

Implementation of Artificial Intelligence for Best Moves using Chessboard

Priya Hajari ,Raakhee Iyer , Ashish Patil

Smt.Indira Gandhi College of Engineering,India

Abstract: Artificial intelligence (AI) is the intelligence of machines and the branch of computer science that aims to create it. This is an application of Artificial Intelligence. Initially a chessboard with sensors are used for the playing. This is then displayed in the screen. This chess playing consists of two major parts. First, is the detecting of the illegal moves. This avoids the player from making wrong moves. Second part gives you the best moves that can be achieved while playing. The best moves can be provided for any person who is new for the chess playing. The minimax algorithm and the alpha- beta pruning is used for the best moves implementation. The Artificial Intelligence is used in the best moves implementation. This chess playing provides the above two important features.

I. INTRODUCTION:

The overall purpose of doing this is to simulate the movements being done on the chessboard, on the PC screen in real time. And to point out the illegal movement during the chess game. The tracking of the keys as well as the moves can be done in this chess game. The chess game also indicates the best moves. This also allows a non- chess player to play chess efficiently. It allows every player to play this game without any guidance of a third party. The moves can be made on the chess board and it will get reflected onto the PC.

II.BACKGROUND OVERVIEW:

A.Existing System:

Here we need to manually play the game. But using this application a player can easily play and enjoy the game at his comfort. Where two person play the chess game on the normal chess board. Here there is only the players who have to take care of the wrong movements. And to broadcast the games played we need to record the game.

B. Drawbacks of Existing System:

Traditional system of playing chess in manual, hence there is no automatic illegal move detection can be done. Moves cannot be recorded for future reference. It cannot be broadcast through Internet.

C. Proposed System:

Our proposed system will give a new future to the Chess game. The followings will be the procedure for the system...

- The hardware will automatically detect the presence-absence of coin on the board in particular cell.
- This information will be sent to the PC. The PC

software will automatically plot the graphical representation of the real chess board, virtually.

- The software will crosscheck all the movements done by the player on actual chessboard.
- Any illegal movement will be raising an alarm.
- The software can indicate best moves to the player. This software will initially construct the game tree and then later on using minimax and alpha-beta pruning we can get the best move.
- The game will also be stored in PC for future reference which can be replayed later on.

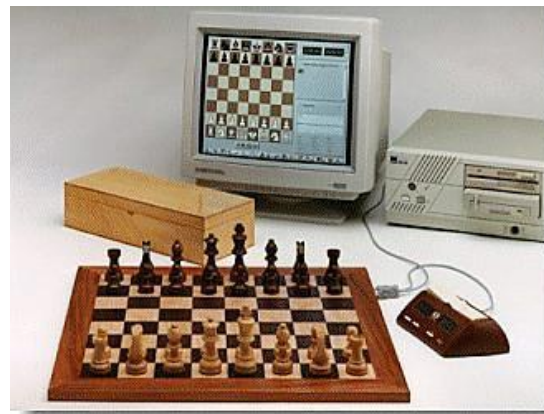


Fig.1 : Chessboard Outline

III.SYSTEM OVERVIEW:

A. Technology and Programming Languages:

As microcontrollers are the core of these days digital circuit design in industry, this system uses it for the centralized operation and digital processing. The technology used here is embedded technology which is the future of today's modern electronics.

The followings are the various Programming Languages & Technologies that are going to be used in the proposed system...

For Embedded System...

- Embedded Technology,
- 8051 Family Based Controller,
- Embedded C - Keil Compiler,
- Eagle Software for PCB Designing,

For PC System...

- VB6.0 Based Application Software,
- ASP.NET Application for GUI
- File Handling.

B. *Algorithm:*

The following steps are followed for the best moves implementation:

a. Minimax: The Basic Search Algorithm

1. Initially, assume that both White and Black plays the best moves. We maximize White's score.
2. Perform a depth-first search and evaluate the leaf nodes
3. Choose child node with highest value if it is White to move
4. Choose child node with lowest value if it is Black to move
5. Branching factor is 40 in a typical chess position

b. Evaluation function:

The evaluation function should return $+\infty$ for white's winning positions, $-\infty$ for black's winning positions and 0, if the game is a draw. The evaluation function should take some basic factors like material, mobility, development and central position into account.

The most important feature in chess is material. Material represents all of a player's pieces and pawns on the board. The player with pieces and pawns of greater value is said to have a "material advantage". Other things being equal, the player who is ahead material will usually win the game. We know that the pieces have different values which can be measured in multiples of a pawn. Standard values are as follows: pawn = 1, knight = 3, bishop = 3, rook = 5, queen = 9, king = above all values (1000 for our project).

Mobility is the total number of moves that can be made by one's pieces in a given state. One possibility to combine material and mobility: $score = material + (0.1 * mobility)$

Development measures how many pieces are moved away from their original positions. If your pieces are all "developed" (off their original squares), then they will be ready for the ensuing battle which comes in the middle game. If you are badly behind in development, then you will be not ready for the struggle. We assume that three extra development moves are worth of approximately one pawn. Finally central position measures the pieces in the center of the board. So if a player has more pieces in the center of the board then his/her opponent, he/she is more advantageous. For our project we exclude the king from this evaluation, because we do not want the king to be in the center of the board, since it should be secure.

When it is decided which features are included in the evaluation function, it is necessary to determine reasonable weightings for the features. Evaluation function takes form " $w_1 * f_1 + w_2 * f_2 + w_3 * f_3 + \dots$ " where f 's are various features and w 's are the relative weights for these features.

c. Alpha – Beta Pruning

1. Have two values passed around the tree nodes:
 - The alpha value which holds the best MAX value found.
 - The beta value which holds the best MIN value found.
2. At MAX level, before evaluating each child path, compare the returned value with of the previous path

with the beta value. If the value is greater than it abort the search for the current node;

3. At MIN level, before evaluating each child path, compare the returned value with of the previous path with the alpha value. If the value is lesser than it abort the search for the current node.

C. *Project Development and Methodology or Steps:*

The following will be development steps so as to achieve the working Prototype Model of the above proposed system...

- Defining the Problem,
- Understanding the Need & Usability in industry and society (Market Analysis),
- Developing Block Diagram,
- Designing Circuits of individual blocks,
- Testing circuits in LAB & Finalizing.
- Developing PCB on PC,
- Getting the PCB printed from market,
- Soldering the components,
- Performing various Basic Experiments to test the PCBs,
- Developing Flowchart for the entire process.
- Writing Algorithms for detecting the best moves
- Writing actual Software Program,
- Compilation & Burning,
- Testing and Debugging,
- Developing Flowchart for PC Side Software,
- Developing Data Flow Diagram,
- Writing actual code.
- Finally Running the system and,
- Documentation.

V. SCOPE AND APPLICATIONS:

Only the imagination can limit the applications of the above proposed system.

Though the following are some examples...

- **Animation**
In Animation, the Mechanical movement in real world can transferred to electrical signal through the Simulation technique used in this project. This signal can be further used, stored, manipulated according to requirements and used to show motion of objects and animation.
- **Robotics**
In Robotics, the computer electrical signals can be transferred to mechanical objects to perform some action, motion using the principle of Simulation.
- **For control purposes**
In Industries this principle can be applied to various instrumentation machines. This will make work easy, as the machines could be controlled by means computer signals or mechanical movement of operator that will be captured and sent to machines after processing through PC.
- **For live chess matches**
As the moves played on the electronic chess board can be viewed in real time on the screen, LCD projector can be used to view the game by the viewers.

V. ENHANCEMENTS:

A. Limitations

As generally all systems have some limitation, here are some listed for the proposed system.

- Wireless communication has a limited range of about 10 meters.
- Baud rate is less, so the processing speed is slow.
- The project cannot suggest any moves to the players.
- Castling cannot be done.

B. Future Modifications

There is always chance to improve the any system as research & development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done...

- Easy switching between different modes.
- Implementing Artificial Intelligence algorithms to enhance the features of the game.
- Using touch-pad technology to move a coin,
- Broadcasting the live game on internet.

VI. CONCLUSION:

By the realization of the above proposed system one can learn many aspects of a digital electronics circuit. This will give the complete knowledge of designing microcontroller based system and developing embedded software.

We will also learn the software development strategies and various programming techniques for PC based applications. This will ease the work of any of the player. It will also help you to learn chess. Since the intelligence required by a human can be achieved artificially using this system. Now as internet as become available everywhere we can later modify this system by transmitting it over the internet.

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