iKSP Journal of Computer Science and Engineering
http://iksp.org/journals/index.php/ijcse/index
iKSP Publisher

Study and Implementation of a Home Automation and Security System

Maamar Souaihia*[1], Rachid Taleb[1], Zakariya Chakrar[1], Aboubakr Brahimi[1]
[1]Department of Electrical Engineering, LGEER laboratory, University Hassiba Benbouali of Chlef, 02002, Algeria

Abstract - Home security systems protect homeowners and their property against hazards such as fires or gas leaks. However, smart home security can offer other benefits, such as alerting homeowners so they can verify the issue. As part of a research study, we have chosen to work on the design and construction of a security system (deadly gas and fire protection) and home automation (temperature and level of 'water). The aim is to automatically adjust the temperature and water level of a house, and also to extinguish the fire and gas extracts. Therefore, the PIC16F877A microcontroller is used to create an electronic board which acquires the data provided by a multi-sensor unit and gives the commands to the actuators accordingly.

Keywords: Automated system, PIC microcontrollers, home automation, C programming, sensors, actuators

INTRODUCTION

Nowadays, automation is playing an essential part in human life. Therefore, household appliances such as light, doors, security Incendies systems oblige us to design and use technology of automation. The home automation means reducing human efforts and increasing the efficiency of the system while saving the time (Asadullah & Raza, 2016).

The primary goal of domestic automation and safety machine is to manage domestic home equipment's through the use of different techniques like android application, internet pages, when a person or the owner is away from home. The system indicates the abnormal work on the residence via acquiring multiples signals which will allow them to regulate their domestic from burglars (Pavithra & Balakrishnan, 2015).

Save electricity of the whole system is the purpose of home automation. As well as, with this technique can manage the home equipment and automatically save the system from incendies or faults caused by abnormal conditions (Gill, Yang, Yao, & Lu, 2009).

LITERATURE REVIEW

Different methods and strategies have been employed in way of implement home automation and protection of system robustly. Therefore, this domain has continued to pay much attention (Jacobsson, Boldt, & Carlsson, 2016). Home automation network such zigbee and java offers rapid introduction and offers devices connected to network Wifi or Bluetoth through the integration of personal computer (PC) based on web server. In addition, the GSM network mobile was the previous strategy used to control home devices (Al-Ali & Al-Rousan, 2004; ElShafee & Hamed, 2012; Gill et al., 2009; Sriskanthan, Tan, & Karande, 2002)

However, the system requires an intrusive and expensive wired installation and the use of a high end PC. introduced a Bluetooth based home automation system, it is desirable for each home device to have a dedicated Bluetooth module. However, due to the fiscal expense of Bluetooth technology (Javale, Mohsin, Nandanwar, & Shingate, 2013;

*Corresponding author:
Email: m.souaihia@univ-chlef.dz (M. Souaihia)

Teymourzadeh, Ahmed, Chan, & Hoong, 2013). Therefore, in this paper discusses PIC microcontroller-based home automation and regulation of temperature and gas toxication with their implementation (Asadullah & Raza, 2016; David, Chima, Ugochukwu, & Obinna, 2015; Kaur, 2010; Puri & Nayyar, 2016).

Home Automation and Security System based on PIC indicates that whenever the temperature up than the suggested or abnormal level at that point the fan start working and antifire system start rush the water and open doors while alarm will start ringing. Moreover, the temperature will be displayed on the LCD screen. Furthermore, detecting a gas or fire will make the pump start working automatically. Whenever the room gets its normal situation then the system will automatically stop the operation of safety and wait until next effect.

METHODOLOGY

1. Home Automation Security System Proposed

The proposed system is based on simple approach which provides a solution for an automation system that offers home security against fire and gas leaks and automatically controls the temperature and water level. Therefore, the system provides basic control of security devices at low cost. It is based on a microcontroller that can be achieved by developing a C language program that allows the microcontroller to control the applications that we use in the specification(Jain, Vaibhav, & Goyal, 2014; Vikram et al., 2017).

Home automation system because of its wide spread coverage which makes it an online system. It has also become popular due to its security feature because of which it is not possible for other people to track the information sent or received (Puri & Nayyar, 2016).

Automatic temperature control

Temperature control is a process in which the change in temperature of a room (and objects collectively within it), or object, is measured or otherwise detected, and the passage of thermal energy in or out of the room or the substance is adjusted to achieve a desired temperature. This function allows us to maintain the ambient temperature at a set value which is determined by the user(Jain et al., 2014).

Automatic fire extinguishing system

An approved system of apparatus and equipment that automatically detects a fire and discharges extinguishing material onto or into the area of a fire.

Therefore, this unit detects the temperature in the environment. This system is made with a precision LM35 integrated circuit, whose output voltage is linearly proportional to the temperature in Celsius, when used as a base temperature sensor (2° C to 150° C), any change in temperature of 1° C will be converted to 10 mV or the output voltage (Vout) = 0 mV + 10 mV/°C, therefore the maximum output voltage is 1.5V

The LM35 temperature sensor detects the temperature and converts it into an electrical (analog) signal, which is applied to the microcontroller through ADC, the analog signal is converted into digital format by the analog to digital converter (ADC). A temperature setpoint value is obtained by a potentiometer which is connected to an analog input of the microcontroller. The measured values and the setpoint are displayed on the alphanumeric LCD 16x2 screen.

Gas detection system

A fire alarm system that has triggering devices that use a gas detector for the protection of the house. Thus, in this unit, a gas sensor is used to detect smoke or other gases considered deadly if left unchecked, the sensor we are going to use is an MQ2 gas sensor, this sensor provides an all or nothing (TOR) which means that it provides a high signal (5V) to the output in case of gas presence otherwise the output will remain in the initial state (0V), this signal is sent to one of the PORTB pins of the peak 16F877A (RB4 to RB7) which provide the interrupt service. The interrupt service routine used in this part prioritizes this task. The same fan used for ventilation is used here to extract gas, an alarm warning is also required in addition to the automation of the door.

Alarm notification

A component of the fire alarm system such as a bell, a horn, a speaker, a buzzer.

Automatic door opening

In the event of a gas leak or smoke detection the door will open automatically. Therefore, this unit helps to detect sources of fire and extinguishes it, in which case a flame sensor is used, this sensor is sensitive to ordinary light that is why its reaction is generally used for flame detection purposes. This module can detect flame or wavelength in range of 760nm

to 1100nm of light source. Small output interface and single chip can be directly connected to the IO port of the microcomputer.

This sensor can provide both analog and digital output just like the gas sensor, we use the digital pin and we connected it to one of the PORTB pins (RB3 to RB7) and we included it in the interrupt service program.

Activation of the fire detector will trigger an audible alarm as well as the fire extinguisher which is an automatic water sprinkler in our case it consists of a few pipes containing water squeezed greasy to a water pump which is fed by the tank. The sprinkler on this system is triggered immediately when a fire is detected.

Automatic filling of the water tank

The water tank is used to power the fire extinguisher pump. Moreover, this unit ensures that the water supply which is needed for the water sprinklers remains within the desired level, this can be achieved by using a water level detector / sensor, the sensor gives an analog signal which is proportional to the water level.

When the water level drops below the threshold, the pumping action start working until the water level is restored to the desired level.

Manual control

All of the features we have mentioned above are going to be controlled manually using a control panel.

2. Home Automation System Using PIC16F877A

The purpose of the proposed system is to provide a solution for an automation system that provides home security against fire and gas leaks and automatically controls the temperature and water level. The system provides basic control of security devices at low cost. It is based on a microcontroller that can be achieved by developing a C language program that allows the microcontroller to control the applications that we use in the specification.

The design of PIC microcontroller-based home security automation system is given in Figure 1. PIC16F877A is an open-source architecture. For programming the microcontrollers platform provides an integrated development environment (MikroC) based on the Processing project, which includes support for C programming language.

The MikroC language for PIC has found wide application for the development of embedded systems based on microcontroller. It provides a combination of the advanced IDE (Integrated Development Environment) programming environment, and an extensive set of hardware libraries, extensive documentation, and many examples.

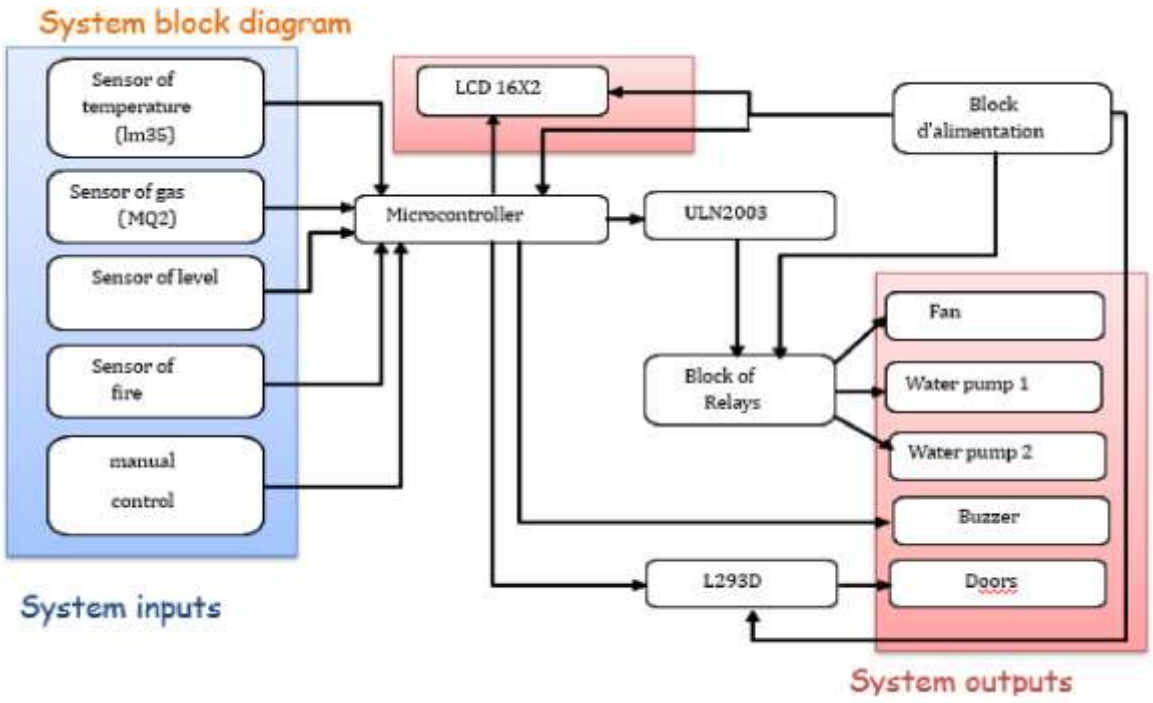

Figure 1: Design of PIC microcontroller-based home security automation

RESULTS AND DISCUSSION

In order to implement our system, we need to design:

• An electronic control card which processes the input signals supplied by the sensors and gives orders accordingly to the power circuit.

• The power circuit converts the control signal into an electric current for driving the actuators.

• A power supply that provides a regulated voltage for the system.

• A glass house to put it all together.

ARES software is an editing and routing tool that perfectly complements ISIS, where ISIS is an application for simulation electrical circuit. An electrical diagram produced on ISIS can then be easily imported into ARES to produce the PCB (Printed circuit board) of the electronic card. Although editing a PCB is more efficient when done manually, this software allows you to automatically place components and perform routing automatically (Puri & Nayyar, 2016).

This simulation includes simulation for temperature control, fire extinguisher system, automatic water tank filling, alarm system, gas detection and manual control with push buttons as depicted in figure 2.

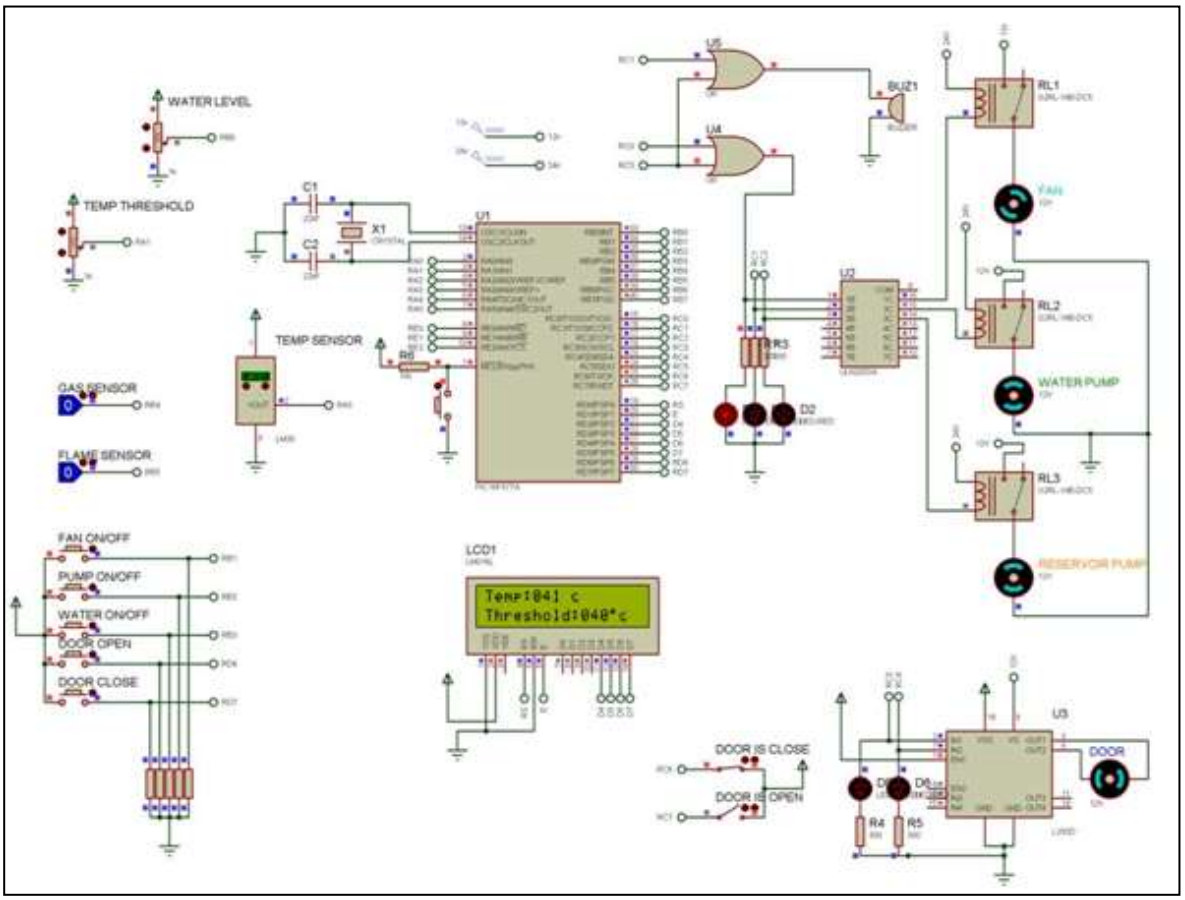

Figure 2: Simulation of the global system through Proteus ISIS

After realization, the developed system was put to the test to check its level of compliance with the design specifications, we tested every functionality of our system starting with automatic temperature control, we can see that the temperature is regulated by the fan according to the setpoint that we set as needed, both the setpoint and the actual value of the temperature is shown on the LCD display, then we tested the functionality of firefighting our system by creating a small controlled fire.

Therefore, the flame detection sensor module is sensitive to flame but also can detect ordinary light, the flame is safely extinguished with the water sprinkler, the water tank is automatically filled with the water pump. Then comes the gas or smoke detection, the alarm and the fan are activated in the event of smoke or gas presence and the door has also been opened automatically. Finally, we tested the manual control panel which consists of ON / OFF buttons for each actuator, everything worked as expected, the result is shown in figure 3 and figure 4 respectively.

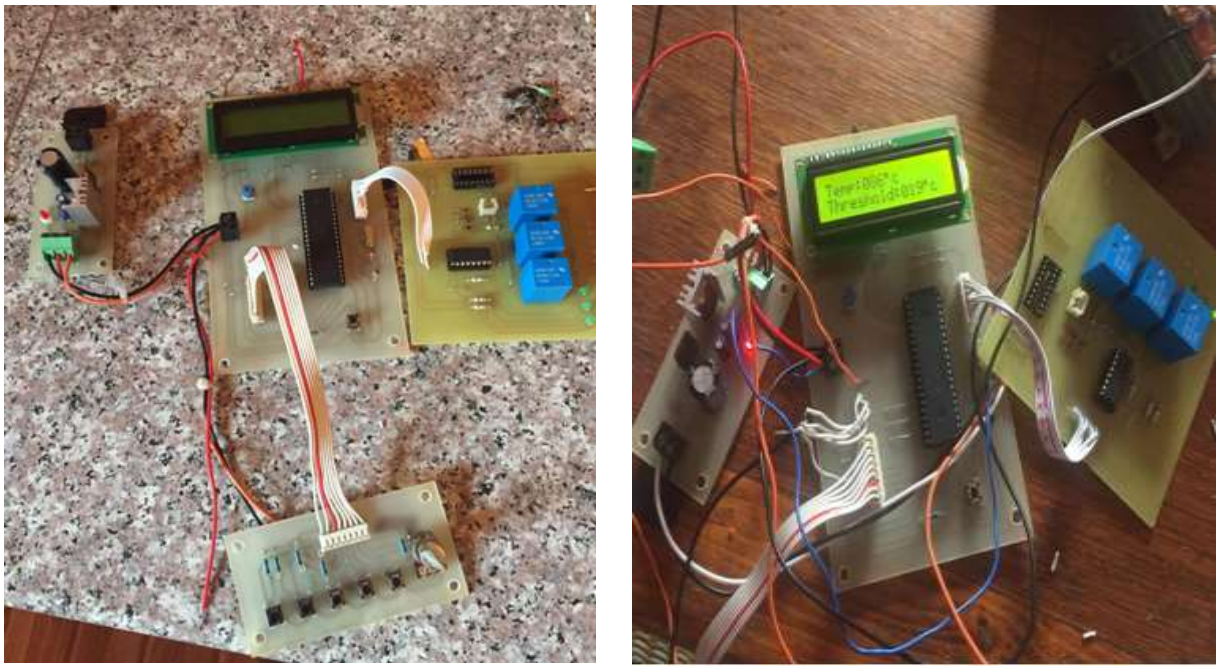

Figure 3. Realization and test of multiple cards.

Figure 4. Final Realization of home security automation.

CONCLUSION

The interest of this project is to develop a tool allowing the residents of a house to protect their properties. The technique used is based on the installation of multi-parameter sensors (smoke, temperature, flame), and connect them to a centralized module which control all of these detectors and triggers, depending on the situation, a signalling of alarm and an appropriate reaction to each event detected (ventilation, fire extinguishing, etc.).

This project allowed us to make the link between multiple circuit of protection, while it is concluded that all the automation security system implemented in order to avoid most know abnormal situation. This work gives us confidence

and enables us to put into practice any microcontroller-based control board and to ensure its maintenance. Furthermore, this control of home appliances leads us to think of developing more modules such as SMS notification in future projects.

REFERENCES

Al-Ali, A.-R., & Al-Rousan, M. (2004). Java-based home automation system. *IEEE Transactions on consumer Electronics, 50*(2), 498-504.

Asadullah, M., & Raza, A. (2016). *An overview of home automation systems.* Paper presented at the 2016 2nd International Conference on Robotics and Artificial Intelligence (ICRAI).

David, N., Chima, A., Ugochukwu, A., & Obinna, E. (2015). Design of a home automation system using arduino. *International Journal of Scientific & Engineering Research, 6*(6), 795-801.

ElShafee, A., & Hamed, K. A. (2012). Design and implementation of a WIFI based home automation system. *World academy of science, engineering and technology, 68*, 2177-2180.

Gill, K., Yang, S.-H., Yao, F., & Lu, X. (2009). A zigbee-based home automation system. *IEEE Transactions on consumer Electronics, 55*(2), 422-430.

Jacobsson, A., Boldt, M., & Carlsson, B. (2016). A risk analysis of a smart home automation system. *Future Generation Computer Systems, 56*, 719-733.

Jain, S., Vaibhav, A., & Goyal, L. (2014). *Raspberry Pi based interactive home automation system through E-mail.* Paper presented at the 2014 International Conference on Reliability Optimization and Information Technology (ICROIT).

Javale, D., Mohsin, M., Nandanwar, S., & Shingate, M. (2013). Home automation and security system using Android ADK. *International journal of electronics communication and computer technology (IJECCT), 3*(2), 382-385.

Kaur, I. (2010). Microcontroller based home automation system with security. *International journal of advanced computer science and applications, 1*(6), 60-65.

Pavithra, D., & Balakrishnan, R. (2015). *IoT based monitoring and control system for home automation.* Paper presented at the 2015 global conference on communication technologies (GCCT).

Puri, V., & Nayyar, A. (2016). *Real time smart home automation based on PIC microcontroller, Bluetooth and Android technology.* Paper presented at the 2016 3rd International Conference on Computing for Sustainable Global Development (INDIACom).

Sriskanthan, N., Tan, F., & Karande, A. (2002). Bluetooth based home automation system. *Microprocessors and microsystems, 26*(6), 281-289.

Teymourzadeh, R., Ahmed, S. A., Chan, K. W., & Hoong, M. V. (2013). *Smart gsm based home automation system.* Paper presented at the 2013 IEEE Conference on Systems, Process & Control (ICSPC).

Vikram, N., Harish, K., Nihaal, M., Umesh, R., Shetty, A., & Kumar, A. (2017). *A low cost home automation system using Wi-Fi based wireless sensor network incorporating Internet of Things (IoT).* Paper presented at the 2017 IEEE 7th International Advance Computing Conference (IACC).