Journal of Advances in Science and Technology
Vol. 12, Issue No. 25, (Special Issue) December-2016, ISSN 2230-9659

Microcontroller Based System Designproteus Simulation for Enhancing Designing Skills

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Abstract – Today's embedded world uses variety of microcontrollers as the heart of processing. Microcontrollers are one of the most important tools for solving engineering control problems. Several microcontroller programming and electrical circuit simulation software packages are available for industrial and educational use. These software packages allow the user to develop and test the complete microcontroller-based designs before the construction of the physical prototype. The proposed paper demonstrates the potential use of two software for microcontroller programming (Keil) and electrical circuit design and simulation (Proteus VSM) to enhance the designing skills. This paper elaborates the working and simulation of microcontroller based design before hardware implementation for the embedded system designers.

Keywords- Embedded System, Proteus, Keil, Microcontroller

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1. INTRODUCTION

An embedded system is defined as the computational system with software embedded into hardware to perform a particular task in the specified time. Designing an embedded system is a major challenge to the designers and experiment learning is an important link in learning activity [1].

In the recent years, the phenomenal growth in the design of embedded system has been observed at chip level, micro architectural, application level and system level, thus increasing the challenge to the embedded system designers. In this paper we focus on designing an embedded system using microcontroller as the heart of the embedded system and application specific circuitry. The continuous growing number of applications results in the design technology to support a unified approach for designing future embedded system. In this context we have proposed Proteus-a simulation platform [2-3], a tool in enhancing the design practice for microcontroller based systems. We hope this paper will aid the researchers and designers in the field of embedded system.

The paper is organized as follows: the section II provides mixed simulation platform using Proteus, section III describes the overview of Proteus and section IV focuses on Experiments and results.

II. MIXED SIMULATION PLATFORM BASED ON PROTEUS

We design the required models based on the learned content of the specification of the design at the first stage. These models were allowed to be designed in corresponding simulation environment and device the proper circuits according to the optimized model in the Proteus to observe the response by setting the appropriate parameters of the circuit in the simulation environment.

We realize the system in the actual experiment platform and observe whether actually we can achieve the requirements or not. Our intension is to acquire the basic skills of designing and possess analyzing attitude the simulation environment. This platform helps us in understanding the basic theory and also to find the difference between the actual working model (system) and the theoretical model of an embedded system. We have developed the designing skill required for a small scale embedded system designer using the mixed simulation platform based on Proteus.

III. OVERVIEW OF PROTEUS

Proteus (Processor for Text Easy to Use) it is mainly circuit level simulation [4]. The platform is mainly used in simulating the courses such circuit analysis,

analogue circuit, digital circuit, microcontroller embedded system.

Microcontroller is one of the most important components in designing a small scale embedded product. Due to limited fund and hardware experiment resource, we cannot have enough chances to exercise it on the hardware and verify its functionality. This platform of simulation would be a boon to the designers as it avoid the waste of execution time and as well as the resource in the development of the embedded system. If we use the simulation/emulation as the auxiliary experimental means, it will greatly promote the understanding of microcontroller based systems.

With the aid of Proteus VSM [5], the designers as beginners can develop and test application systems before physical prototyping. The virtual lab [6] obviates the need for expensive hardware and allows us the freedom and flexibility to design and develop microcontroller solutions without the need of the physical prototype.

IV. EXPERIMENT

Project 1: Interfacing of input devices such as keypad.

Keypad is a widely used input device with lots of application in our everyday life. From a simple telephone to keyboard of a computer, ATM, electronic lock, etc., keypad is used to take input from the user for further processing. In this article we are interfacing keypad with the MCUAT89C51 and displaying the corresponding number on LED as shown in Figure 1. This module can be further used in a number of systems to interfaced keypad with microcontroller and other processors to fed desired input. The program to interface keypad with microcontroller is written in C language in Keil IDE software [8].

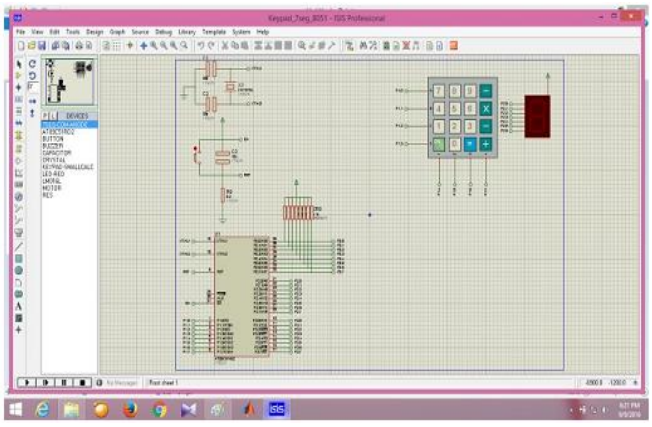

Figure.1. keypad interfacing

Project 2: Interfacing of output device such as LCD.

LCD (Liquid Crystal Display) screen is a display module and a 16x2 LCD module is very commonly used. These modules are replacing seven segments and other multi segment LEDs for these purposes. LCD can be easily interfaced with a microcontroller to display a message or status of a device. This topic explains the basics of a 16x2 LCD and how it can be interfaced with AT89C51 to display a character as shown in Figure 2.

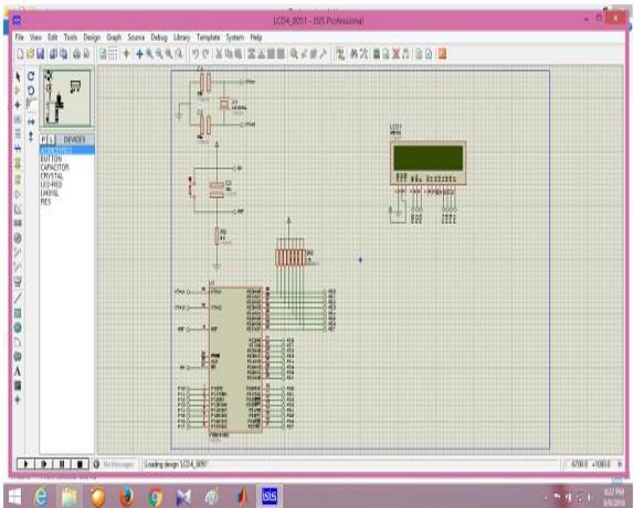

Figure.2. LCD Interfacing

Project 3: Interfacing of monitoring unit such as LED blinking.

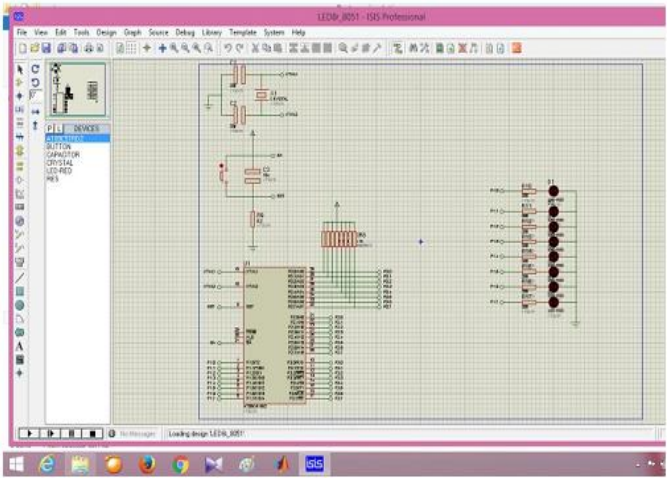

Figure.3. Simulation of LED

In this project we focused on building a monitoring unit as it is very important feature in embedded system. Figure 3. Shows interfacing of LED blinking simulated in Proteus.

Project 4: Interfacing of DC motor and stepper motor.

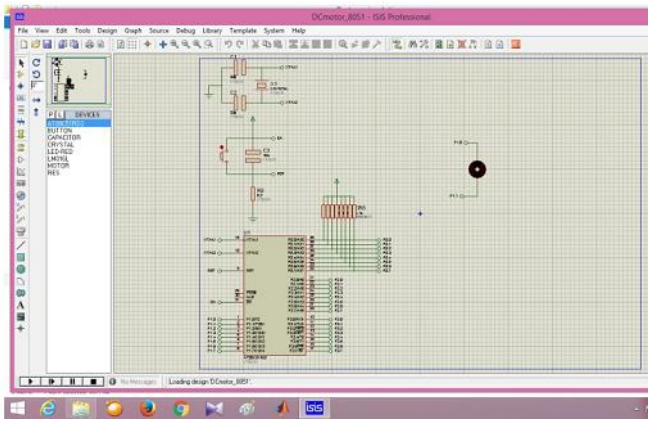

Figure.4.1. Interfacing of dc motor

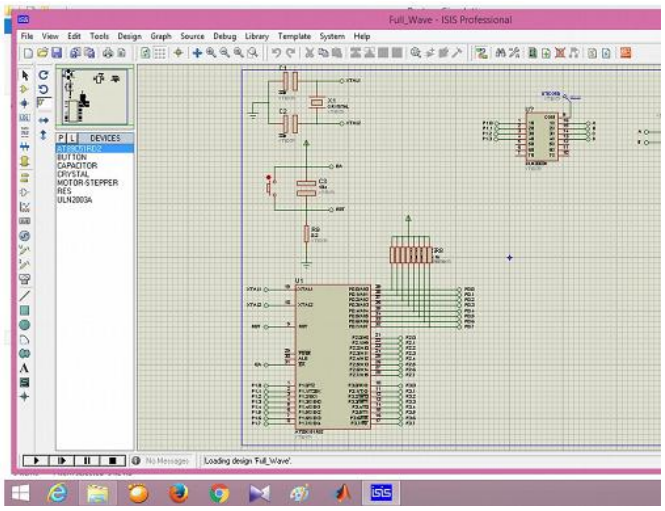

Figure.4.2. Interfacing of stepper motor

Figure 4.1 and 4.2 shows interfacing of dc motor and stepper motor using Proteus. This project enhanced our designing skill for interfacing and controlling the speed of motors, and developed confidence in building an embedded system.

Project 5: Interfacing of buzzer

As a part of enhancing the skill in designing of the alarming unit, we have developed a project, where in the buzzer was interfaced as in Figure 5 and in the simulation environment we could buzz the alarm. This is very important for a monitoring and control unit of an embedded system.

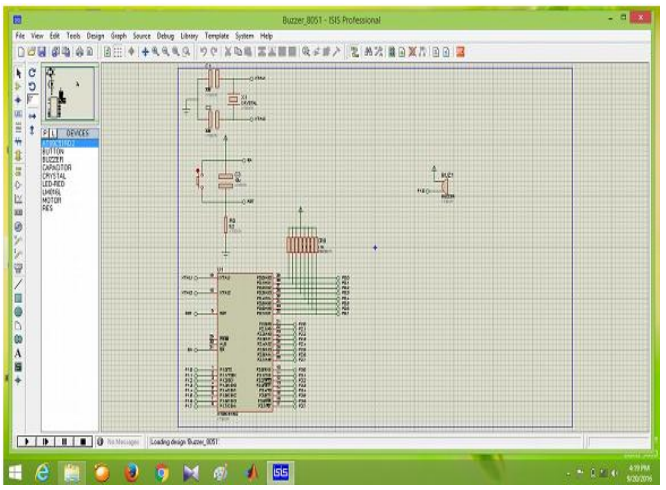

Figure 5.The interfacing of buzzer.

Project 6: Interfacing of RTC using I2C As shown in figure 6, we have developed a Real Time Clock on LCD using the I2C (Inter Integrated Circuit) communication protocol to demonstrate the real time embedded system. This kind of simulation is also called real-time simulation and has aided in the understanding of real time functionality.

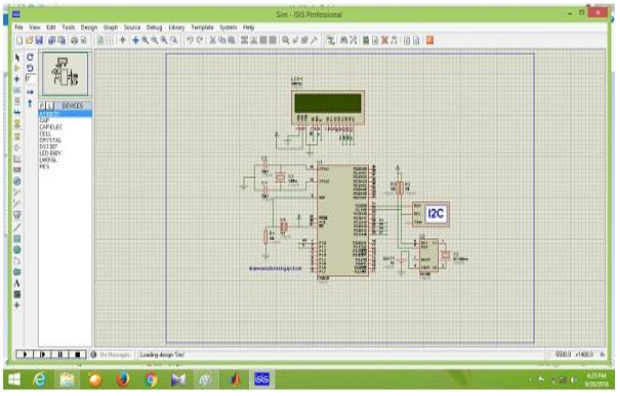

Figure.6. Interfacing of RTC

V. CONCLUSION

From the above examples, the conclusions could be drawn that establishing a simulation platform by Proteus on a computer can easily build all kinds of experiment models, in addition to carry the simulation and test to the embedded system. The mode of virtual experiment combined with practical experiment may not only enable students to master basic theory and skills of electronic technology curriculum, but also give full play to the initiative, and ultimately enhance the student's practical ability and scientific innovation consciousness. It plays a very important role in updating experimental method, improving the quality of understanding circuit courses, and optimizing the effect of learning. We are planning to work on other software platforms like LABVIEW & MATLAB.

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