

Home Video Surveillance and Security Sensors with Mobile Application

Sheila Mae S. Gomez', Bobby D. Gerardo', Joel T. De Castro',
Ma. Beth S. Concepcion', Cyreneo S. Dofitas', Yung-Cheol Byun²

¹ Institute of ICT, West Visayas State University, Luna St., La Paz, Iloilo City, Philippines
bgerardo@wvsu.edu.ph

² Telecommunications and Computer Eng., Cheju National University, Jeju City, Korea

Abstract. Crime is a significant concern in urban areas of the Philippines. There is a great importance of security surveillance system installed in one's homes or offices. Security and surveillance technology issues are very crucial to give a person relaxed freedom in his surroundings, a peace of mind and a feeling of security against crime incidents. This study aimed to develop a home security system using sensors and video surveillance that can send reports to a mobile phone. In the case of motion detection, the comparison of two frames was used to detect motion. The security sensors further aimed to detect early unusual smoke and temperature that may lead to fire and sudden temperature change. The surveillance camera connected to the computer monitored the incident and which would directly send a warning message to a mobile phone.

1 Introduction

Today, home security system manufacturers and alarm monitoring services offer a variety of ways for one to monitor his home's security system even when he's away from his home on vacation or simply away because of work. Modern alarm systems can notify of changes in the alarm system status by paging the owner or even calling him on his cellular phone. While these innovations are certainly useful and offer more peace of mind about the security of one's home, they are not the most exciting technologies used in many home security systems. The Internet has made monitoring of one's home security system easier than ever. Many alarm monitoring services now will allow access to one's home security system online. Very advanced alarm systems even allow one to change security codes, lockout security codes and arm or disarm the security system via a web interface. However, there is a new and very popular trend emerging in home security system monitoring - mobile devices and telephones.

With the advances in broadband technology and Web mobile web browsers, mobile devices have become the perfect medium for monitoring a home security system. When used in conjunction with a compatible home security system and an alarm monitoring service that provides Web enabled access service, one can use either his mobile phone or computing device to monitor the status of his home security system.

This study takes into consideration the above mentioned concepts and has the aim of developing a home security system with security sensors and video surveillance

connected to a mobile phone through a mobile application to be used at home to monitor and maximize security levels and prevent crime incidents.

2 Related Studies

In the study of Ijazuddin [1] about Wireless Home Security Architecture Using PDA and Hand Held Devices, he proposed a wireless home security architecture using PDA and hand held devices describe the ease of security while on the go, by using the PDA from anywhere. The system will recognize the user and then connect the user with its server to handle the security devices installed on the station. The client will gain access through a WAP with the server using username and password, and can access the different devices attached with the server. In the proposed paper the main emphases are on security, i.e. locks, lights and camera etc. Statistically the system achieved 93% results with failures of two times and one disconnection error.

In the study about smart home system by Robles et al [5], they develop a smart home or building equipped with special structured wiring to enable occupants to remotely control or program an array of automated home electronic devices by entering a single command. A smart home security system, offers many more benefits. Home automation technology notifies homeowners of any problems, so that they can investigate. For example, a homeowner on vacation can use a Touchtone phone to arm a home security system, control temperature gauges, switch appliances on or off, control lighting, program a home theatre or entertainment system, and perform other tasks.

In the paper Automated Video Surveillance for Monitoring Intrusions Using Intelligent Middleware Based on Neural Network by Pangapalan et al. [4], they presented a Java based system that detects human activities in a security sensitive area and provides alarm for illegal activities identified. The system composes three major processes: Motion Detection, Subject Identification and Behavior Classification. Motion Detection captures image of any movement detected. Subject Identification screens every captured image by classifying whether the motion is made by human and eliminating those which are caused by wind, animals and other non-human entity. Behavior Classification categorizes the image passed as to what action and outputs alarm if it is considered as illegal. The result shows that the system processed video continuously as it classified behavior automatically.

In study on Intelligent Home Security System [2], the researcher develops a real-time security system based on facial feature recognition. The system has a (certain number of) camera(s) mounted at some strategic point(s) in the house toward strategic point(s) (e.g. door, windows, etc.) in a house. If the system detects an intruder, his/her image is then sent to the user by MMS. The system recognizes the people living in the house and automatically get deactivated if one of these people enters the house and activated when all people leave the house. As background knowledge, an intense literature review has been done, mostly in the area of facial feature processing, in the aim to select the best techniques.

3 System Architecture

This proposed study is a home security system connected to a mobile phone. The security system is composed of camera with motion detection program, a temperature and smoke sensor. The mobile phone used is Toshiba Portege G900. The system is supported by a software application developed by the researchers using MS Visual Studio 2008. The database for the recorded videos and logs are stored in MySQL.

The home security system features include motion detection program, smoke sensor and temperature sensor. The motion detection program functions by the use of comparing the difference of two squares. The smoke sensor is triggered by unusual smoke and the temperature sensor is triggered by abrupt change in temperature. When a motion is detected or when the sensors are triggered, it will then send a warning message on the user's mobile number configured in the program. The warning message will then cause the owner to open the live video streaming. The live video streaming is always available and only depends on the user to open it or not. The warning notification message serves only as an indication that a motion is detected or unusual smoke or temperature is detected. It also stores the recorded video upon detection of motion. The server consists of the following: preview window, an arm button, an unarm button, LED lights, video expander, help expander, an exit button and an inside video expander. The arm button allows the system to activate its sensors, and start detecting, as well as to start its live video streaming from a mobile phone feature. The unarm button deactivates the system. LED lights blink to represent that sensors detected motion, smoke or unusual temperature. Videos expander lists the recorded videos which are stored in the computer's hard drive.

The mobile phone is capable of receiving warning notification messages and opening live video stream sent by the server through a mobile application developed. This feature is supported by an application developed for the system. The proposed home security system is composed of a server and client side as shown in Figure 1.

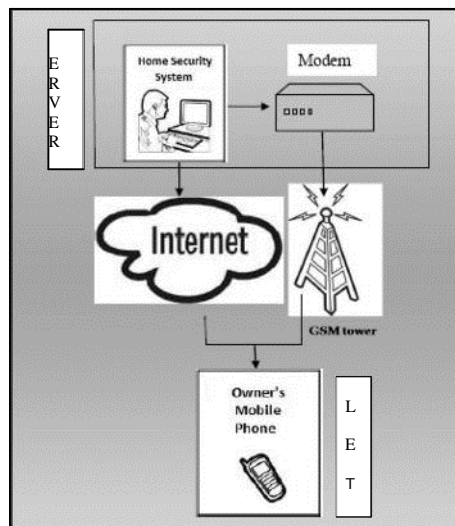


Fig. 1. Architectural Design of the Proposed System

3.1 Server Side

As shown in Figure 2, the server side is composed of a smoke detector and temperature detector connected to a game pad to convert analog to digital signal. A surveillance camera is also connected to the server and a motion detection program detects motion by comparing the difference of frames.

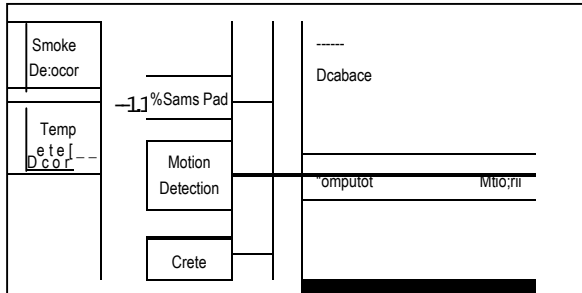


Fig. 2. Architectural Design (Server Side)

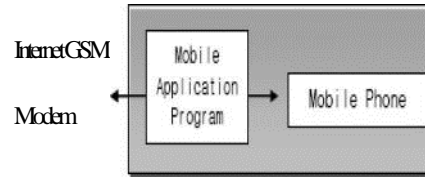


Fig. 3. Architectural (Client Side)

3.2 Client Side

The client side is composed of a mobile application deployed on a mobile phone as shown in Figure 3. When a motion is detected or the sensors are triggered, it will then send a warning message on the user's mobile number configured in the program.

4 Simulation and Results

The system is composed of a motion detection program; a smoke detection sensor; a temperature sensor; a server which the sensors are connected and the programs are embedded; a modem that is connected to the server; a mobile application that is installed in a Windows Mobile Phone that serves the client; a server side program written in C#; a client side program written in C# and designed in Microsoft Visual Studio 2008. As shown on Figure 4, the server side the Home Security System features the system's functionality; the activation of the security system, the video display, smoke detector, motion detector abnormal heat detector, temperature reading, and access to recorded videos stored and help for instructions.

As shown in Figure 5, when the smoke is detected, the smoke detector blinks and shows a red light and displays the video being recorded on the screen. Figure 6 shows the motion detector of the system. When motion is detected, the motion detector blinks and shows a white light and displays the video being recorded on the screen. On the other hand, when there is an abnormal temperature change, the heat detector blinks and shows a green light and displays the video being recorded on the screen. The thermometer shows the temperature reading. The heat sensor of the system is presented in Figure 7.

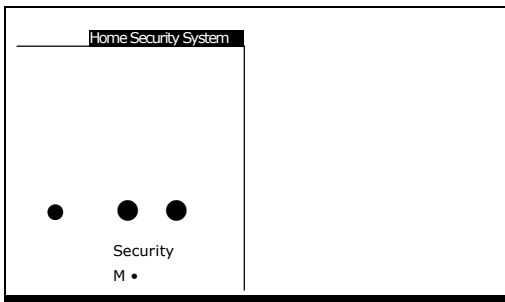


Fig. 6. Motion Detector of the system

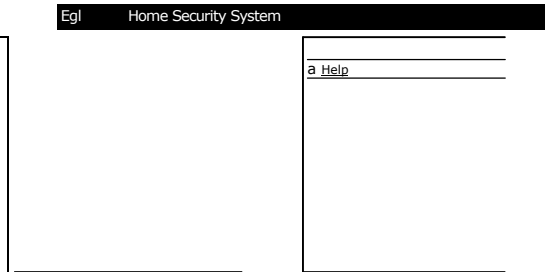
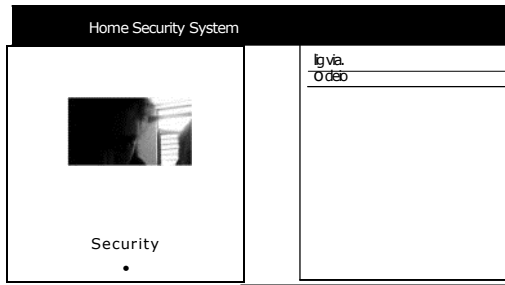
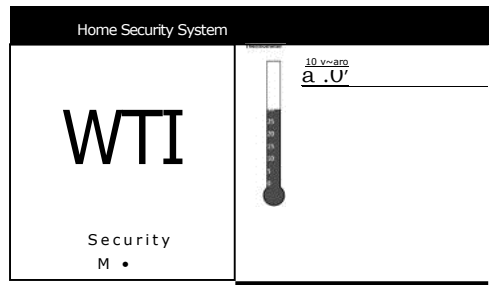


Fig. 4. The Home Security System Interface

Fig. 7. Heat Sensor of the system



If the system detects motion, smoke, and abrupt change in temperature it will then send an SMS message to the client. The client side will then received an SMS notification if what detection had occurred. The said SMS message will be the one that will trigger the user to open the mobile application for him to view exact and live video streaming. The aforementioned functions are presented in Figure 8 and 9 respectively.

1111111111
 +6309079639622
Warning!
Security Status:
An abrupt change in
temperature.
View video.

111&—
 Fig. 8. SMS message received for heat detected



Fig. 9. Mobile Phone views the live video stream.

5 Conclusions and Recommendations

The Home Video Surveillance and Security Sensor was developed to maximize security levels at home. It offers a simple and effective way to monitor our home. The researchers were able to demonstrate an application for home security that involves motion detection, smoke detection, temperature detection, surveillance, storing and sending data. In addition, the system could be able to send SMS message to the client's mobile phone and that triggers the user to view the live streaming video.

In order for a system to be more effective, clear and reliable video recording, a high-resolution camera with a high-pixel count needs to be used. To further improve the efficiency, an exact temperature reading when abrupt change in temperature happens can be included in the text message to be sent as notification to the client.

Moreover, it is recommended to use mobile phones other than Toshiba Protégé G900 wherein mobile application can be developed and deployed.

References

1. Ijazuddin, U. A., : Wireless home security architecture using PDA and hand held devices Retrieved: May 2011, from: http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=4724135 (2008)
2. Kouma, J.P., Intelligent home security system. Retrieved: December, 2010 from: http://www.medialab.tfe.umu.se/publications/master_thesis/2006/intelligent_home_security_system.pdf (2008).
3. Mobile Application. (2008). In mobile applications. Retrieved August, 2011 from: <http://mmaglobal.com/mobileapplications.pdf>
4. Pangapalan, A., Gerardo, B., Byun, Y.C., De Castro, J., Osorio, F.: Automated Video Surveillance for Monitoring Intrusions Using Intelligent Middleware Based on Neural Network. Communications in Computer and Information Science Vol. 226. Springer-Verlag, Berlin Heidelberg New York (2011) 220-228
5. Robles, R. J., & Kim, T., Smart home. Retrieved: March 2011, from: <http://www.sersc.org/journals/IJAST/vol15/2.pdf> (2010)
6. Smoke Detector. (2006). In merriam-webster dictionary. Retrieved: May 2011, from: <http://www.merriam-webster.com/dictionary/smoke%20detector>
7. Temperature Detection Sensor. (2006). In introduction to sensor dynamic. Retrieved: May 2011, from <http://www.facstaff.bucknell.edu/mastascu/elessonshtml/Sensors/SensorDynamicsIntro.html>

Acknowledgements. This research is not possible without the help of the research team composed of Rachel T. Camince, Winona Xylene Joy D. Fajermo, Sasha Lyn L. Sejane, Charmaign Mauren V. Suan and some Faculty of the Institute of Information and Communications Technology of West Visayas State University.