COMPUTER SCIENCE AND ENGINEERING
CSE497 ENGINEERING PROJECT I
PROJECT SPECIFICATION DOCUMENT

TURKISH WORD GAME

01.12.2014

ÖZLEM ULAĞ-150110063
DİLEK DÜNDAR-150110853
BARIŞ GÜN SÜRMELİ-150112827

Project Adviser : Assist. Prof. Ali Haydar Özer

1. Problem Statement

The scope of the project is to work on “Artificial Intelligence” subject in a word game which is based on the well known board-word games. The main idea of the game is generating new words by individual letters that player has and place on board where the each word has at least one contact to another one. The application is planned to provide human versus human or human versus computer game modes, so should provide a strong artificial intelligence to check the possible words depending on status of game and generate the ones that evaluates most points.

2. Problem Description

Artificial intelligence (AI) is the intelligence exhibited by machines or software. It is a field of study which has the goal of creating intelligence. There is a very wide spread area that artificial intelligence studies are involved. Machines or softwares that can make their decisions depending on the situation they are in could help people in lots of complex tasks. Some applications of AI are; general machine intelligence, conversational behavior, data-mining, automated assistants that help people in processes, games with virtual players that can compete with human such as board games, where this project is an instance.

Mostly, the challenging part in board games is that the game forces the person to think deeply who plays the game to do the best move. The crucial point of this project is to create a virtual player that imitates the way that human thinks with an artificial intelligence. Since the human behaviour is too complex, the task is not easy and very interesting. For example, in this game’s scope, choosing the best word option with the most points is might be not so hard for the computer, but choosing a commonly used word that a human would play might be hard. Thus, the use of this project is to work on an instance of artificial intelligence problem and develop its solution algorithm on this game.

The planned route is firstly develop a user friendly graphical interface, apply the rules of the game, connect on network to enable multiple player. Then lastly implement the artificial intelligence based search and processing algorithms which is going to search for the words that evaluates to maximum points. The plan also contains the implementation of the expect minimax algorithm which guesses the opponent’s move and generate words depending on it.

The game consist of letters, bag that contains the letters, trays and board, each player has a tray and seven letters in their trays. There are pockets on the board for letters to be placed. In the move, player should generate a word from their letters and place it in the middle of the board, and then next player's turn, a word should generated where at least one letter of the new word has to be next to a letter and for vertical and horizontal lines, all letter combinations should produce a

word. After each move the points of the move is calculated by the values of letters of the new words generated and letters that are on bonus pockets. The game goes so on. When there is no more letter in the bag, the game is over.

3. Aims of the Project

- Provide a well designed, consistent, user friendly graphical interface for the game.
- Produce a word game atmosphere with all it's individuals such as letters, board vs.
- Apply all the rules of the word game to the application and the constraints for a move.
- Provide human versus human multiplayer option via network.
- Develop artificial intelligence based search and process algorithms for searching a word to play that is legal in the scope of rules.
- Implement an expect minimax algorithm for playing depending on opponents move.
- Make the artificial intelligence have a human like success of play, which is not just the best word possible to play.
- By these, have more ideas of artificial intelligence topic, see what are the challenges of implementing such a program.

4. Related Work

There are some mobile applications which presents the same word game with the same rules, they provide human versus human game mode, not an artificial intelligence. These games have very well designed graphical user interfaces, they are easy to play and optimized. They come with a robust networking system which enables fast peer matching and synchronous play. Player can have several games on progress and switch between them easily. Some of these applications are very famous and has a big community playing, either in Turkey or other countries.

There are some "free software" applications also on the internet which might be without or with artificial intelligence which are with robust algorithms that enable the computer to compete with the human player with reasonable moves. But generally does the very best move, which makes the artificial intelligence unbeatable. They come with a little more plain user interface which might be due to the applications are not non-profit.

The plan of the project is to contain all this features and add some more if there will be enough time.

5. Scope of the Project

The scope contains a well designed look of which consist of gameboard, word tiles, tray of the player and buttons. The game board consists of the pockets that tiles are going to be placed and the tray consists of the letters that player has. The plan is to load the board as an image from memory but draw the tiles to the screen separately at each refresh of the screen. Grabbed tiles are going to be highlighted.

The tiles are going to be dragged around by player with mouse, and problems such as at which positions could tiles be placed on board or tiles that dropped on another tile are planned to be handled. Tiles should slide near if they dropped on a pocket already in use, and they should slide to the closest other pocket. The player should also be able to change his letter tiles in his tray to try combinations of words. To provide this, tiles should shift if one of the tiles is dropped between two other tiles.

Game board, tiles, bag that contains the tiles, players and buttons are all will be implemented as individual objects. Buttons will be mainly; play, shuffle and quit, where play will be making a move, shuffle is shuffling the words in the player's tray and quit is simply end the current game session.

When the play button is played, there will be several actions taken by the program; the word that is generated by the user will be checked if it is in the dictionary database, if it is, then the word is accepted and played tiles will not move again, if it is not in the database then the word is not accepted, the tiles will be put back to player's tray. If the word is accepted then there will be evaluation of points that player get from that word depending on the points on tiles and if there is tiles on the bonus pockets. As the game goes, the tiles in the bag will decrease, and when there is no more tile in the bag, game ends.

The scope covers a robust artificial intelligence feature which enables having a competitive human versus computer playing mode, including to find the words that is possible to generate with the letters that are owned. It will choose the word that evaluates the most number of points by:

- Using the letters that has the biggest values,
-Checking the pockets that contains bonus actions like: double the point of the word, triple etc.
-Checking possible multiple words to be generated in only one move.

Expect minimax algorithm will also be featured, which will enable computer to move depending on the opponent player's possible moves such as; it will not make a move that gives the opportunity to use very easily the bonus tile that triples the word's point.

Difficulty will also be provided to not to make the computer to impossible to beat, for example; depending on case it should choose one of the best moves, but not the exactly the best.

Human versus human game mode is covered via network, the players will also be able to play multiple games with multiple players in the same time.

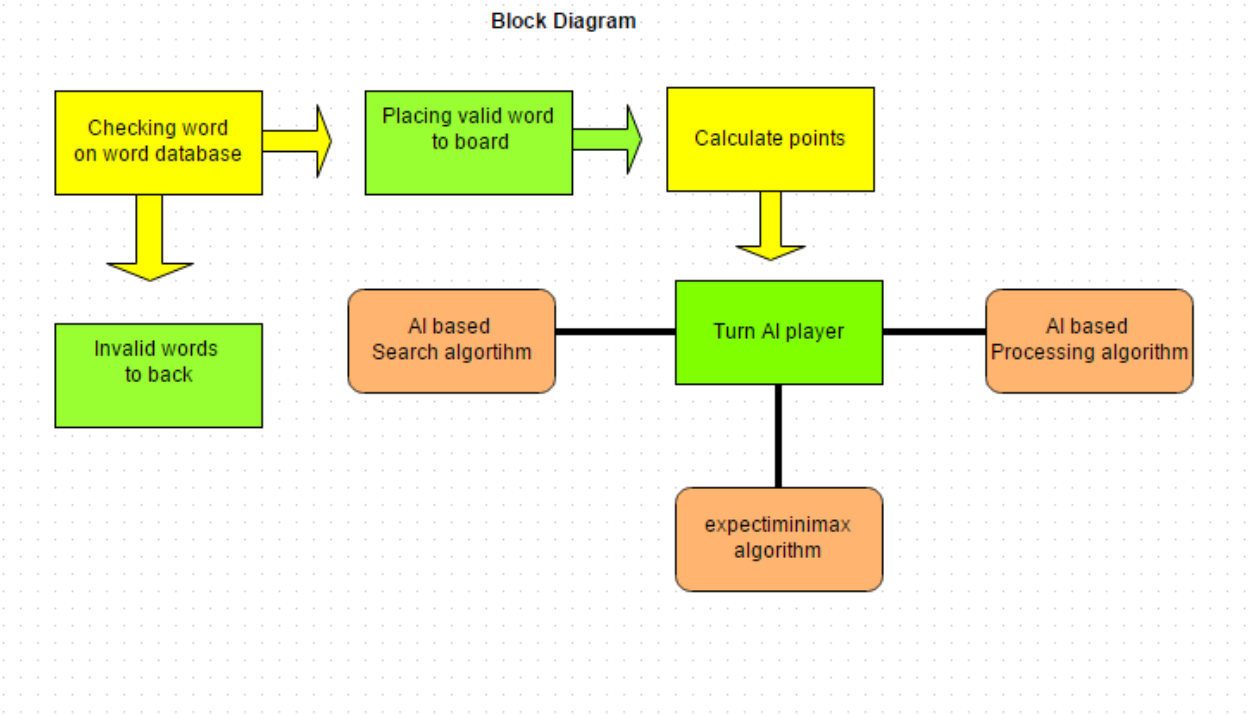
If time will be enough, adapting of the application to a mobile platform will be covered.

6. Success Factors and Benefits

The project meets the goals if people are able to play this game against the computer like they are playing against a human. That means the computer can play the game, it will generate an appropriate word by thinking to get maximum points and it has to obey the rules of the game like a human. The computer will imitate human-like behaviour so it will not this game not perfectly, not just the best option to play. Additionally the computer will make a move depending on opponent's move, it will think the options to play with thinking its profit for game.

This project will be a solution approach to similar AI problems. When the project is completed, it will help to think how the computer acts like a human , how it thinks. By these, enlightening about the ideas of artificial intelligence topic, seeing what are the challenges of implementing such a program are expected. The people that are interested in artificial intelligence topics, especially ones that wonder about the state of the artgame programs can examine this project after it's successful completion to have an idea about the AI behaviour in such a game. Additionally, this project will give an idea about some AI algorithms like searching, processing and expect minimax and their usage.

7. Methodology and Technical Approach



Resources:
-Python Programming IDE
-Turkish word database
-Network connection
-Some softwares like Paint to prepare graphical user interface
-Windows platform

Algorithms:
-AI based search and processing algorithms
-expectiminimax algorithm

8. Management Plan

Description of task phases:

1.Requirement Specification: Having information about the game and game rules such as board size,tile points,bonus points on board.

2.Research similar apps: Searching for the similar applications on web and mobile

3.Study on Python Programming Language: Python programming language should be studied by group members to implement this game

4.Design Specification:

4.1.Universal GUI Design: Design a user friendly graphical interface

4.2.UML Diagram: Design a UML diagram to show the relation between game entities such as Board,Tile,Menu,Player vs.

4.3.Database Schema: Prepare a Turkish word database

5.Implementation:

5.1.GUI: Implementation of game board,tiles and game menu

5.2.Mouse action events: Enable to move tiles with mouse drag event and put tile either on board or tray

5.3.Check of valid move: Playing the game and control of valid word in Turkish word database

5.4.Apply the rules: Put the game rules(point of tiles, bonus points on board,distribution of tiles to players)

5.5.Provide network connection: Provide a network connection to enable multiplayer human versus human game

5.6.Human versus human game: In this phase the human can play this game against a human

6.Maintaining changes: Maintain if there is any changes on requirements

7.Research on AI programming: Research on AI programming

8.AI programming artgames: Research on general AI artgames samples

9.AI based Search algorithm: Research on AI based search algorithm to search words on database

10.AI based processing algorithm: Reserach on AI based processing algorithm to generate words

11.expectiminimax algorithm: Research on expect minimax algorithm for playing depending on opponents move

12.Adding AI player: Implementing artificial intelligence

13.Human versus Computer game: At the end of this phase the human can play this game against computer

Division of responsibilities and duties among team members:

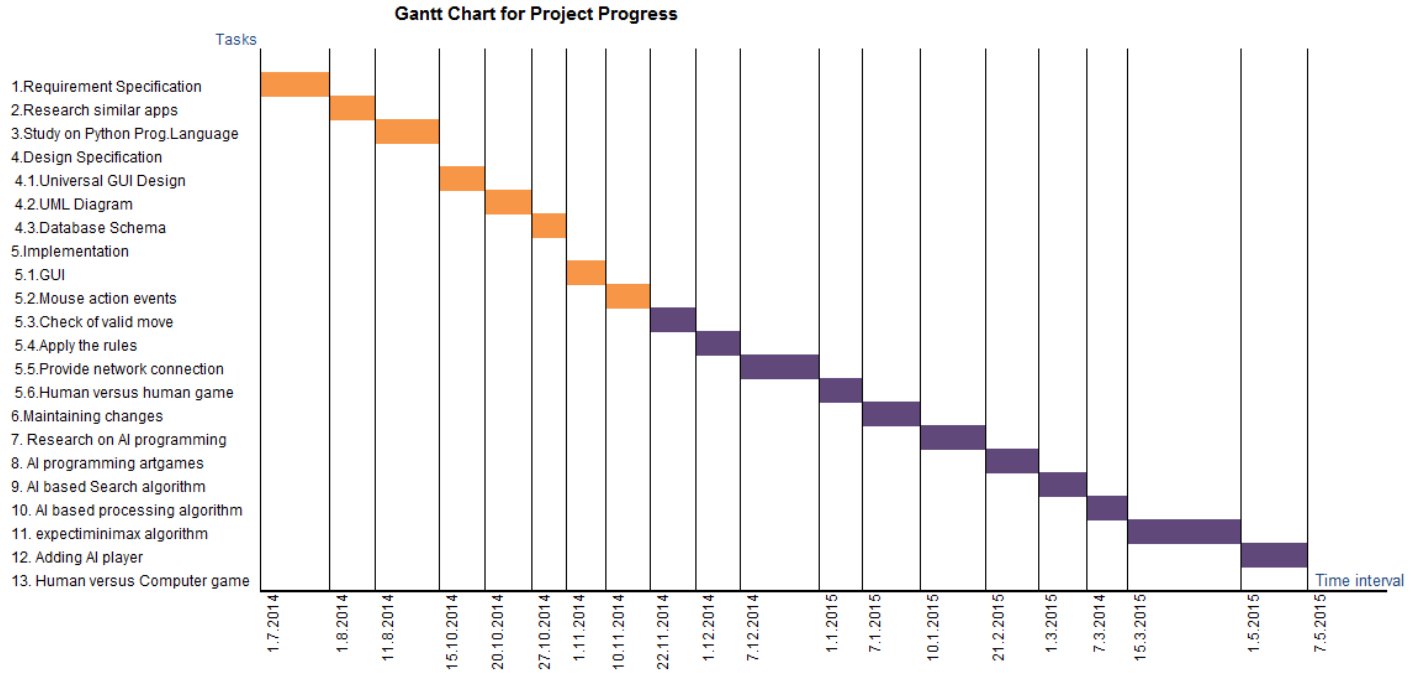
1.Work-Completed

Task 1-2-3 and 4 is completed by all team members.

2.Work-Sharing Table

Team Members	Tasks
ÖZLEM ULAĞ	**5.3 - 5.5 - 5.6 - 6 - 9 - 12 - 13**
BARIŞ GÜN SÜRMELİ	**5.2 - 5.5 - 5.6 - 7 - 10 - 12 - 13**
DİLEK DÜNDAR	**5.4 - 5.5 -5.6 - 8 - 11 - 12 - 13**

Timeline with milestones



Risk Management

The one risk that may encounter through the project is the computer can play the game excellently, it generates the words by providing maximum points, it chooses the best option to play. In this situation we should adjust the level of the difficulty so the computer will play the game on human level.

9. References

- Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig
-
- http://www.istihza.com/
- https://www.python.org/doc/
- http://programarcadegames.com/