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Четврта меѓународна научна конференција „ Науката - подршка на развојот во Југоисточна Европа “

Скопје 23-24 декември 2016

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П Р Е Д Г О В О Р

Позади нас е уште една конференција „Науката-подршка на развојот во Југоисточна Европа одржана од 23 до 24 декември 2016 година во Скопје, Конференцијата е со наслов Науката – подршка на развојот во Југоисточна Европа.

Пред четири години за прв пат ја организиравме оваа конференција со цел студентите од вториот и третиот циклус на студии да се оспособат за пишување и презентирање научно-стручни трудови, а останатите учесници да ги пренесат своите најнови истражувања во посочените области.

Програмскиот одбор и реценентскиот тим изврши селекција и овде се презентирани само прифатените трудови. Пред Вас се 13 квалитетни трудови презентирани во 4 секции

За следната конференција ќе се потрудиме да имаме поголем број на трудови и секако трудовите да бидат поквалитетни.

Проф. Д-р Сашо Гелев

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SMS SECURITY SYSTEM FOR SMART HOME DETECTORS

Abstract: *Security has always been an important problem everywhere. Home security has been a major issue where crime is increasing and everybody wants home security to protect the home. Safety from theft and flame are the most important requirements of a home security system for people. A remote home security system offers many benefits from keeping homeowners, and their property safe.*

This paper present controlling of the home security system remotely from Android Application. Owners can turn on or off the security system and provide security when the owner is away from the place. The system is SMS based and uses cloud and wireless technology, sensors, and Arduino Uno microcontroller.

The system sends SMS to the desired number to take necessary actions. When the secure system is activated from Android Application the microcontroller can detect the theft and flame, and send alarm SMS remotely. SMS will come to the owners in seconds after the motion or flame is detected. This paper presents the design and implementation of a low-cost secure system for the smart home.

Keywords: *Android App, Arduino Uno, Cloud Computing Services, ESP8266, Flame Detector, Motion Detector, Short Message Service (SMS).*

1. Introduction

Safety is the most important requirement for people. Practically, safety always begins from home[1]. With the development of IT technology, network, and automatic control technology, a remote home security monitoring and alarming system become more and more practicable today. Home security has been a major issue where crime is increasing and everybody wants to take proper measures to prevent intrusion. The homeowners need to be informed instantly in case of emergency[2]. According to the research, the common parameters or characteristics of the home security system are 24 hours monitoring of the intruder, ease of use, reliability, efficient, fast and precise notification system[3],[4],[5].

Mobile phones today are not just used to make calls. The use of mobile phones is changing with the development of technology and they can be used for different purposes. They can be used as clocks, applications, calendars or controllers instead of being used just as phones.

Cloud computing has recently emerged as a new paradigm for hosting and delivering the services over the Internet. It is an enhanced version of the client-server application.

The wireless security system became popular nowadays. For this project, implementation of wireless security system is adopted. This paper presents an analysis and implementation of efficient and intelligent home security system by a low-cost Short Message System (SMS). Security system gets feedback from sensors (motion and flame detectors). Also, system mostly focuses on the security of a home when the user is away from the place.

2. Literature Review

For this project, some researchers have been investigated to understand the concept and purpose of alert using mobile (SMS notification), programming language, protocol language, and existing system that related to this project.

Ciubotaru-Petrescu, Chiciudean, Cioarga, and Stanescu [6] present a design and implementation of SMS-based control for monitoring systems. The paper has three modules involving sensing unit for monitoring the complex applications. A processing unit that is a microcontroller and a communication module that uses GPRS modem or cell phone via serial port RS-232. The SMS is used for status reporting such as power failure.

Alheraish [7] implemented home security system by means of GSM cellular communication network using microcontroller 89X52 and Sony Ericsson GM-47 GSM module. This system enables far end user through SMS facility to monitor the state of the home door, provide password facility for key based door lock and control home lighting system.

3. System Structure

In our system we have some major goals:

- Our first goal was to provide an automated system in terms of manual system to make life simpler,
- Security is a big issue in our daily life. The system will provide some security features to its users with SMS.

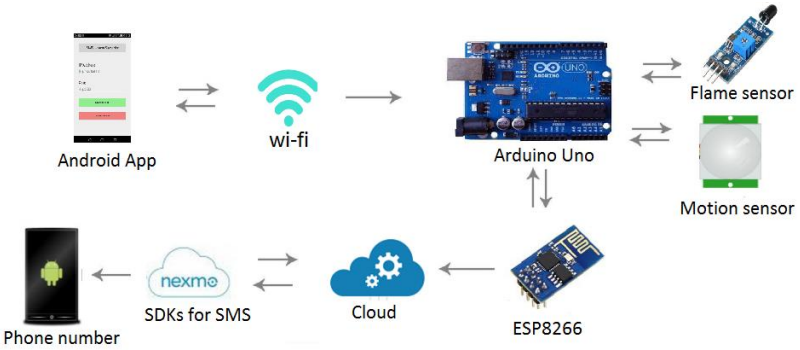


Fig.1 . Block diagram of the system

The system mainly comprises three parts: the mobile phone, the microcontroller unit, and cloud. The system structure is shown in Fig.1. The mobile phone is responsible for getting the response from sensors and user interface for turn on or off sensors. The second unit, the microcontroller unit which is the brain of the system and controls and processes information to and from all other units of the system. Cloud is responsible for get the response from sensors and send SMS on the homeowner throw Nexmo.

3.1 Hardware

Hardware of the system contains an ATmega32 microcontroller, ESP8266(wi-fi module), motion sensor, flame sensor, power supply, jumper wires in system programmer and relays to control the appliances. The hardware design is shown in Fig. 2.

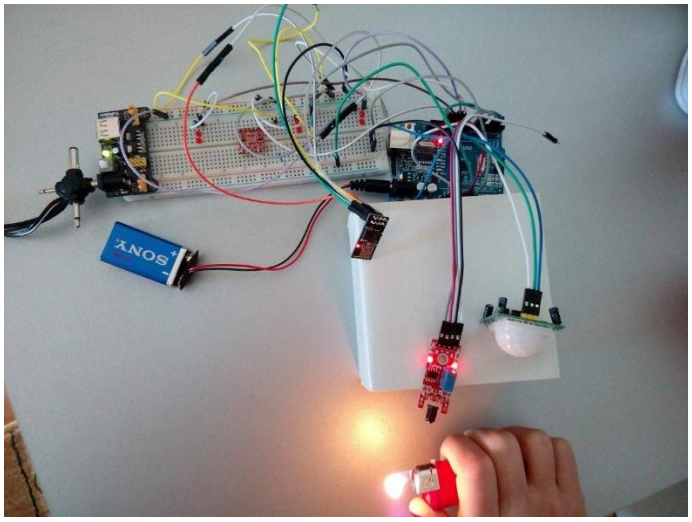


Fig.2 . Hardware design

The proposed system is controlled by an Arduino microcontroller. It collects information from the sensors, makes a decision and sends SMS to a corresponding number. If it finds any interruption in its sensors then microcontroller will send an SMS to the homeowner. Send SMS is “Flame at home” and “Motion in home”.

Controller Unit is built using Arduino Uno open-source microcontroller. The Arduino Uno is a microcontroller board based on the ATmega32. It has 14 digital input/output, 6 analogs, ceramic resonator, USB connector, power connector, ICSP, and reset button. Support everything needed for the microcontroller simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

The **ESP8266 WiFi** Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

Motion detectors are used to detect the unwanted movement of people around the restricted premises. The passive Infrared sensors could be used as a motion detector and the alarm could be triggered if there is some movement around the restricted premises. The passive Infrared sensor manufactured is used as a motion detector in the system. The 5V power supply is given to the sensor through the board and the output of the sensor is connected to the digital input of the Arduino board.

Flame sensor detects the presence of fire or flames. These types of sensors are used for short range fire detection and can be used to monitor projects or as a safety precaution to cut devices off / on. The flame sensor is very sensitive to IR wavelength at 760 nm ~ 1100 nm light. Detection times for flame detectors are generally measured in milliseconds from fire ignition. Analog output (A0): Real-time output voltage signal on the thermal resistance. Digital output (D0): When the temperature reaches a certain threshold, the output high and low signal threshold adjustable via potentiometer.

3.2 Software

Android Operating System is developed for smartphones and tablets. It is an Open source Software. Android is the most widely used mobile Operating System by the people nowadays. Android Software Stack contains four Layers: application layer, application framework layer, Libraries, Linux kernel. Android uses Java programming language the API is open and allows easy access to the hardware components.

Arduino microcontroller programming language is based on C/C++. The software written on the platform can be uploaded to the microcontroller (i.e. the Arduino board) using Arduino IDE software.

Cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. Some of the benefits of cloud are:

- Flexibility,
- Disaster recovery,
- Automatic software updates,
- Work from anywhere,
- Security,
- Environmentally friendly.

Nexmo provides SMS services. Nexmo is innovative communication SMS & Voice APIs that enable applications and enterprises to easily connect to their customers. With low latency and high deliverability, our SMS API is the most reliable way to reach users around the globe.

The pseudo code for Android and Arduino is:

```
begin
        Run System
        Connect Arduino to Wi-fi with AT commands
        If Communication != OK
                Wi-fi is not set
        If Communication = OK
                Wi-fi is connect
                If System = 0  //system is set from android application
                        Secutity system off
                If System = 1
                        Security system on
                        If motion==0 || flame==0
                                No motion or flame
                        If motion==1 || flame==1
                                Start TCP connection to server
                                Post data
                                Close connection
  end
```

The pseudo code for Cloud is:

```
begin
        Run System
        If post data== Motion detect || post data== Flame detect
        Get post sensor data and mobile number
```

Input in to database

Set received data to nexmo PHP client library for use Nexmo's API

Nexmo sent security alert SMS to the number

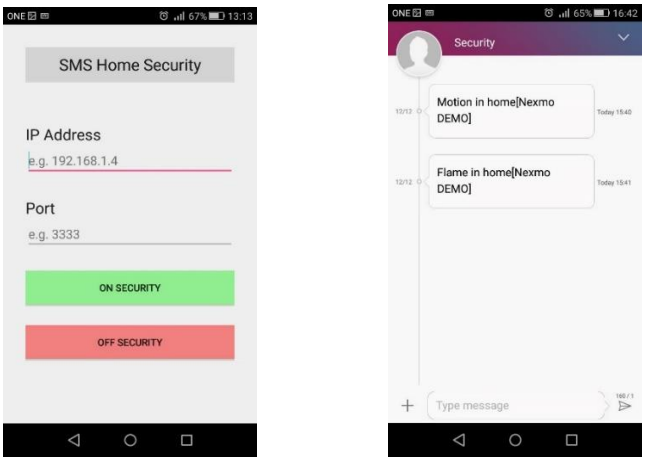
end

From Android Application is controlled the security system via Wi-fi. Motion and flame sensor modules are connected with Arduino Uno separately. When the motion detector finds that some people intrude into the house abnormally or when the flame sensor detects when the flame show microcontroller get the sensor data. The microcontroller throw Wi-fi will send data to the cloud. Received data will set to Nexmo client library and will send security alarm to the homeowner through the SMS.

4. Testing and Results

The proposed security system is tested in the home. The result of this implementation is good, communication from system security and device (Huawei Y5) throw Wi-fi and cloud via SMS is working. The smartphone can "off" and "on" the security system via Wi-fi using user interface in the android application shown in Fig.3.a).

The system can receive a message from home security via SMS. The message "Motion in home", indicate the sensor PIR detect movement in PIR area. The detection range of PIR tested was found up to 10 m. Message "Flame in home" indicate flame in area and alarm is on. Fig.3. b) shows the received security alert SMS on Huawei Y5 phone.



a) b)

Fig.3 . a) User interface for on/off the security system

b) Result of alert SMS home security system

The system is tested more times. The few results (in %) of successfully recognized motion and flame, if alert SMS is received and time for received security alert SMS are presented in the Table 1.

Table 1:

Test	Motion			Flame		
	Detect %	Alert SMS	Time SMS	Detect %	Alert SMS	Time SMS
Try1	100%	Yes	12 seconds	98%	Yes	14 seconds
Try 2	100%	Yes	15 seconds	100%	Yes	12 seconds
Try 3	100%	Yes	12 seconds	100%	Yes	13 seconds
Try 4	100%	Yes	13 seconds	99%	Yes	14 seconds

5. Discussion

The motion and flame sensors based security system detects the motion and fire and sends SMS to the homeowner. The system is very simple and easy to use, also the system is powered by 5V. There are various parameters which can be adjusted in this software. The developed security system gives a good response to the sensor and sends SMS when it detects the flame or motion. The time taken by the system to deliver the SMS in 12-15 seconds. The hardware components are low cost around 30 euros.

Advantages of the proposed system:

1. Real-time notification,
2. 24 hours monitoring,
3. low-power consumption,
4. Secure,
5. It is very cost effective, as day by day the cost of SMS is reducing.

6. Conclusion and Future Work

This paper presents one solution for establishing a low-power consumption remote home security alarm system. The approach discussed in the paper is novel and has achieved the target to control home appliances remotely using the SMS-based system satisfying user needs and requirements. This type of system is useful when the owner is out of the station and the home is locked. The homeowner will be alerted in real time as intrusion or flame occur through SMS. With the advantages of reliability, easy usage, complement wireless, and low power consumption, the system also has practical value in other fields.

For further development should be added a camera for making video and images. By installing the web camera at the door site, an intruder can be detected and the owner can receive an SMS telling the intruder entry in a home.

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