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DOMOTICS – PRACTICAL IMPLEMENTATION AND GENERAL CONCEPTS

Essay

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Domotics
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e-society
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home security

Abstract

This article presents the general concepts of home automation. A new model of home automatisation which gives the user an unique feeling of security and comfort is going to be implemented. The solution proposed in this paper has advantages in contrast to the existing solutions affordable by large masses of the population; but also by the increased safety.

1. Introduction

The theme of the research was chosen according to two of the most important current problems: an individual and a developer face. Therefore from the point of view of the individual it was approached the issue of individual property security, and for of developer the issue addressed is of interoperability of several software modules that make up an integrated system.

An intelligent security system for house was developed aiming to address the individual's issue. The system can detect changes in temperature, humidity, light, changes of concentration of inflammable gas in the air or changes in the concentration of carbon monoxide in air. Accordingly, depending on certain external stimuli the system can open / close the gas pipe and can stop / start the power supply. With the help of these two actions the system prevents unpleasant accidents that can happen in case of owner if not home. This system is both autonomous and manual. The second approached issue is the developer's dilemma. It is often met in the attempt to use simultaneously at least two different modules/systems. This proposed architecture will integrate under the same system eight different modules that together must solve the problem of property security.

2. General Concepts

Home automation represents expanding the residential assembly by building automatization. Domotics deals with home automation, household related work or activities. Automation may include centralized control of lighting, heating, ventilation, air conditioning, appliances, security gates of locks and doors and other systems that can provide improved comfort, energy efficiency and security. For the elderly and disabled persons automatization can provide a higher quality of life.

The popularity of home automation has greatly increased in recent years due to greater accessibility, simplicity and smartphone connectivity to the Internet. The concept of the "Internet of Things" (IoT) is closely related to the popularization of home automation.

A home automation system integrates electrical devices in a home. The techniques used in home automation include the following: building automation and control of internal activities such as home entertainment systems, indoor plants and watering the yard, pet food, ambience change for different events (such as celebrations or parties), and the use of domestic robots (for cleaning). Devices can be connected through a home network to allow control using a personal computer and allow remote access through internet via a secure environment to prevent foreigners to control the home. By integrating information technologies in the home environment, systems and devices are able to communicate in an integrated manner, leading to benefits in terms of comfort, energy efficiency and safety.

"Automatic homes" were continuously exhibited in world invention fairs and in popular mediums for creating science fiction. However, the factors such as complexity issues, competition between suppliers, multiple incompatible standards, and large expenses limited the penetration of the concept of smart home among the vast majority of people. As a result, this system isn't accesible for everyone, unless the users have ambitious passions

2.1 Practical implementation – examples

(figure 1 & figure 2).

2.2 From concept to practical implementation

A household security system can be integrated with a home automation system and may provide additional services such as remote monitoring security cameras using the Internet, or central locking of all doors and windows as defined by user (Figure 1).

With home automation, the user can select live streaming webcams from an external Internet source for their home. Security systems could include motion sensors(Figure 2) that will detect any unauthorized movement and can notify the owner via security system or via mobile phone.

The automation system can simulate the scenario where the house is being occupied by automatically adjusting the lighting or window coverings. Detection systems such as fire alarm, gas leaks(3 from Figure 2), carbon monoxide(4 from Figure 2), or water leaks(6 from Figure 2) can be integrated with a remote warning system(1&2 from Figure 2). Personal medical alarm systems allow an occupant of the house to be able to ask for help when needed, as well.

2.3 Costs

The costs include mainly equipment, components, furniture, and custom installations.

Costs increase due to higher electricity prices to run the control systems, maintenance costs for network systems, including troubleshooting and possibly the cost of modernization once the standards increase. Augumented complexity can also increase maintenance costs for network devices. Cloud-based services that support the installation can also involve fees for installation, use or both.

Learning to effectively use a complex system can take significant time.

Security control system can be difficult and costly, especially if the control system extends beyond the origin (technology - wireless), eg by wireless or internet connection or other networks.

Necessary products for the proposed architecture are purchased from Romania and the currency used for this study is RON.

Table 1. Goods purchased and their prices:

Raspberry PI model b + frame + charger	310 RON
Arduino uno V3	110 RON
Sensor MQ 7 – Carbon monoxide and MQ 4 – flammable gases	78 RON
Sensor LM50 and SYH-2R	10 RON
Phototransistor sensor	10 RON
Cables, condenser, resistences	15 RON
Servo motors Futaba 180 degrees	130 RON
Battery LiPo 7.4V 1000mAh	80 RON

As can be seen from the table above the financial resources needed to make the prototype for the proposed solution is 644 RON; these expenses don't include the hours of work nor any boxes / design-related devices.
Compared with market prices of a smart automatisation system that comes with additional video monitor (50RON), the solution proposed and developed is superior in terms of price.
At this point on the Romanian market the least expensive alike system amounts to over 25,000 RON.

2.4 Proposed solution - Current concepts
Currently the proposed system has been tested successfully for a period exceeding one month in 5 different houses. The data received have an index of success of 80%, the remaining 20% is considered calibration data of the product. This calibration can take from one hour to three hours tops. This aspect can be seen as a minus because the system can not adapt as soon as it happens in case of more expensive systems.
The system has been autonomously tested by applying 2 batteries: one of 7.4V with 1900mAh aiming to start and stabilise Arduino component and one of 12V 2200mAh who's task is to start Raspberry Pi. In autonomous mode the system runned approximately 3 hours under normal - free alerts circumstances and an hour in case of continue alerts.

2.5 Possible improvement of the system
In the future the system can be successfully implemented in different mediums such as cars as a fire protection system due to engine overheating; in data centers as auxiliary system of protection against overheating and / or in case the main system fails; office buildings both as a fire-related safety system and a system for refreshing compartment air.
A possible future implementation: Based on the temperature and carbon monoxide sensor the system will collect information from the environment and will store this data. Based on the data stored in the system, it will "learn" in between what temperature ranges or gas concentration will the ventilation be on. Therefore after about a month of collecting data, the system can accurately predict (60% or more accurately) when ventilation in the building will be either on or off. This will result in energy savings because the ventilation will run only between certain optimum parameters.

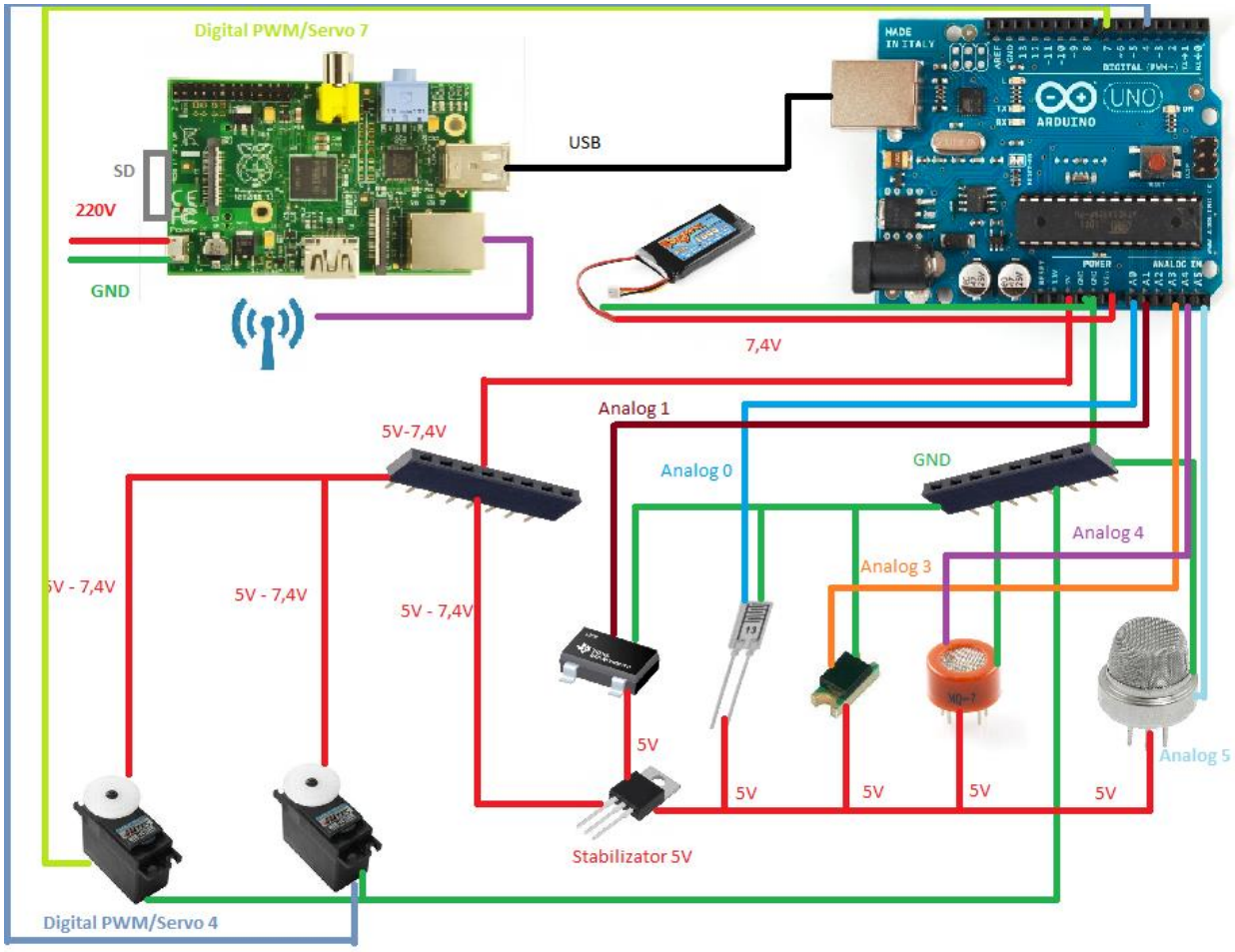

Figure 1. System's hardware scheme

Legend:

1.RasperryPi
2.Arduino UNO
3.Sensors – MQ4 Semiconductor Sensor for Naturas Gas
4. Sensors – MQ7 Carbon Monoxide Sensor
5. Sensors – Humidity SYH-2R

1.

2.

3. 

4. 

5. 

Figure 2. Legend elements