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СИСТЕМА БЕЗОПАСНОСТИ УМНОГО ДОМА

Статья посвящена теме использования технологических решений в сфере безопасности, применяемых вкупе с современными системами умного дома. Данная работа может быть формально поделена на две части. В первой части изучаются готовые комплексные решения в сфере обеспечения безопасности с целью выделить главную отличительную особенность, определяющую понятие «система безопасности». Определение данной особенности послужит основой для работы по созданию прототипа базового решения в сфере обеспечения безопасности в условиях обычных малогабаритных жилых помещений, что и является сущностью второй части данной работы, как попытки создать систему, отвечающую главным критериям, описанным в первой части, в то же время представляющую меньшую сложность реализации и лучше вписывающуюся в условия среднестатистического жилища в Республике Казахстан. Будучи частью научно-исследовательской работы магистранта «Разработка централизованной системы управления функциями умного дома на базе мобильных устройств», практическая часть данной работы в основном рассматривает вопросы аппаратной реализации, поскольку программная сторона будет подробно и комплексно рассмотрена в самом магистерском проекте, логически продолжая описанную в данной статье работу.

Ключевые слова: умный дом, система безопасности, микроконтроллер, GPRS-shield.

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SMART HOME SECURITY SYSTEM

The article is dedicated to the topic of using security-related solutions and technologies, implemented within the framework of modern smart-house systems. The article can formally be subdivided into two parts. In the first part, a number of ready-made solutions in field of security provision are studied with the purpose to outline the main distinctive feature that defines the term "security system". That peculiar feature is to become the basis of the further work on creating a prototype of the most basic solution for security provision in conditions of a conventional small-scale domestic establishments, which is the core of the second part as an attempt to elaborate the system meeting all the main criteria described in the first part, yet being less complicated and fitting the environment of an average apartment in the Republic of Kazakhstan. Being a part of "Development of centralized smart-home functions management system based on mobile devices" master project, the practical part of the article mainly focuses on the hardware part of the prototype since the software aspects of it will be considered more closely in a comprehensive manner in the master thesis itself as a logical continuation of the work conducted in this article.

Keywords: smart home, security system, microcontroller, GPRS-shield.

Nowadays, it is difficult to deny the influence of technological advancement on every single aspect of life, including the focus of this work – security. The advancement of technology has contributed to the changing concept of security in modern homes. It has changed from a simple lock and key security concept to implementing sophisticated security systems using cameras, microphones, contact sensors, proximity sensors, alarms, silent alarms, etc.

«The tasks of a modern security system include identifying an intruder trying to gain access to the home, alerting the homeowner about the intrusion or intrusion attempt, preventing the intruder from gaining access to the home, and gathering or collecting evidence regarding the intrusion so that the perpetuators can be brought to justice» [1, p. 271]/

Up to date, there are many out-of-the-box security systems on the market, providing a wide variety of functions. This variety, of course, depends on the users' needs. Let us take one of such solutions in this field as an example. The company named «Vivint» offers its clients various ways to set up home security and automation. It is issued in a form of «packages», which may include whatever a certain client has a need for in the above-mentioned field. The package may simply include doorbell camera observing the entrance to the premises and a number of

indoor cameras – a basic package offered as an anti-burglar solution. One may also add a number of sensors to expand the package and the functions of the system. According to the company's website, the following equipment is available to within a personalized home-security package: smart home control panel, doorbell camera, outdoor camera, garage door control, smart locks. In addition, the company itself provides 24x7 monitoring, which means that in case of any emergency sensor triggered, all you need to do is to contact a call-centre of the company for further assistance with the issue at hand. The information about the system is available on «Vivint» official website [2].

Having considered the common functions of the above mentioned smart house security systems, it is now possible to rule out the most basic feature, which defines the term itself: detection of force entry or unauthorized access to the premises/objects protected by the system, as well as transmission of this information to the owner/security agency. And considering the offers on the market of smart home security solutions, we can clearly see that the minimal functionality one can receive from installing the most essential parts of the system is what may be called as «burglar protection». In the following part of the work, we are going to consider the simplest solutions for carrying out this most essential task of a security system.

As a matter of detection of force entry, this can be achieved by setting up quite a simple system, consisting of a motion sensor and microcontroller with GPRS-shield installed. The most basic solution for this task consists of an Arduino Uno with the SeeedStudio GPRS Shield V2.0 connected to an ultrasonic sensor HC-SR04. The idea behind this is very simple, when the ultrasonic sensor detects a difference in the distance that is being measured, the controller reacts with conducting a call to a certain phone number that is specified within the code. This will be the signal of unauthorized movement detected within the premises observed by the sensory system. The equipment needed to create such a system is listed below.

Hardware: Arduino Uno microcontroller, GPRS shield, ultrasonic range finder HC-SR04, power supply 12V/2A, breadboard, jumper wires. Software:

Arduino IDE with sim900 library installed. All the above-mentioned hardware is widespread on the marked with a huge variety of different models, most of which fit the purpose, the software specified is open-source based and free to download.

First, we need to connect all the components, the scheme is provided in shield module datasheet [3]. Another important thing about setting up the shield is about the way it will communicate with the controller. There're two choices for you to communicate GPRS shield with the main board while plugging the two jumpers on to the SWserial or HWserial positions. If using SWserial, D7 and D8 will be used by SIM900 of GPRS Shield; if using HWserial, D0 (RX) and D1 (TX) will be used [3]. Next step is sim card preparation. The most important moment here is that the sim card must be activated and not be requesting pin code once inserted into any device. The latter option, however, is turned off by default.

When the sim card is installed, we may proceed to setting up the prototype and uploading the GPRS library and the sketch code onto it. GPRS shield will rely on sim900 library, which is available in free access on the internet resources, related to the topic. However, for the library to be fully functional after being installed to Arduino IDE, it must have debug mode turned off. To achieve this, we need to comment the «debug mode» string within «GSM.h» file of the library by putting "//" before the string, thus the result will look as follows://#define DEBUG_ON

In this very file, there are the following strings:

#define GSM_ON
#define GSM_RESET

Here we need to tie the first string to the pin 9 by simply adding «9» after it, since this is the power toggle pin, the second string needs to be commented as it was described above.

Another modification within the library needs to be done within «GSM.cpp» file. It is necessary to find _GSM_TXPIN_ and _GSM_RXPIN_ within the code, and then assign them to the communication pins we use in this project, thus pins 7 and 8 respectively. The result will be as follows:

#define _GSM_TXPIN_ 7

#define _GSM_RXPIN_ 8

The last step is the code to control the system itself. We, however, do not consider including the code itself within this work. Since all the gear used in this project is open source based, the numerous sketches can be downloaded freely, moreover, the libraries themselves have example sketches to start with.

Despite the above described project is a very primitive way of realizing basic smart home security functions, it will certainly fit for the most of small-scale living premises in the Republic of Kazakhstan, having no excessive features of the complex solutions in this field that are offered on the market. It can also be a foundation for somewhat bigger and more complex projects and prototypes in field of home automation. The project described is also to be integrated as a subsystem of the prototype of smart home functions management system, which is currently in development within the framework of «Development of centralized smart-home functions management system based on mobile devices» master project.

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