Experiment No. 2
Finite State Machines
ECE 213

Peter Chinetti

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Instructor:	Professor Shanechi

1 Introduction

2 Theoretical Background

2.1 Purpose

This experiment will build a Finite State Machine. Specifically, a blinker appropriate for a automobile will be designed and built.

2.2 Background

According to Wikipedia, 'A finite-state machine (FSM) or finite-state automaton (plural: automata), or simply a state machine, is a mathematical model of computation used to design both computer programs and sequential logic circuits. It is conceived as an abstract machine that can be in one of a finite number of states. The machine is in only one state at a time; the state it is in at any given time is called the current state. It can change from one state to another when initiated by a triggering event or condition; this is called a transition. A particular FSM is defined by a list of its states, and the triggering condition for each transition.' In this case, the states are stored as values in flip-flops while the transition is generated by a clock pulse.

3 Lab Procedure and Equipment List

3.1 Equipment

- Digital Multimeter

- Function Generator
- Power Supply
- SN74LS08
- SN74LS32N
- SN74LS175N
- Protoboard

3.2 Procedure

3.2.1 Turn Signal

The Turn signal was built in sections. First, the equations for flip flop inputs was determined. They are:

- $D_0 = (\bar{L}R)(\bar{Q_2}\bar{Q_1}\bar{Q_0}) + (LR)(\bar{Q_2}\bar{Q_1}\bar{Q_0}) = (R)(\bar{Q_2}\bar{Q_1}\bar{Q_0})$
- $D_1 = (Q_2\bar{Q_1}Q_0)$
- $D_2 = (\bar{R}L)(\bar{Q_2}\bar{Q_1}\bar{Q_0}) + (LR)(\bar{Q_2}\bar{Q_1}\bar{Q_0}) = (L)(\bar{Q_2}\bar{Q_1}\bar{Q_0})$

This is fairly straightforward to implement. Simply construct gates to implement the functions above and the flip flops will assume the values required by the FSM design specification. Flip flop clock input is connected to a square wave output on the function generator with $V_{min} = 0v$ and $V_{max} = 5v$.
The only further difficulty is designing a method of input and output to the FSM.
Input was handled by connecting one side of a dip switch, then connecting the other side to both the gate input and through a 1K Ω resistor to ground. By tying through the resistor to ground, the time where the input of the gate is in an undefined state can be minimized. Output was handled by connecting a LED to the output of the flip flops, then conneting the other side of the LED through a current limting (330 Ω) resistor.

4 Results and Analysis

The FSM operation was verified to the Teaching Assistant in the lab. There are no additional results to present.

5 Conclusions

This experiment was accomplished. The FSM was built. Through building the FSm, other designs arose to solve the problem of input/output. This lab achieved its goals.