International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 2180-2182 www.ijaem.net ISSN: 2395-5252

IOT based home automation system using FPGA

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Submitted: 01-07-2021 Revised: 13-07-2021 Accepted: 16-07-2021

ABSTRACT: Technology advancements have made the implementation of embedded systems within home appliances. This increased the capabilities and features. IOT (Internet of things) had many applications in several domains; it also strides into home automation. Controlling application with IOT can be easily done using smart phones through Android apps. Home automation is one of the profound in day to day applications. Due to hasty progress in technology, Wireless Fidelity (wi-fi) has brought revolutionary change than compared to Wired LAN communication. Existing wireless communication devices such as Bluetooth, ZigBee and NRF24L01 etc. are limited to short range. IoT uses Wi-Fi to exchange data wirelessly for large distance using internet. IoT module (ESP8266) is used to control home industrial application in remote area anywhere in the world. Serial Communication exchanges the data between FPGA and IoT module. Home application are controlled using FPGA which receives commands in serial communication from IoT Module through smart phone app. This paper presents a possible solution for user to control different equipment's by using Field Programmable Gate Array (FPGA) controller to which the devices and sensor are interfaced. This would result in a flexible system, making a good candidate for future home automation solutions.

KEYWORDS:Internet of things, LAN, ZigBee and NRF24L01, FPGA

I. INTRODUCTION

Home automation is building automation for a home, called a smart home or smart house. A home automation system will control lighting, climate, entertainment systems, and appliances[1]. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of things. The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human to human or human to computer interaction[2]. With an increase in the number of devices in our everyday lives, it is important to have an easy and centrail control over the devices. Here we present a possible solution wherein 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 Wi-fi interface. Using FPGA for IoT fills the gap between hardware and software and offer many advantages such as flexibility, reliability, low cost and long-term maintenance[3][4]. The home automation improves the lifestyle of the control of the home devices.

As the devices are filling the home, the home appliances are filling the homes to improve the comfort to the user. Here we are using FPGA as controller to control the devices connected to it. We are using the android mobile for speech recognition. We are using the FPGA other than the micro controller because we can connect many devices which can be monitored and the FPGA can be used as a controller or a processor[5][6]. The enormous development in present day developing innovation, people are adjusted to these innovations from multiple points of view. communication means sharing information from one point to another point. It can be done in two ways ,wired communication and wireless communication. Wireless communication plays a dominant role in present scenario because of its high security and easy accessibility. Monitoring and controlling home appliances can be done usingTo perform extensive literature survey and component selection[7][8].

- To design and develop Home automation framework.
- To utilize FPGA and VHDL programming in creation of application.
- To control home appliances using android application as a part of mobile phone.
- To analyse the proposed system systematically to identify the characteristics of system.

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II. PROBLEM SPECIFICATION

In the proposed methodology we are using FPGA as the processor for the system. FPGA is a computing device. An FPGA uses a grid of electronic Logic Modules which contain bundles of Logic Gates. A microcontroller contains a CPU that executes instructions one at a time but it cannot run two simultaneous instructions. The FPGA allows you to make connections between the logic modules to make up complex processing logic.

BLOCK DIAGRAM

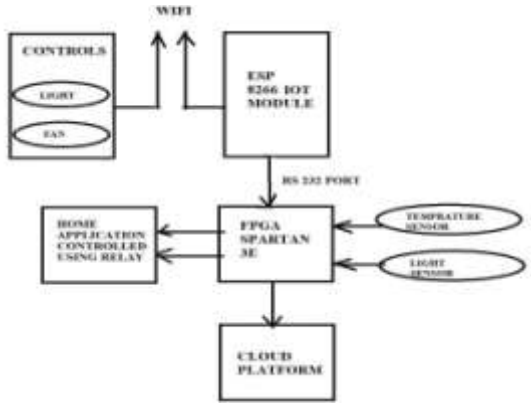

Fig .3 : Proposed Block Diagram

In our proposed home automation framework, home appliances are controlled using android application in mobile phone.

User will be presented with various controls via the android application. Upon clicking a particular control option like an option to turn off the ceiling fan a signal is sent wirelessly.Wireless communication is established between android phone and IOT module ESP8266 through WIFI.

The wifi module is connected with the same network as android phone.

Fig .4 :XILINX Spartan 3E XC3S500E

IOT module is connected with FPGA using RS232 protocol. Using the data received from ESP8266, FPGA will process the input signal according to the VHDL coding. Bit file consisting of output actions according to input must be downloaded into the FPGA board. The FPGA will then perform the action specific to the input.

III. IMPLEMENTATION

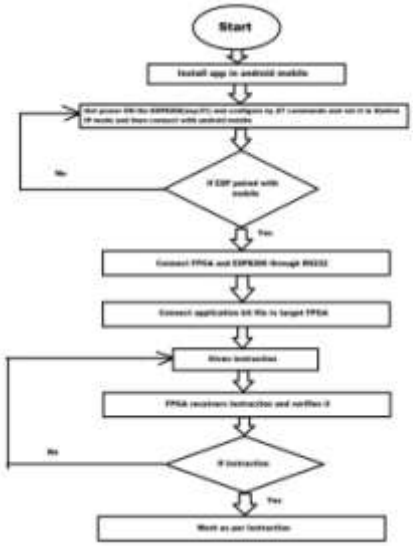

Fig 5: Flow chart of the proposed system

IV. RESULTS

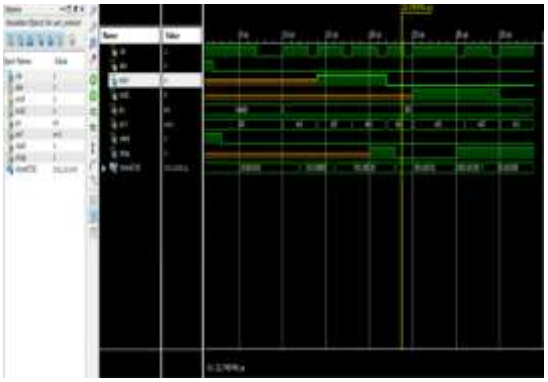

Fig .6 : Simulation Result

LED 1 and LED 2 are considered output variables. Vhdl code used processes the 10 bit Input from UART port.

UART frame (10bits)-Start bit - 1bit Store[7:0] - 8 bits (Data) Stop bit - 1bit

After processing UART input frame the required action is enforced.Output variables simulate home appliances.

V. CONCLUSION

The design of home automation framework using FPGA is achieved after carrying out a detailed study on every selected component. Use of FPGA is beneficial in the proposed system because of parallel processing feature. It can process several input channels of information like many simultaneous A/D channels or control several channels at once.

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