Digital Logic & Design

LAB PROJECTS

Fall-2023

INSTRUCTIONS

These projects aim to a better understanding of the Labs and the practical aspects of Computer Logic Design.

Group Members

Students can work in groups of two members. Every group member must contribute equally (would be judged by the demonstration). No group with more than two members is allowed.

Equipment

You are to purchase all the components, required in the project, yourself. No apparatus will be issued by the Lab. Labs can be used in the free time for testing and debugging of your circuit. Debugging your circuit is not the responsibility of your lab instructor.

Don't use Decade ICS, Arduino and shift registers for your projects that will result in 50%-mark deduction in your projects. Try to use different types of gates for creating the circuits and avoid the use of direct IC.

Project Report

You've to submit a Project Report including; implementation details, proteus circuit diagram, and components used. The report should be no more than ten pages and no less than five (use standard formatting).

Evaluation

The project grade will contribute 30% of the Lab's final grade. Your project will be evaluated on the following metrics.

Neatness, Implementation, Design, Report, and Demo.

Due Date

GROUP AND TOPIC Assignment Date: 17-November-2023

Report and Proteus Submission: 5th December

DEMOs: TBA

Projects

Each group will be assigned any of the following projects by their lab instructors.

- **Traffic Signal:**

Design an LED-based Traffic Signal Generation Circuit for an intersection using clocks and timers. The signal should be implemented at an intersection of 4 Roads. Red, Yellow, and Green LEDs are to be used for Stop, Ready, and Go signals. Each Signal is to be opened for a specific time and the time of opening should be adjustable.

- **Digital Clock:**
  Design a clock that displays time on seven-segment LED displays using Counters and 555 Timer. You should implement Hour, Minute, and Second displays. One push button should be used to start/stop the digital clock. Your circuit should be able to set time to any particular starting value and also reset the time to zero.

- **Random 6-bit Number Generator:**

  Every time a new/random 6-bit number should be generated and displayed both in decimal and binary codes. Show output on seven segment displays.

- **Security System:**

  A seven-door (5+2) security system is to be implemented with two doors being the Main Gates. If all the doors are closed no alarm/output should be triggered. If any of the inner doors or main gates are opened (one at a time), its LED Indicator should turn Green with the Door number displayed on 7-the segment Display. If any of the main gates along with any of the inner doors are opened at the same time, ring an Alarm Sound. A physical buzzer is to be implemented making a buzz sound.

- **Tic Tac Toe Game:**

The aim is to design a tic tac toe game, with logic Ic's only. Dual color LEDs should be in place, RED should denote player1 and Green should denote player2. A player should not be able to override another player's move. For example, if player 1 selects the first cell, player 2 should not be able to select the same cell again. Players should have the ability to reset the game at any point. Once a player wins, the "result" state should be locked. i.e. If player 1 wins first and then player 2 makes a move and satisfies the winning criterion – the output should show only "Player 1" as the winner. If all the switches were pressed or if there is a draw situation – a separate LED should glow.

- **Whack-a-mole Game:**

This is an interactive game that, is often played in carnivals and circuses. The game consists of a number of "moles" which are animals that pop out of a box, in which there are a lot of holes. The mole popping is completely random. There is a timer in the game, which determines when the game has to end. The objective of the game is to "whack" the moles using a large hammer. Whacking a mole gives the player one point. When the timer runs out, the score is displayed. The game starts when the next coin is inserted.

The game is implemented using a set of 8 LEDs that represent the moles. The LEDs will flash randomly, and the corresponding tick button must be pushed at the instant to register the score. There is a timer of 30 seconds which is being displayed along with the score counter. When the timer reaches zero, the game stops, and a buzzer turns on for 1.25 seconds to indicate the end of the game. The game is restarted using a switch button. The switch button allows you to reset the game and also to start it. When the game hasn't started, the moles do flash randomly but the scoring is not registered. The scoring is only done when the button and the corresponding LEDs flash at the same time.

- **Water Tank Control Mechanism**

A water tank fill-up and overflow control mechanism with alarm. A circuit needs to be designed that displays the present level of water in the tank. The circuit also opens an outlet valve when the level in the tank exceeds a particular level, and finally opens the inlet valve when the water in the tank falls below a particular level.

- **Scoring game circuit**

A simple scoring game circuit that can be used for all occasions when a dice is needed. The circuit is based on a timer, a counter, a decoder, and a 7-segment LED display.

- **Chip Tester**

The circuit must determine whether all 4 gates on three specific types of quad-gate chips work (choose types from 7400, 7408, 7432, or 7486). If all 4 gates on the chip work perfectly, for all 4 possible input conditions, then an “OK” light comes on. If any of the 4 gates fails to function for any of the 4 possible input combinations, then a “BAD chip” light comes on**.**