

EC316: Microprocessor Project

Tic-Tac-Toe against the 8085 Microprocessor

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Synopsis

The primary objective of our project is to create a hardware implementation of the game 'Tic-Tac-Toe' with the facility of playing against the 8085 microprocessor. The microprocessor will algorithmically analyse the state of the game and pick the most optimum move so as to ensure that it always wins or draws. We intend to use the Minimax algorithm to determine the moves picked by the 8085. This project aims at highlighting the decision-making capability of microprocessors. Additionally, a separate mode for player-versus-player games will be provided aswell.

Keywords: Minimax Algorithm, 8085 Microprocessor, Game Theory

Date: January 2018

1 Introduction

1.1 Motivation

Tic-Tac-Toe is a game which we have all played at some point in our life and its sheer simplicity contributes to its widespread adoption, making it one of the most popular pen and paper games. The EC-316 course provides the perfect platform to give our beloved game a concrete form. The notion of computer intelligence is one that has always intrigued us and we aim to demonstrate with our project how even a microprocessors from the 70's can be programmed to be unbeatable.

1.2 Justification

Why choose this project? For starters, just the rapid re-usability of the board makes it great for playing Tic-Tac-Toe. However the heart of our project lies in the usage of the Minimax Algorithm to play against a user. This project demonstrates one of the most basic forms of artificial intelligence, a computer which is able to make decisions about which move to make.

2 Description

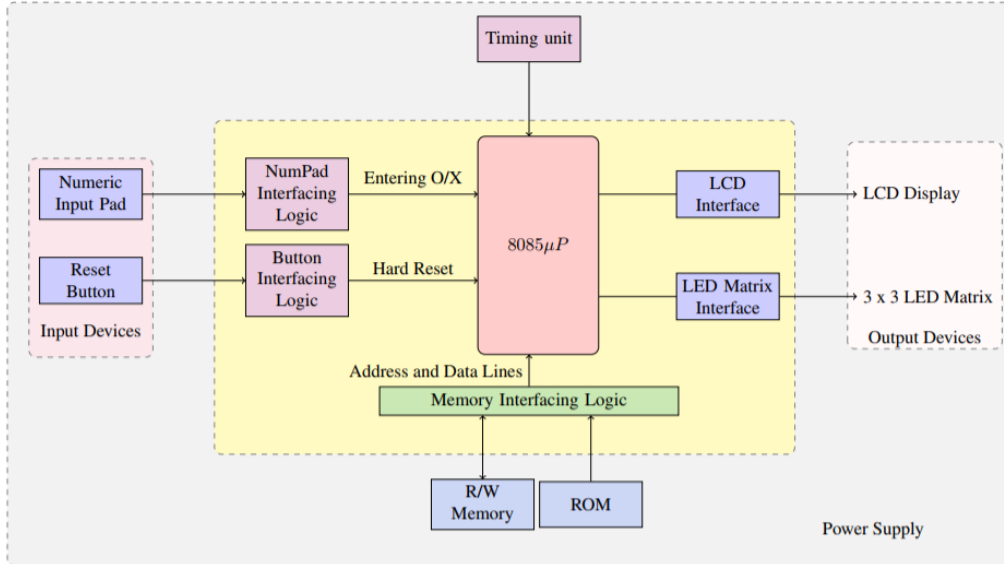


Figure 1: Block Diagram Representation of Proposed Model

Tic-Tac-Toe is a simple two-player game played in turns where each player places their mark on a 3x3 grid with the goal of having three consecutive marks in either the horizontal, vertical or diagonal direction. The game can end in three possible states of either winning, losing or drawing. We aim to construct the hardware implementation of this popular game with the facility to play against either another player or the 8085 itself. We intend to take user input using a re-purposed numeric keypad and instead of placing a mark, an LED of a specific colour is lit instead, representing either *O* or *X*. The state of the game will be displayed using a 3x3 grid of bi-colour LEDs and a 16x2 character LCD will be present to provide textual information about the game status. The block diagram representation of the proposed model is shown in Figure 1.

3 User Interface

Broadly, the *Input Devices* to be used in this project are a Numeric Input Keypad and a Reset Switch (Tactile - Momentary action). The numeric Input Keypad's numbers 1-9 are mapped to the 9 LEDs which represents the Tic-Tac-Toe matrix. On pressing the corresponding Num-pad key the user can mark on his/her turn *O* or *X*. While, the *Output Devices* used in the project are a Liquid Crystal Display (LCD) and the 3x3 LED Matrix. The LCD Display will be used to prompt the user regarding initial settings and also be used to maintain a score tally. Here, a 3x3 LED Matrix is composed of bi-colored LED matrix and is used to display the current state of the game. The detailed flowchart for the user-interface is given in Figure 2.

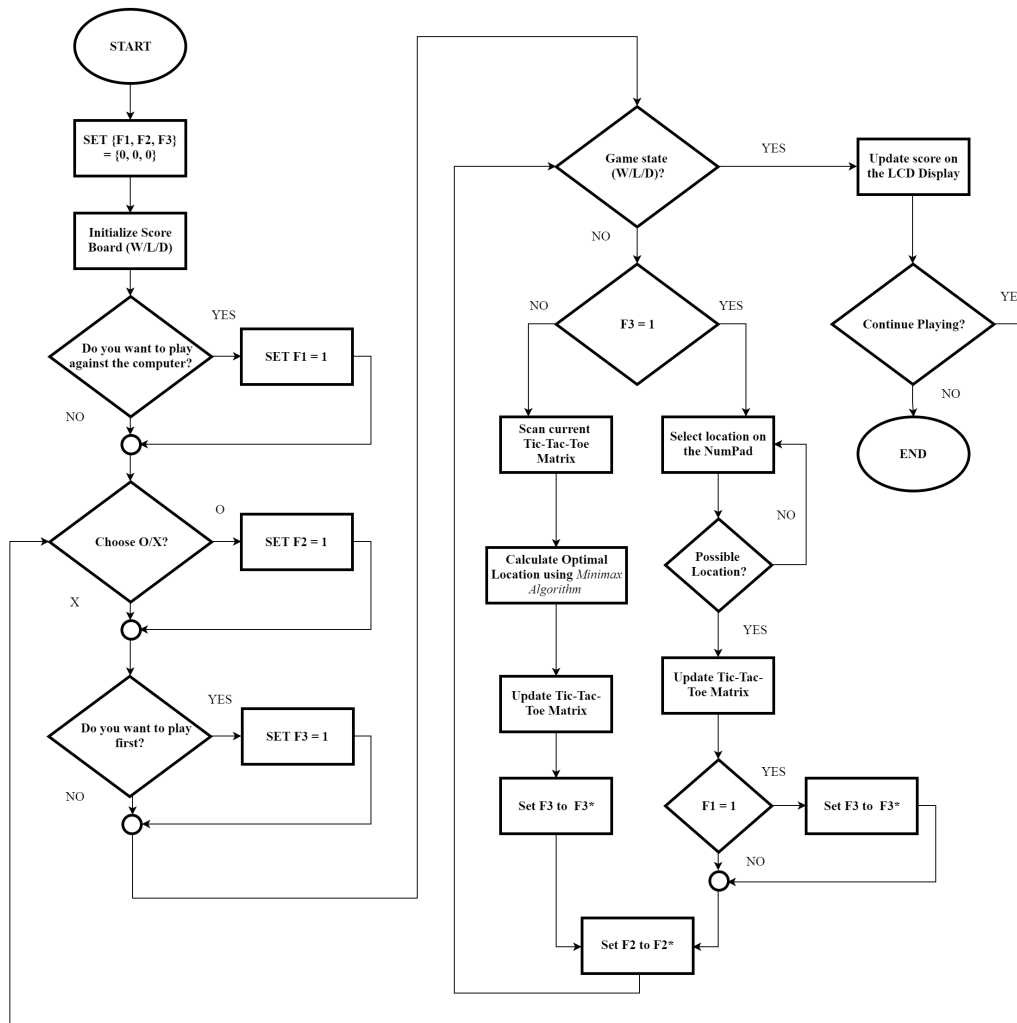


Figure 2: Flow Chart

4 Gantt Chart

The project duration is 16 weeks, starting from January 1, 2018 till April 30, 2018. The detailed distribution of the tasks using Gantt Chart is shown in Figure 3.

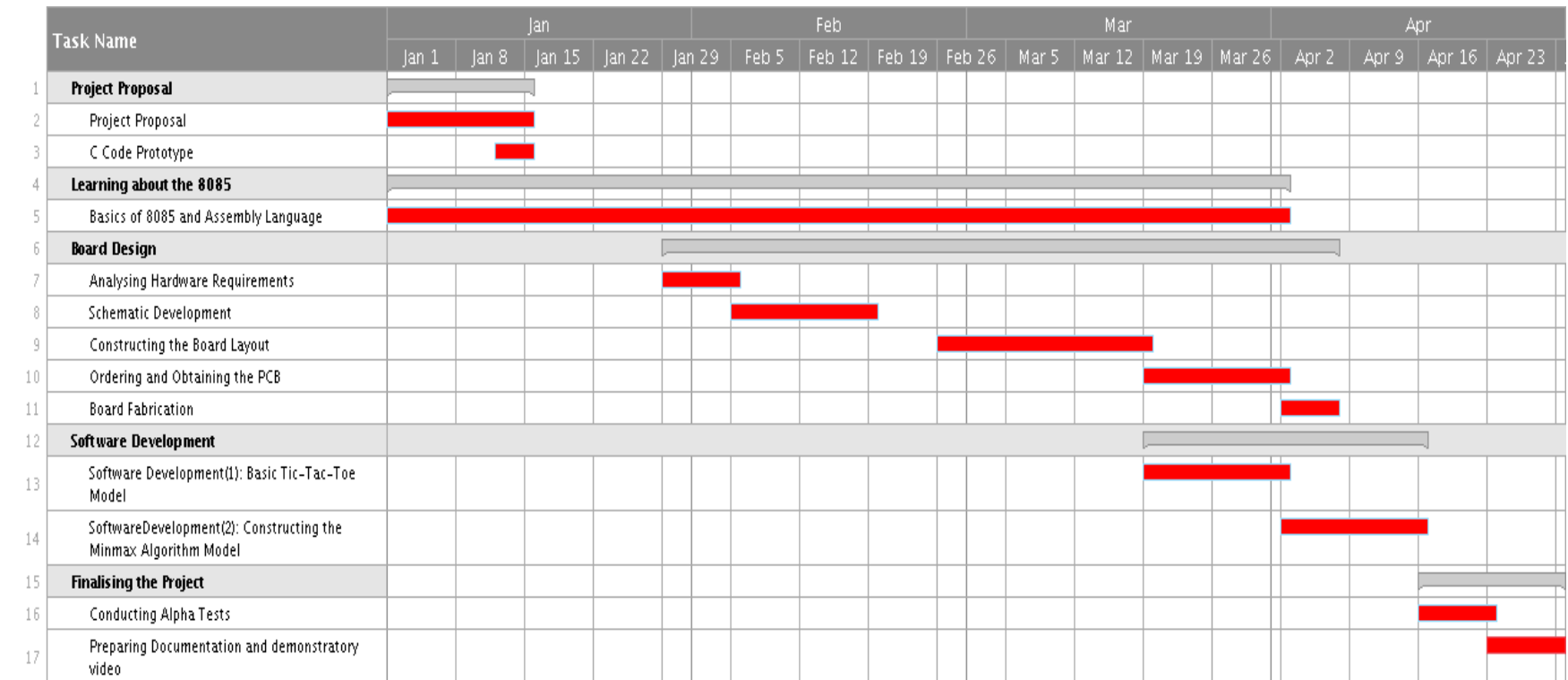


Figure 3: Gantt Chart

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