Monitoring Of Home & Activation of Automated System Via GSM Through FPGA

Srinivas gopu and G Shyam kishore

Abstract—Technology advancements have made possible the implementation of embedded systems within home appliances. This has added new capabilities and features, however, most of the time, the implementations are proprietary and networking is not always possible. Yet there is an increasing demand for smart homes, where appliances react automatically to changing environmental conditions and can be easily controlled through one common device. This paper presents a possible solution whereby the user controls devices by employing a central Field programmable Gate Array (FPGA) controller to which the devices and sensors are interfaced. Control is communicated to the FPGA from a mobile phone through its GSM Modem interface. This results in a simple, cost effective, and flexible system, making it a good candidate for future smart home solutions.

Keywords—Sensors, Sms, Gsm Technology, Radio Transmission

I. INTRODUCTION

The requirement for a suitable technology that enhances the quality of life in homes has always been at the center of research. User needs that a home must satisfy can vary from basic requirements to external and internal aesthetics to comfort within the home. With the advancements in technology, electrical appliances are filling the homes, providing more comfort to the dwellers and improved entertainment systems. However, their proliferation and costs related to electricity consumption are increasing user demands for home automation systems. Yet, commercially available solutions are still limited and most of the time they are tailor made for a customer, resulting in high costs.

This paper presents a cost-effective solution that uses a Field Programmable Gate Array (FPGA) controller at the core of the system to provide the intelligence for the home system. Moreover, the controller interfaces to a mobile device through the Gsm Modem [1] communications port to allow monitoring, configuration, and switching of devices. This allows the user to set the home environment according to the personal needs. This paper is organized as follows; Section II gives some background on systems found in literature. Section III provides an overview of the system developed, while Section IV presents the implementation of a prototype. Section V gives the obtained test results, while a final conclusion is drawn in Section VI.

II. BACKGROUND WORK

The concept of intelligent homes has attracted the attention of a number of researchers and practitioners during the last years. Most of these recent techniques focus on exploiting wireless communications to communicate with the devices. The authors introduce the idea of using Gsm Modem as a cable replacement for home automation. However, no implementation details are given. An automation system based on Gsm Modem was developed. It consists of a mobile host controller that communicates with several devices representing the home appliances. A similar solution was presented, where a Gsm Modem multi hop mesh topology was used to relay sensor node information to a mobile phone or a personal computer. A Gsm based home automation system was integrated with a Gsm network through a gateway. The gateway provides the user interface and accessibility to the system. The system was evaluated using four devices. A similar approach was taken by the authors, where the design of an architecture integrating a Gsm home network into the Open Service Gateway initiative (OSGi) framework-based home gateway is presented. Techniques that use Internet as the means for home automation have also been proposed in this context.

A system based on a central Fpga which is interfaced via an RS232 port to a personal computer web server was presented. The controller is then connected to the appliances and sensors. The Internet access allows both local and remote access to the home system. A system using the Global System for Mobile communications (GSM), Internet, was proposed for real-time monitoring and activation of the home appliances. This adds flexibility to the system, however, it increases the cost when using GSM technology. The authors try to improve the Graphical User Interface (GUI) of the home automation system by introducing a 3D visual interface. The aim is to enhance the user experience and allow faster take up of such technologies. This system also exploits Internet to allow dwellers to control and monitor the home from outside.

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III. SYSTEM DESIGN

A block diagram of the system developed is shown in Figure 1. It consists of a mobile phone having a Gsm interface, a central FPGA controller that communicates via the RS-232 protocol to the Gsm interface, and a number of devices which are connected to the central controller. The latter links can be either wired or wireless.

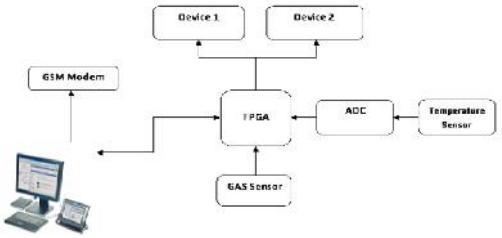

Figure 1. Block diagram of the system

A. Global System for Mobile communications

GSM, the Global System for Mobile communications, is a digital cellular communications system, which has rapidly gained acceptance and market share worldwide, although it was initially developed in a European context. In addition to digital transmission, GSM incorporates many advanced services and features, including ISDN compatibility and worldwide roaming in other GSM networks. The advanced services and architecture of GSM have made it a model for future third-generation cellular systems, such as UMTS. This paper will give an overview of the services offered by GSM, the system architecture, the radio transmission

B. Gsm Modems

A GSM modem can be an external modem device, such as the Wavecom FASTRACK Modem. Insert a GSM SIM card into this modem, and connect the modem to an available serial port on your computer. A GSM modem can be a PC Card installed in a notebook computer, such as the Nokia Card Phone. A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port on your computer. Phones such as the Nokia 7110 with a DLR-3 cable, or various Ericsson phones, are often used for this purpose. A dedicated GSM modem (external or PC Card) is usually preferable to a GSM mobile phone. This is because of some compatibility issues that can exist with mobile phones. For example, if you wish to be able to receive inbound MMS messages with your gateway, and you are using a mobile phone as your modem, you must utilize a mobile phone that does not support WAP push or MMS. This is because the mobile phone automatically processes these messages, without forwarding them via the modem interface. Similarly some mobile phones will not allow you to correctly receive SMS text messages longer than 160 bytes (known as "concatenated SMS" or "long SMS").

C. Control and Monitoring Devices

The number of control and monitoring devices attached to the FPGA depend on the number of free input/output ports available on the FPGA. Furthermore, the system can be further expanded by cascading FPGAs or by multiplexing data coming from different sensors. This makes the system scalable. The devices connected to the FPGA can use either a wired connection or a wireless one, such as Gsm Modem. The modules interfaced were; a temperature sensor, a gas sensor, a relay switch, a Light Emitting Diode (LED) and a servo. These represent typical sensors used in the home which can allow the central controller to make decisions on whether to switch on or off various devices. Moreover, the circuits tested emulate low voltage switching, high voltage control via the relay, and Motor control through the servo. The latter is useful for example to control light in a room by opening or closing shutters. Thus, the system covers most of the typical interfaces found in appliances in homes.

IV. IMPLEMENTATION

In Home automation, mainly used to identify the problem in residential areas. Some peoples they are went for abroad or any foreign countries. On that time if any problem or accident occurs means the message forwarding is not possible. In our home automation system will identified such kind of problem. Our system is mainly concentrated about Gas sensing, Fire sensing, Heat sensing etc.

Home automation consisting of FPGA– Field Programmable Gate Array, Gas sensor, Fire Sensor, Temperature sensor, GSM Modem. The Gas sensor sensing the leakage of gas. The Fire sensor sensing if any where fire accident in the home, Temperature Sensor sensing the room temperature. These all sensors directly connected to FPGA, it is the one of the controller, it sensing these all factor occurs or not, if any problem occurs means Fpga sends the information via GSM Modem to owners mobile. Any gas leakage occurs in home means gas sensor sensing and information sends to fpga (ie.) Normally fire sensor inactive means it will be '0', if it is active means '1' will be sends to FPGA.

When room temperature increases means, temperature sensor sensing temperature and send '1' to the FPGA. When fire accident occuring in the room, the fire sensor sensing the fire and '1' will sends to the FPGA.FPGA analyzed and sends the information to GSM modem. GSM modem sends the message to owner mobile.

V. RESULTS

VHDL test benches were designed to test all the developed VHDL code both at block level and at top level before downloading the synthesized code on the FPGA. The waveforms were checked to verify correct operation, both states and timings, of the hardware. The devices connected to the FPGA were also tested by forcing outputs and inputs and checking the functionality. All interfaced circuits functioned as expected. The communications channel had to be tested as well. A serial port monitoring program installed on a PC was used for this. A Gsm dongle was connected to

the PC and the communication between mobile phone and the PC, and the PC and the FPGA controller were tested. This was done by sending Gsm commands and monitoring the replies. Once the controller and the Gsm connection were tested, the whole system was tested exhaustively by sending commands and reading and noting the results. Photos of the mobile modem screen are shown in Figure 2, while a photo of the system which involves the central FPGA controller and the interface circuits is shown in Figure 3.The GUI which we get when a fire, dangerous gas, Max Temperature is sensed is shown in Figure 4.

Figure 2- Gsm Modem

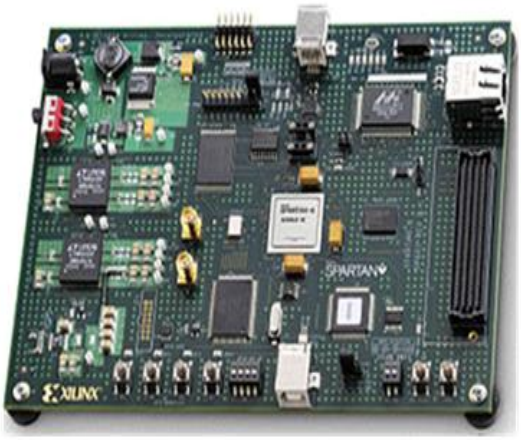

Figure 3- The FPGA controller and interfacing circuits

Figure 4- Indications of Fire, Danger Gas, Temperature

VI. CONCLUSION

An implementation of a home automation system using an FPGA central controller was presented. The FPGA was selected as, compared to microcontrollers, it provides a larger number of input/output ports and the parallel implementation of hardware results in faster algorithm execution. The user interface on the mobile phone communicates with the FPGA using the Gsm interface. This leads to a low cost system that can be easily scaled up. Furthermore, pairing allows some level of security to avoid network intrusion. As it uses GSM interface the system can be used in remote areas also. The system provides security of the home with a vigilance of gas sensor, temperature sensor, etc. In future it can be Extended to different home appliances and automatic controlling of them, and also in different areas of industry .This can be useful for automated switching of the devices.

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I am very much interested to explore new ways of technology .I think technology plays a vital role for a better living and eases the complexity in working for a better society. From childhood I have very much interest to

discover new things, my passion has dragged me to take Electronics as my career .I have learned a lot while exploring new technology in my study and at my project. G shyam kishore sir has given me great support in handling the project and helped me in completing my project in time. He has given me valuable suggestions from his experience. He has made me my project look different from others.

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