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Web Based Home Security and Automation System

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ABSTRACT

Home security and automation is crucial issue concerned by people. A home security system is needed for convenience and safety. A home automation system is a key to having effective energy efficiency in the house. In this paper, we present the design and implementation of a web-based home security and automation system. This system uses PIR motion sensor to detect intruder in the house. This sensor is further fed to microcontroller which would help the GSM module to send notification to house owner regarding the intrusion. On the other hand, the LDR light sensor is used to provide auto-light functionality which will turn on the light at night and dim it at day time. A web-based system function as a remote control system for user to monitor controls the sensors and lights at home in order to save energy consumption. This system is accessible by user anytime and anywhere as long there is an Internet connection.

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1. INTRODUCTION

During this fast pace of technology development, there are many technologies can be used to secure the home. One of the technologies is using microcontroller based home security system [1]. It is built to monitor the doors and windows of a house. It will trigger an alarm to send warning signal to nearest police station when persons tried to break into the house.

According to [2] existing system for security are passive and costly. They developed a web based home security system can be used to detect intruder, fire and smoke at home. The aims of their project to provide security in such a way that user can monitor his home and at the same time can control for any bad situations occurring at home. Using this system, one can manage his home safely from remote places.

Work in [3] presents the design and implementation of a GSM based wireless home security system which take a very less power. The system is a wireless home network which contains a GSM modem and magnet with relay which are door security nodes. The system can response rapidly as intruder detect and GSM module will do alert home owner. Suspected activities are conveyed to remote user through SMS or Call using GSM technology.

Nowadays, most of the people are the smartphone users. This cause the technology of home security system look towards to android based. The android based home security system help users to control their home appliance by just touch a button on their smartphone. They can control their home appliance at everywhere with access to the internet. It also uses to inform the house owners in a remote location about any home intrusion or attempt to intrude the house [4].

In this paper, the home security system provides Passive Infrared Sensor (PIR) motion detector and light detector to users. Any motion detected by the PIR sensor in the home will notify the users via SMS and at the same time will trigger the buzzer in the remote home making others aware of the possible intrusion. On

the other hand, the Light Dependent Resistor (LDR) light detector sensor is used to detect the presence and absence of light. The lamp will light up automatically at night and dim at day time. In additon, web based system allows users to choose which light to be turned off when it is unused. By using auto-light system, the energy consumption can be gradually reduced. In summarize, the web based home security system is developed to allows users to know the status of their home by accessing to the internet although users are not at home.

The main advantage of developing web based instead of android apps is it allows users of any mobile device such as iPhone and BlackBerry to access the website and use it immediately [5]. Besides that, it only needs one person or a team to maintain the single code base. This enables all users across all platforms access and use the system.

2. RESEARCH METHOD

This project involves the implementation of software and hardware. Three modules have been carried out in this project, which include authentication module, home security module and GSM module.

2.1. Authentication Module

Figure 1 shows the flow chart of the system's authentication module. For the first time login, users may access to the system by using the default password provided, which is 12345. Then, users are required to change to a new password, in order to prevent unauthorized person from accessing to the system. Once the password is changed, they need to login again to verify their identity.

When entering the main page, the system would requests user to enter the IP address of the system before they can start to configure the sensors and lights, as illustrated in Figure 2. This method has provided one more protection layer to the system [4]. Therefore, only authorized person, who inserted the correct IP address of the system implemented at their home, can access to the configuration page.

The GUI was created using Adobe Dreamweaver. The Apache and MySQL in XAMPP server act as a web server and database system. The data of username and password was kept in MySQL database. This system limit to only 1 user account per house. After successfully login to the system, user can start to configure the motion sensor, light sensor and lights in the house.

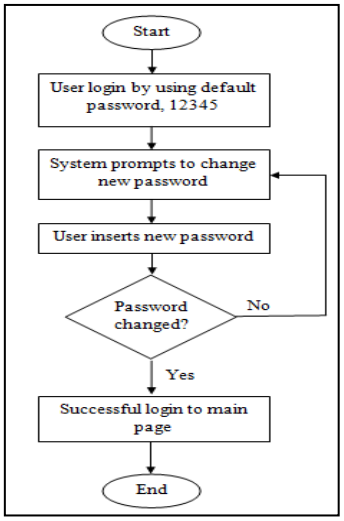

Figure 1. Flowchart of authentication module

Figure 2. Main page of the system

2.2. Home Security Module

Figure 3 illustrates the overall home security system in this project. In this system, Arduino Uno board with Ethernet shield is used as the main controller for all devices and components. The control program, which was embedded into the Atmega328 microcontroller on the Arduino Uno board [9], was developed in Arduino IDE software by using the Arduino programming language, which is a language based on C++ language. Meanwhile, the Arduino Ethernet shield [10] is the interface which connects the Arduino Uno to the Internet, thus make it possible to be controlled by users remotely.

The Arduino Uno board is connected to several sensors and components, such as a PIR motion sensor, LDR sensors and also buzzer. PIR motion sensor is used in this system for motion detection inside the house, whereas the LDR sensors are responsible in detecting the presence and the intensity of light [1]. A buzzer, which function is to emit the sound, is used to scare off the intruders, besides alerting the neighbourhood. Besides, a GSM module is also connected to the Arduino Uno, thus allowing the latter to send and to receive SMS messages from mobile phones.

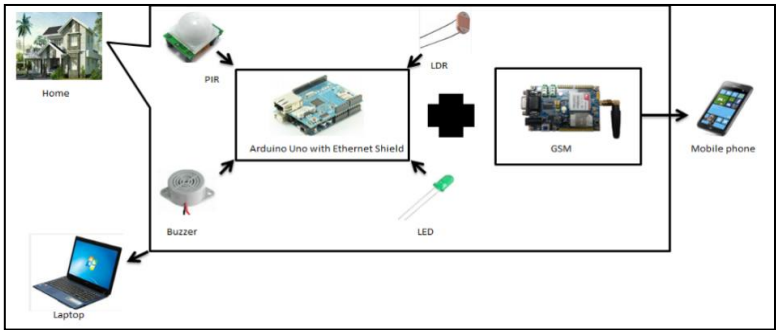

Figure 3. Overall home security and automation system

2.3. Notification Module

A notification module is required in this system, in order to send SMS messages to users, alerting them regarding the detected motion inside their home [6, 7, 8]. The GSM module is chosen as the communication medium, since it doesn't have any limitation on the communication range, thus SMS can be successfully sent to the recipients, even if they are fare away from home. In the proposed system, it is initialized to send and receive mode. At first, Arduino sends the AT commands to GSM module repeatedly, until the latter reply an acknowledgement to the former. After that, it waits for inputs from the PIR motion sensors. Once it detects movement inside the house, the warning light would light up and the GSM module will initiate a warning SMS message, which will be sent to users' mobile phones. The process is illustrated in Figure 4.

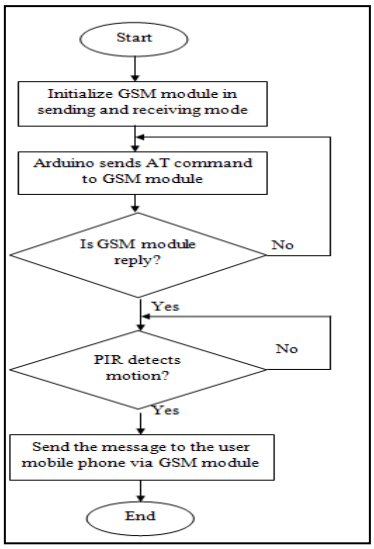

Figure 4. Flow chart of Notification module

3. RESULTS AND ANALYSIS

The system was constructed as shown in Figure 5, where the Arduino Uno with Ethernet Shield, GSM module and sensors were attached and connected together, and implemented to a home prototype. A series of tests were conducted in order to validate the functionality of the proposed system.

Figure 5. Side view of home prototype

As can be observed in Figure 6, the warning light is lighten up and the buzzer is triggered, once the PIR sensor detects inside the house. Furthermore, users also receive messages on their mobile phones, sent from the GSM module regarding detected motion at their home, thus they can take immediate actions, as can be seen in Figure 7.

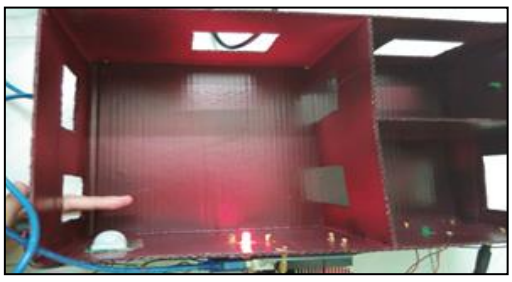

Figure 6. Warning light turn on when detect movement

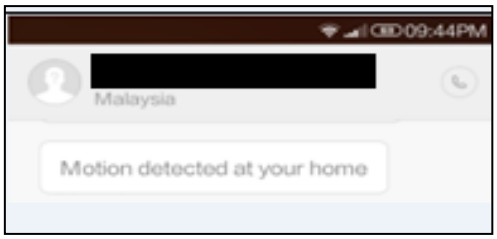

Figure 7. Warning message received by users

Figure 8 shows the configuration page of the home security system for activation or deactivation of the sensors. On one hand, users can remotely choose which lights (represented by LEDs) to be turned on or off as they desired. Therefore, users can choose to turn off the LEDs remotely if the light not necessary, thus reducing the energy consumption.

On the other hand, the LDR sensor can be activated in order to detect the light intensity inside the house. This feature contributes to another application, which is the auto-light control system, where the lights or the LEDs can be automatically turned on in the darkness, or turned off during daylight, as pictured in Figure 9. For this purpose, a specific value of LDR reading is set as the threshold value, thus any read value which is below than the threshold value, can be considered as dark and the light will be turned on.

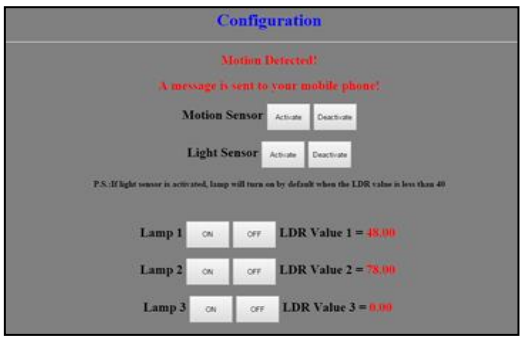

Figure 8. Configuration page

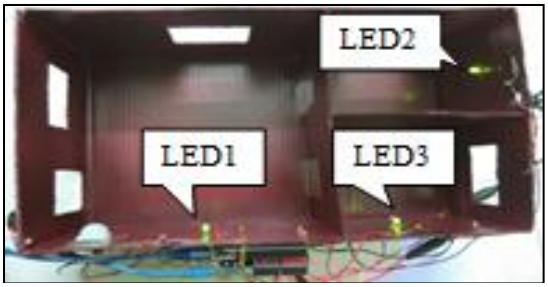

Figure 9. LEDs light up when value of light intensity less than 40

4. CONCLUSION

In conclusion, implementation of web based home security system can enhance the home security. Besides that, it also brought convenient to users by providing auto-light system and configure which light to be turned ON. The energy consumption can be reduced gradually. This project also enable users to access to the system anytime and anywhere when there was internet connection.

This home security system can be improved by using another motion detector to avoid mistriggerring the buzzer when there have a pet pass by. This is because PIR sensor does not know how to differentiate the movement of human and animal. In addition, this project can also be improved by making

the home become even smarter, which mean installing temperature sensor, webcam, and also face recognition system before entering home.

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BIOGRAPHIES OF AUTHORS

Norfadzlia Mohd Yusof received his MSc in the area of Computer Science in 2014 and BSc of Computer (Software Engineering) from Universiti Teknologi Malaysia. She has 5 years working experience in software house and research and development organization before joining Universiti Teknikal Malaysia Melaka (UTeM) as lecturer and researcher, Her research interest include sensor and wireless system, artificial intelligence, computational intelligence and semantic technologies.

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Lim Mei Sze studied her Bachelor of Computer Engineering Technology (Computer Systems) with Honours from Universiti Teknikal Malaysia Melaka in 2012. Currently, she undergo her 6 months intership at Intel Microelectronics (M) Sdn. Bhd. Her job scope at Intel is running integration and simulation tests using FPGA. Besides that, she has also help to debug the test errors and develop automated script to ease the effort on integration testing.