his cell phone when he is far away from his home. The general idea was taken from Kim and Lee (2007) in which security issue is being dealt by OSGi Service platform and its implementation was done in home security system, in which an algorithm was developed to make the system functional. The proposed system also makes use of wireless USB technology and home security system is taken as an application, in which different algorithms are used to apply checks on multiple entrances to enhance the security. We also use GPRS devices to enhance the efficiency of the designed system. Further details are presented in later section.

EXISTING TECHNIQUES ARCHITECTURES

Several contributors presented their architectures in the area of smart home security system as USB-Based Home Control System Using OSGi (Kim and Lee, 2006). The architecture of this technique for home security system consists of embedded home server which is further connected to USB host which manages and controls the USB. A PCMCIA interface which is connected to a CDMA module and finally an Ethernet device that provides remote access through the internet (Kim and Lee, 2006). The architecture is clearly depicted in the Fig. 1.

Similarly another architecture is Wireless USB-Based Home Security System on the OSGi Service Platform (Kim and Lee, 2007). The architecture presented for home security system in Kim and Lee (2007) has used Wireless USB for the implementation of the system. In this system, a USB hub and Ethernet device is used which controls WUSB home control and provides remote access respectively. USB hub and Ethernet device have connection with the embedded home server. This scenario is shown in the following Fig. 2.

The existing techniques of home security system using USB or Wireless USB at OSGi platform has

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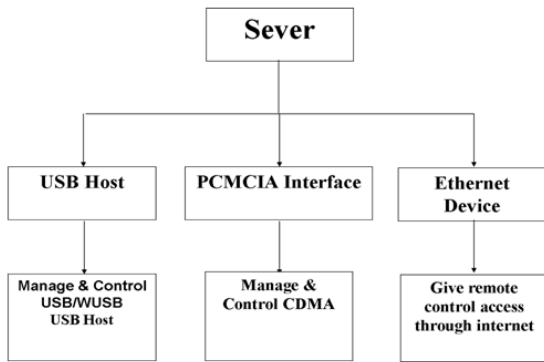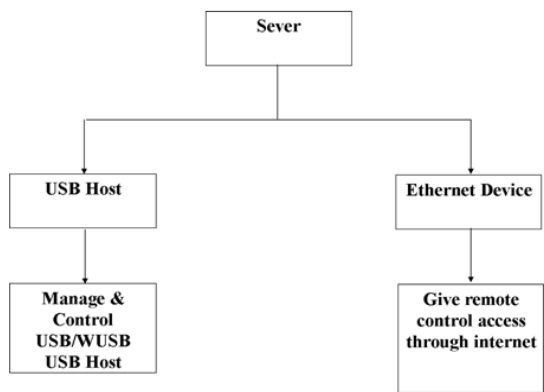
Fig. 1: OSGi architecture

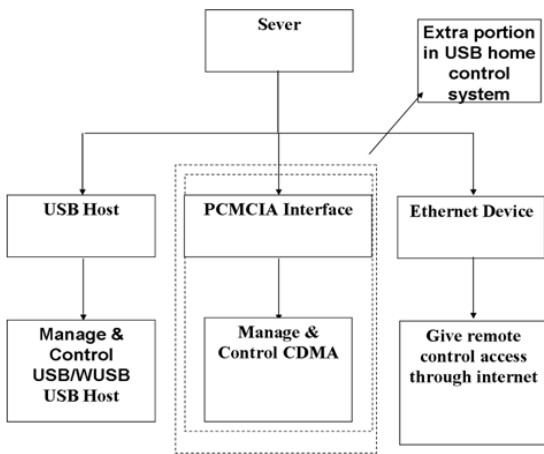Fig. 2: Wireless USB-based control system using OSGi platform architecture

Fig. 3: USB-based home and wireless USB-based control system using OSGi architecture

almost the same architecture, the difference is that USB OSGi platform has PCMCIA interface and manager (controller) of CDMA in addition to other features. The differences of both techniques are graphically represented in Fig. 3.

The reasons for developing a new system was that the previous techniques only secured the single house

and another drawback was that if the user mobile did not respond, the message could not be delivered. In order to overcome these drawbacks a new idea of having the central authority is introduced and a dynamic algorithm is developed that will perform services efficiently.

Like above mentioned architectures related to our system also many other methods has been proposed such as Hsu *et al*. (2009) proposes architecture for proposed home security as well as commercial-security system using phone-net and blue tooth mechanism. Zhao and Ye (2008) proposed GSM/GPRS based wireless home security system and also claimed wireless protocol can be used for communicate with other home appliances. Similarly, in Ishiguro and Huang (2011) proposed same system based on wireless communication technology such as Bluetooth, mobile and wireless sensors.

PROPOSED SYSTEM

The complete scenario of proposed system is presented in Fig. 4 where the main control is located at Central Home Servers Control (CHSC). This CHSC will also be implemented at the nearest police station. This central server is responsible for delivering the text message to remote mobile and taking an action in case user mobile did not respond previously.

The main component of this system is an embedded home server which has connection with a Wireless USB host and GPRS device. The Wireless USB host manages and controls the Wireless USB device connected at various locations i.e., on Windows and Doors. The Wireless USB host has high speed transmission and auto configuration. The GPRS device will manage and provide the remote access and will also help in transferring the interrupt on to the CHSC and it guarantees that the CHSC receives interrupt from Embed Server through GPRS device within 2 sec. Graphically it can be depicted as in Fig. 5.

In this system first of all session is developed by connecting the USB devices through the USB host to the Embedded home server. As the connection is established automatically, the authentication process starts, in which number of Wireless USB devices are detected automatically and numbers are assigned, initially the value set to 0, but once they are connected the value is changed to 1, at the same time authentication table is also updated by setting the set address value of USB to 0 when authenticated and vice versa. As long as the Wireless USB devices are connected the value of their sum must be equal to total numbers of Wireless USBs, error will be generated if one of the USB is not connected to the embedded home server. Once the authentication session is completed, the system starts working in real time. The complete procedure of the system will be explained later in the section. Graphical representation is depicted in Fig. 6.
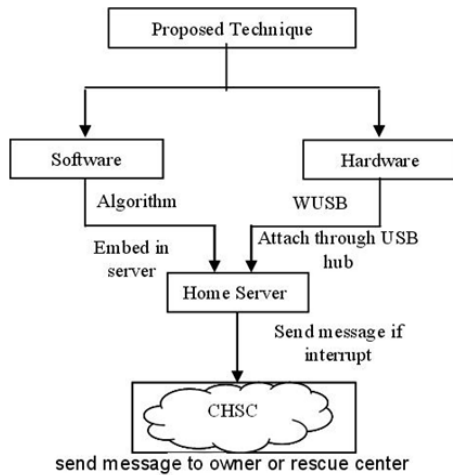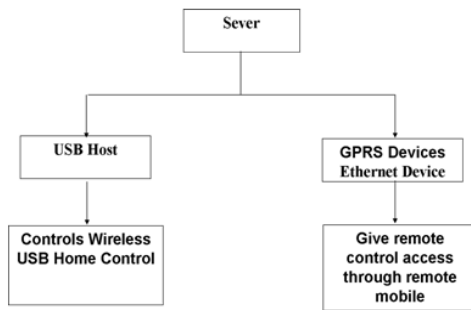
Fig. 4: Brief overview of the home security system
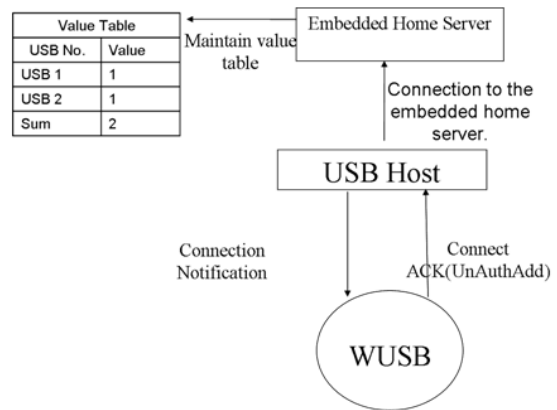

Fig. 5: Hardware architecture of the system

Fig. 6: Software architecture of the system and authentication process

FUNCTIONALITIES OF CHSC AND IMPLEMENTATION SCENARIOS

The Central Home Servers Control (CHSC) maintains the database of all the houses by dividing the area in different zones. Each message that arises from a particular house has an associated zone number which helps the central server to determine the exact location.

Figure 7 demonstrates the proposed security system for homes with fixed door and window lock. This constitutes of two WUSB which will be connected to the USB host, GPRS device will manage and control the functionality of sending message to CHSC. Both of
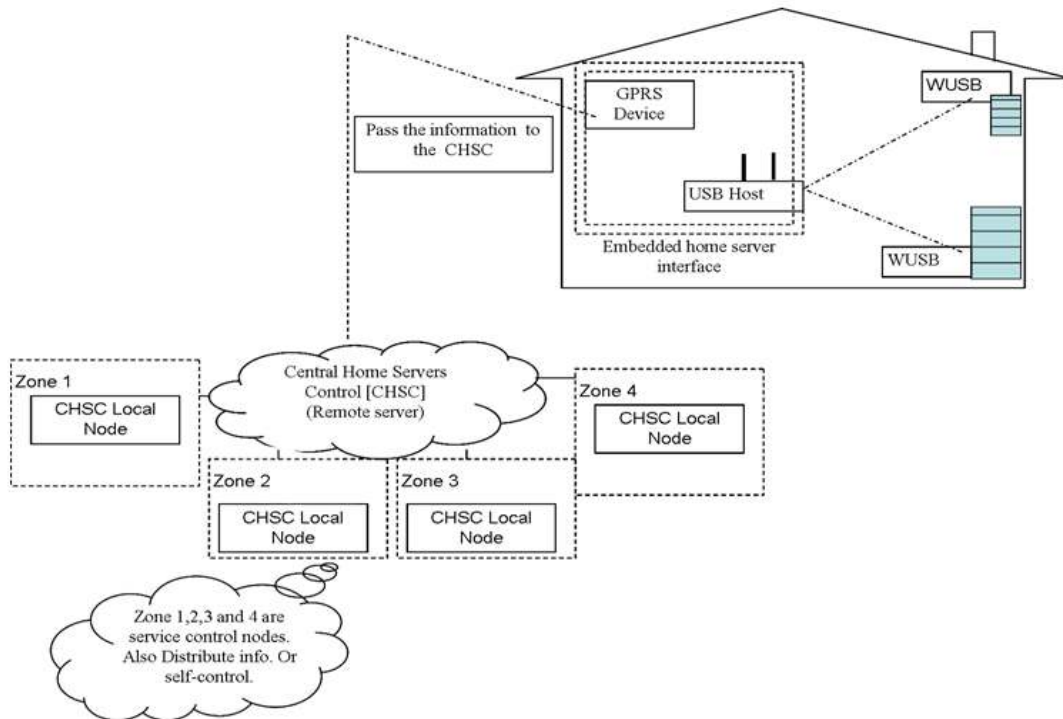

Fig. 7: Demonstration of proposed system

Table 1: Packet performance

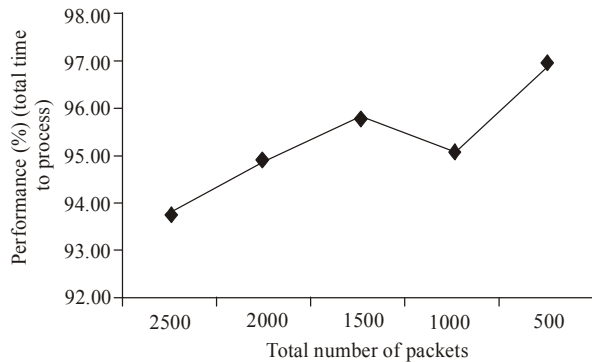| Packets	Bi-direction				Total performance (%)
	Z1	Z2	Z3	Z4	
2500	2325	2336	2319	2397	93.77
2000	1902	1891	1910	1892	94.94
1500	1448	1442	1389	1468	95.78
1000	970	973	906	956	95.13
500	488	471	493	487	96.95

Fig. 8: Packet performance

these are connected to the embedded home server. The algorithm updates the table as soon as the connections occur, the values of connected USB's are maintained in a table; as long as they are connected their aggregate sum must be equal to the total number of USB's. In case of any detachment among any of the USB's, the table is updated and when it finds that the total sum is less than the sum it should have, then at this stage the status of system will be sent on the CHSC via GPRS device. The CHSC is divided into different zones, when the interrupt arises it has zone number associated with it, which prevents the system from overloading. According to that zone the whole process will continue i.e., if the message is failed to deliver to the user mobile the CHSC will handle the remaining procedure itself and in this way the owner of the house can be informed about the intrusion.

IMPLEMENTATION AND RESULTS

In order to evaluate the proposed system we have implemented it into local area networks and monitor the bottleneck problem during transmission of messages. In this regards, we have generated data through Wireless USB's according to above mentioned framework and saved it into the text files. There are 100 different files that contain 25 messages (known as packet) in each file with different scenarios. Each packet has the following information zone number, message, home info and time. Table 1 shows zone wise packets and their total performance and internal structure of the packet is depicted in Fig. 8:

$$Total\ performance = \frac{\sum_1^n Z}{P_n \times 4} \qquad (1)$$

CONCLUSION

We have successfully tested the devices namely, gas valve controller and digital door lock. In order to control and manage these devices, two Wireless USBs are used. The owner of the system can verify the status of devices by sending SMS via Mobile. In this study Wireless USB is used to implement and test a home security system. The uniqueness of the proposed technique is that it uses the GPRS devices and the algorithms that are used in communicating with the Central Home Server Control (CHSC) that send the message to the owner of the home and also if the owner of the mobile is not responding at that time then CHSC takes an action. Also we divided the zones for reducing the time to efficiently process the information and send the message to the owner of mobile or control the situation.

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