

Implementation of Smart Home Automation with Enhanced Security

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ABSTRACT

With the surge in usage of power and human population, there is a vital need to conserve electricity in every way possible. The lack of ability to access and control the appliances from remote locations is one of the major reasons for power loss. To overcome this automatic techniques are employed in every aspect of day to day activities. Automation refers to the ability to program and plan a list of events for the devices on the network. The programming may include time-related commands, such as having your lights turn on or off at specific times each day. It can also include non-scheduled events, such as turning on all the lights in your home when your security system alarm is triggered. This paper describes the design and prototype implementation of new home automation system with enhanced security that uses Wi-Fi technology as a network arrangement connecting its parts. The proposed implementation consists of a hardware interface segment, which includes fingerprint sensor, temperature sensor, motion sensor, and camera and provides appropriate interface to sensors and actuators of home automation system. Unlike most of the home automation systems available in the present scenario, the proposed system is accessible that one server can handle many hardware interface modules as long as it exists on Wi-Fi network communication coverage. The proposed system supports a widespread variety of home automation devices like power management components, and security components.

Keywords: Wireless, sensor, simulation, hardware, Wi-Fi, network coverage and actuator.

I. INTRODUCTION

As advanced technologies are evolving day by day, information or raw data plays a very major role in every aspect of communication. In fact it is everything in today's real life. Particularly when this data is liable to affect their life in close way, then data has to be properly monitored and executed. People are left from their home for work or for any other reasons and there is always insecure of what's happening in their home and equipment related to home appliances whether they are operating or turned On/Off and several other things associated to their house. Home automation is the alternative to

solve these problems and provides the user with live monitoring and controlling of the entire home with electronic hardware.

Today people are considering at various ways and means to improve their life-style using the newest technologies that are available. Any new capacity or home appliance that promises to improve their life-style is grabbed by the customers. The more and more such facilities and appliances are added, it becomes inevitable to have easy and convenient methods and means to control and operate these appliances. Conventional wall switches are located in different parts of a house and thus necessitates manual

operations like to switch on or off these switches to control various appliances. It gets virtually unmanageable to keep track of various appliances that are running and also to monitor their performances. Also installing a home security system is very costly and a difficult task. The advantages of home security system are that it protects from unauthorized intruders entering into the house, it helps monitor and save power usage for the house and it helps to control various aspects of the house from a simple smartphone.

Home automation has been around for the past decade in terms of lighting the house and simple house hold appliances control, and only in recent time's technology caught up the idea of the interconnected world, permitting full control of the home from anywhere, to become an actuality [1]-[3]. With home automation, any device in the house can be made to react i.e. when it should react, and why it should react. The schedule of the event is prepared and the rest is automated and based on the personal preferences it provides convenience, control, money savings, and an overall smarter home will be built.

In general Smart home technology commonly refers to any suite of devices, appliances, or systems that connect into a common network and that can be independently and remotely controlled. When a home technology like this works together in one system, it can also be mentioned more loosely as a "connected home". As an example, in an individual home various devices such as thermostat, lights, audio speakers, TVs, security cameras, locks, appliances, and more are all connected into a shared system, which can be controlled from a smart phone or through a mobile touch screen device. Smart home automation allows tapping into high-tech functionality and luxury that had not been possible in the past. As technological developments continue to grow, so will be the potential for consumer home automation to make life easier and more enjoyable [5].

A "smart home" typically is a domestic atmosphere that has been partially automated. Home automation includes centralized control for lighting, HVAC (heating, ventilation and air conditioning), appliance management, and others. The main objective of home automation is to boost the comfort, reduce the energy consumption and increase security in domestic scenarios. Generally, houses are furnished with independent control panels to regulate all of the systems and appliances present in the house. Furthermore, these control panels are often not associated each other. The main purpose of a smart home is to consolidate the control of all the devices into a single control unit, which can be programmed to do specific tasks suitable for the house owner and the home of importance. Also other parameters such as reduction of consumption of resources such as power, gas, etc. play a very major role. Due to the very high pricing on energy, resource conservation has become a part of a person's day-to-day life [6]-[7]. If a person has the possibility to control his home automation remotely he can reduce the consumption of energy and thus reduce his own expenses.

Furthermore, environmental sustainability has gained significance in the recent years. If a person is away from home there is no need for the air conditioner or ventilation to operate. The same principle applies to illuminations, heating and other appliances. Some smart homes systems suspend the operation of house hold appliances until they are operated again as per their wish. Furthermore, there are several different technologies for implementing such smart homes. Some standards utilize complex communication protocols and control wiring; others rely on embedded signals in the existing power circuit of the house. A portion relies on radio frequency signals, and others become hybrids by combining several methods. All of the controlling tasks are done through a microcontroller, such as 8051, PIC, ARM and Arduino, which enables the communication and upon receiving some commands controls the different systems in the house. Finally, the commands to

control the appliances in the house are sent by a central control unit such as a computer, remote control or smartphone.

This paper proposes a novel design and implementation for the smart home automation using the wireless sensor network and the biometric technologies. Also the proposed system employs the biometric technology in the authentication for home entrance which enhances home security as well as easiness of home entering process.

This paper is organized as follows. Section II presents the design and implementation of the proposed system using LPC2148 ARM7TDMI microcontroller. Section III explains the working of the system and shows flowchart. The hardware prototype implementations are presented in Section IV. Finally, conclusions are drawn in Section V.

II. DESIGN AND IMPLEMENTATION OF THE SMART HOME AUTOMATION SYSTEM

The proposed smart home automation system has the ability to control and monitor the following physical parameters in house environment. They are temperature and humidity, motion detection, fire and smoke, detection, door status, light level and video monitoring. Also the implemented home automation system can be used to switch on/off the following electrical appliance Lights on/off/dim, HVAC on/off, Door lock, Window shutdown and on/off different appliances. The main challenges faced during the implementation of Home automation systems are poor manageability, high cost of ownership, inflexibility, and difficulty in achieving good level of security.

The proposed working model of the smart home automation system is as shown in the figure1. The system consists of different sensors for measurement of physical parameters such as temperature, gas, motion, and video. The threshold levels for all the

sensors are set as T_1 , T_2 , T_3 and T_4 etc. The microcontroller used in the proposed work is LPC2148 ARM7TDMI microcontroller. These microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. The program is written such that if the sensor parameters are greater than the predetermined threshold levels, then the corresponding alarm circuits are activated. Once this happens, the home appliances are switched ON/OFF based on the physical parameter monitored. The proposed smart home automation system is shown in figure 1.

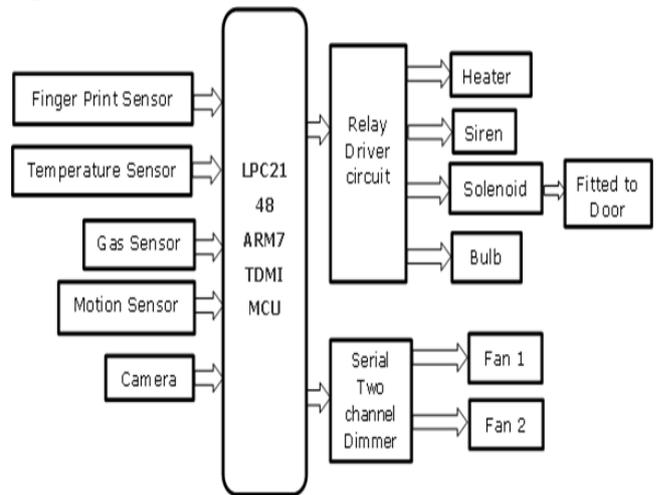


Figure 1. Implementation of the proposed smart home automation system

III. FLOWCHART

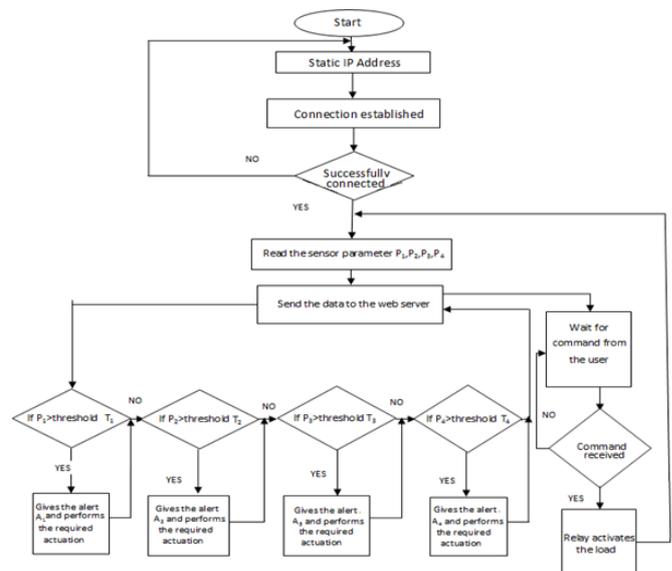


Figure 2. Flow chart of the entire process

The flowchart of the proposed smart home automation with enhanced security is shown in figure 2. If the temperature exceeds the threshold level $T_1=35^{\circ}\text{C}$, then the air conditioned machine will turn on automatically and will turn off when the temperature returns to normal conditions. Likewise when there is a leakage of cylinder gas in the house, an alarm is raised giving the alert sound. This alerts the nearby people, so that they can switch off the cylinder. Using the passive infra-red sensor and light dependent sensor, and based on the movement of the individuals, the lights are turned on/off automatically by detecting the individual inside the house. The threshold values T_2 , T_3 , and T_4 are set according to the individual room requirements. The individuals can also monitor the electric appliances through the internet via web server technologies. If electric lights or any other electrical appliances are left unoperated, then it can be sensed by the corresponding sensors and can be turned off remotely by entering the IP address of the web server.

IV. HARDWARE IMPLEMENTATION

In this proposed work, is LPC2148 ARM7TDMI is used as the main microcontroller. All the sensors such as temperature, PIR, fingerprint and gas sensor are interfaced to LPC2148 ARM7TDMI which is located in the home of interest. Camera is also interfaced to the LPC2148 ARM7TDMI to capture the live events occurring inside the home. Figure 3, shows the hardware prototype of the smart home automation system and figure 4, shows the on/off controlling of the electric bulb.

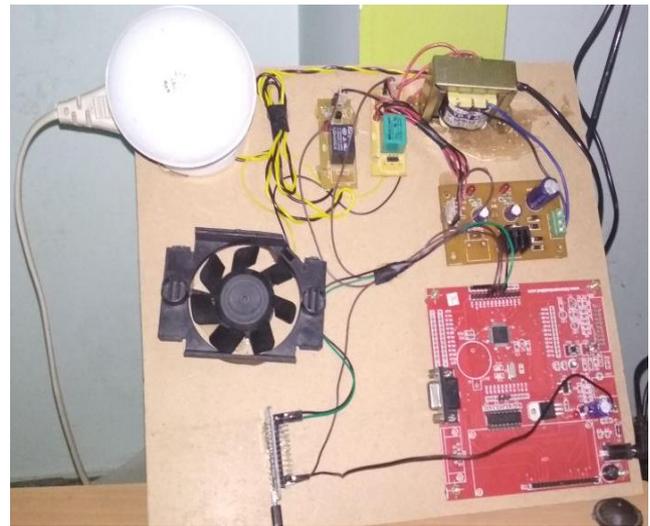


Figure 3. Prototype of the smart home automation system



Figure 4. controlling of electric bulb

The controlling of fan is shown in figure 5.



Figure 5. controlling of fan

V. CONCLUSION

Smart home automation is an emergent, active market and a very popular research field where lot of changes and new ideas are possible. It is becoming more popular due to the latest developments in electronic hardware which have significantly reduced the cost and improved the capabilities. This is due to the fact that advanced technologies around us evolve and the access to desired information is easier than ever before. In this paper a highly secured, low cost, remotely controlled, easily accessible smart home is designed and implemented. The proposed system is a novel implementation and uses Wi-Fi technology for controlling the various sensors in home. A prototype of the entire system is carried out and remote monitoring/controlling of the smart home is effectively implemented practically and satisfied results have been achieved. In future, more improvements can be carried out in monitoring and controlling part. Also more sensors and devices can be connected and monitored on. Furthermore, camera module can be adjusted to operate in different modes. Lastly, the selection of home automation system depends on the situation and requirements.

VI. REFERENCES

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