Board Game Playing Companion Using AI

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ABSTRACT

Chess which do play between two players on a board is intellectual and mental game, it has its own rules of play which help to enhance and improve the mental activities of the player. We implemented fully working electronic Chess Game, interact, the game computerizes for two players to do play chess according all the valid rules of the chess on computer. Secondly, for making the game more interesting that will make users to direct do play against AI, AI programming is added so that opponent player mode changes to AI .Chess which do play between two players on a board is intellectual and mental game, it has its own rules of play which help to enhance and improve the mental and intellectual activities of the player, and this game has a huge amount of players around the all world they have strongly interested to have play it . Chess has proved to be too challenging for many of the AI techniques that have been thrown at it. we have used reed array ,Led matrix array to implement chess, similarly we used arduino mega and shift resistors to develop our product . we used stock-fish library to build AI as to an opponent side. We can use it to record moves and save game for that we can use memory card.

Keywords— Electronic chess set; shift register; multiplexer; encoder, Reed matrix, LED matrix

1. INTRODUCTION

Many children nowadays are more attracted to electronic media and computer games as compared to traditional games . Less attention has been given by children in playing traditional board game such as chess game, and they tend to neglect it. This is because there are very few activities or lessons related to chess in society, and the number of trainers that specialized in chess game during co-curricular program in primary and secondary school are very few.

This task depicts the structure and usage of an electronic chess set which is created for the instructive reason.Thirty-two transmitters for the chess pieces and sixty-four receivers for all squares on the chess board are required to build chess set. The reason to choose the infrared light emitting diode (IR LED) as transmitter and photodiode as receiver is to reduce the cost for these sensors compared to other type of sensors. Arduino Mega 2560 is the controller unit for this project. Furthermore, the output device is light emitting diodes (LEDs), a liquid crystal display (LCD) and computer display.

2. RELATED WORKS

A keen electronic chess set utilizing reed switches is structured and actualized by Mahmood N.H et al. [2]. The reason for the chess set is to extend the procedure of the chess amusement on the PC screen amid chess competition. The fundamental control unit for the electronic chess set is PIC18F452 which gotten the information from the reed change to acquire the data about the situation of the chess piece. The information from the control unit is changed over to the appropriate information position as per RS-232 standard. The information is sent through sequential link (DB9) to the PC and to show the introduction of the chess amusement on the PC screen. The expense of the materials and electronic segments that utilized in the electronic chess set is low, which is appropriate for chess competition. The created chess board can perceive the nearness of the chess pieces and to show the chess diversion on the PC screen however it can't recognize the job of the chess pieces.

Matuszek et al. built up a self-ruling chess playing mechanical framework known as Gambit [3]. It is intended to play the chess consequently against human adversary. It comprises of PrimeSense profundity camera mounted on the robot's arm and a palm camera based on the gripper to give profundity and RGB shading information's. The profundity and RGB shading information's are utilized to identify and perceive the chess piece.In [4], an execution of independent chess playing robot utilizing electromagnet is displayed. This robot is competent to move chess pieces consequently, and it is intended to expand the chess playing ability of the player. The plan recognizes the area of the chess piece utilizing the camera and picture handling procedures. The picture is caught by the camera and after that MATLAB executes the picture handling calculation to distinguish the arrangement of the chess piece. The controller controls the chess motor by means of XY positioner dependent on the yield from the picture handling programming. Besides, the base of every chess piece is made of metal. In this manner, XY positioner is able to use the electromagnetism rule and engines to move the chess piece to goal.
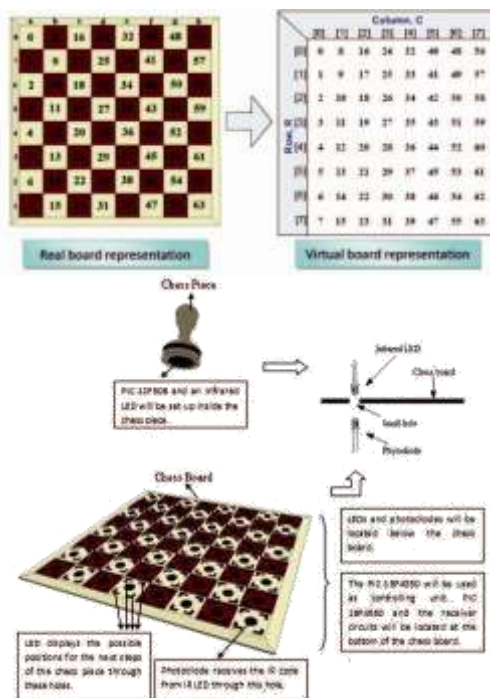
Fig. 1. Block diagram for the hardware design

A man-made brainpower chess robot utilizing electromagnet is introduced by Gurjit Kaur et al. [5]. The go for the undertaking is for chess darlings' excitement reason, particularly for the individuals who play the chess alone. AT89C51 microcontroller was utilized in the undertaking to get the contribution from parallel port and controls the engines to move the chess piece. The calculation was composed utilizing codes and C programming. codes are utilized to process the RGB picture caught from the camera so as to identify client's turn and to get the situation of the chess piece. Then again, C writing computer programs is utilized as Artificial Intelligence (AI) specialist code to create the counter strides against the human adversary. The quality of the venture are the AI calculation is utilized to choose the PC's chess development effectively and it is skilled to move the chess piece consequently. A disservice of the task is the job of the chess pieces can't be perceived, in light of the fact that just the top perspective on the chess piece is caught and prepared.

In [6], a chess vision framework is displayed by Piskorec et al. to distinguish and perceive the genuine chess diversion. This framework is customized utilizing C++ with Open Source Computer Vision (OpenCV) libraries and it is synchronized with two cameras: top-view and side-see cameras. The reason for the top-see camera is to distinguish the chess pieces' arrange while the side-see camera is utilized to perceive the kind of chess pieces.

3. METHODOLOGY

3.1 Hardware Design

Fig. 1 shows the setting of the sensor unit for the electronic chess set. The photodiode under the chess board receives the signal from the IR LED inside the chess piece in order to detect its position and role.Fig. 2. Real and virtual board representation

3.2 Software Design

The genuine chess board portrayal is changed over to 8x8 grid structure for the chess vision framework as appeared in Fig. The numbers on the chess board and the network structure are spoken to by the decimal position code for each square of the chess board. The 8x8 network is utilized in programming to investigate the substantial goals of the present chess piece.

Table 1 and Fig. 3 demonstrate the virtual and numerical portrayal for chess pieces' job in the programming. The negative sign speaks to dark chess piece, while the positive sign speaks to white chess piece. The vacant square of the chess board is spoken to by zero in the product. The virtual chess piece portrayal is shown on PC show, while numerical portrayal is utilized in programming. The logic behind the IR code for the chess piece is magnitude and sign representation which is used as chess piece identification code in the program.

3.3 System Flow

Earlier the players begin the chess diversion, a chess piece is put on the chess board. The modified PIC12F508 inside the chess piece controls the IR LED to send the IR code to enact the photodiode inside the chess board. The 64-to-6 line course encoder recognizes which position is set by the chess piece and it creates a twofold code as position distinguishing proof code. The Arduino Mega 2560 controls the 64-to-1 line course

multiplexer to get the IR code from the photodiode dependent on the specific position ID code. The procedure will be rehashed until all the chess pieces are put on the chess board. This procedure is appeared in Fig. 4. At the point when a chess piece is lifted by the player from the chess board, the 64- to-1 line multiplexer recognizes which chess piece is being lifted. At that point, the legitimate goals for the present chess piece will be broke down by Arduino program and sends the information to the 64-bit sequential in, parallel-out move register so as to switch ON the LEDs on the potential positions for the present chess piece. At the point when the chess piece is put on the chess board, the encoder distinguishes the situation of the chess piece. The procedure will be rehashed until the chess diversion is finished. This procedure is appeared in Fig.

3.4 Circuit Design

As clarified in past area, the model uses an Arduino Mega 2560 as the controlling unit that gets the info information from the sensors, and transmits the handled information to the yield gadgets. Notwithstanding, a drawback of Arduino Mega is the information and yield pins are insufficient for the proposed model. The model requires sixty - four sensors and sixty-four LEDs. Along these lines, as appeared in Fig. 6, we have created advanced electronic circuits for the chess diversion model to beat this weakness.
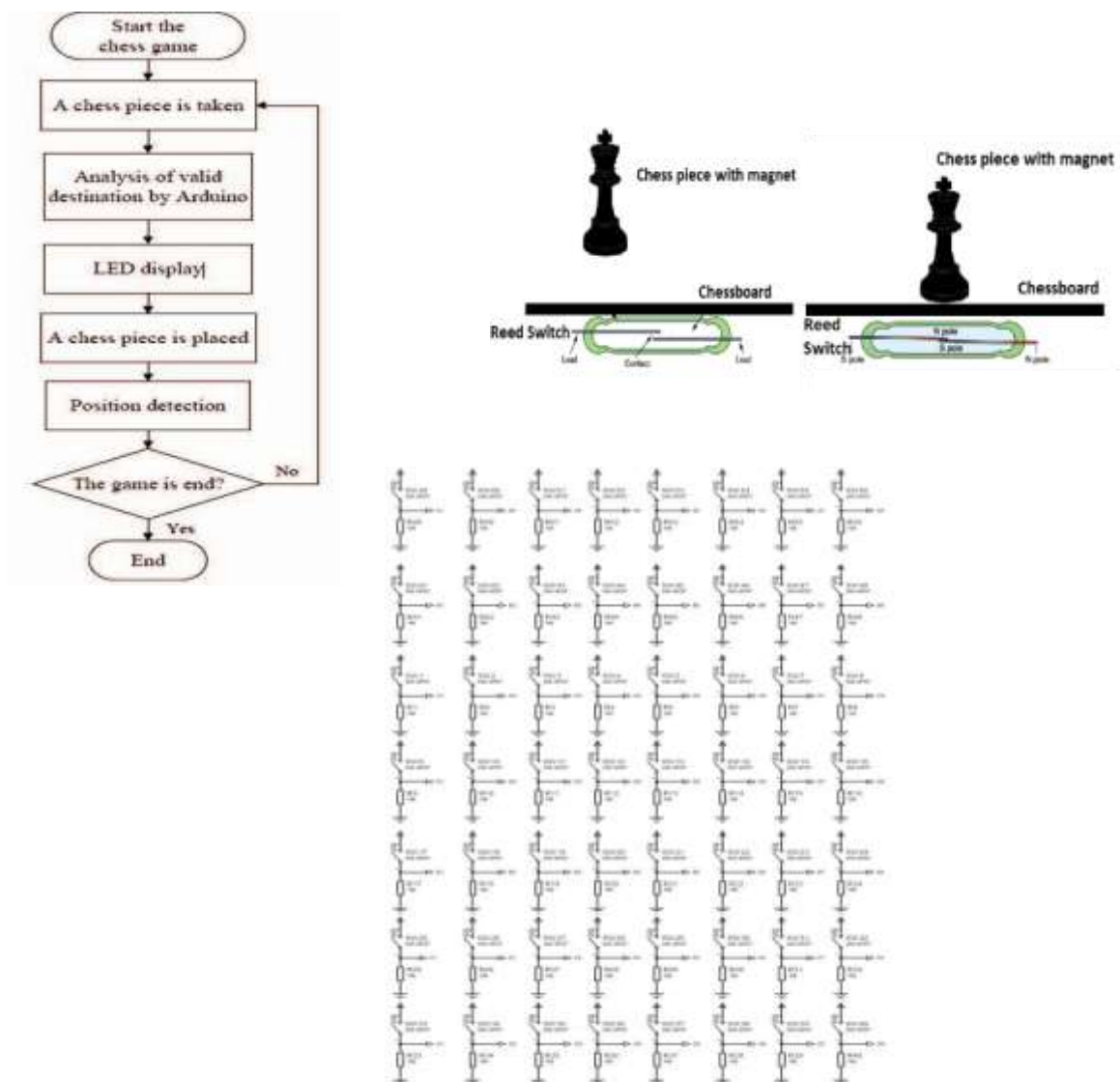

Fig. 5. Flow chart for the system during the chess game

We have to configure the pins connected to the wires as inputs with their pull ups enabled. Set the number pins to inputs as well, but without the pull up enabled so that they are floating. The number pins will be each set as an output in sequence with the value being low (non-active number pins are set back to inputs). we can read the pins on the letter wires and build a the board of Matrix that can detect chess pieces .similarly Led matrix input is 8 bit Information to keep Led on and of Ex. (10111001) in form of 2nd pair.

3.5 Reed switch

The reed switch which is also known as an electrical switch is operated by an applied magnetic field. Walter B. Ellwood invented this switch at Bell Telephone Laboratories in 1936.It consists of a pair of ferromagnetic flexible metal contacts in a hermetically sealed glass envelope in its simplest and most common form.

3.6 The Arduino Mega

The Arduino Mega 2560 could be a microcontroller board supported the ATmega2560. it's 54 digital input/output pins (of which 15 will be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz oscillator, a USB connection, an influence jack, an ICSP header, and a button. As we are using 8*8 LED and Reed matrix we want 32 pin connections for that arduino uno is insufficient so we are using arduino mega which has 54 digital pins

3.7 Diodes

A diode is defined as a two-terminal electronic component that only conducts current in one direction (so long because it is operated within a specified voltage level). a perfect diode will have zero resistance in one direction, and infinite resistance within the reverse direction.With the help of diodes in 8*8 reed matrix we can accurately detect the position of elements.

3.8 Analysis of Valid Destinations for Pawn

The developed Arduino program is needed to investigate the valid destinations or legal movie of the present piece throughout a chess. There have some rules for the movement of pawn, knight, rook, bishop, queen and king. during this section we'll describe an easy algorithmic program that may offer valid destination for a pawn to manoeuvre. The algorithmic program to produce valid destination for different chess items won't be delineated here.

In the first place, the standard of the pawn moves is appeared in Fig. 10. A pawn moves one sq. amid a forward heading. Another vital rule for pawn movement is its 1st move. it's going to move either 2 sq.s or one square for its 1st move. These squares should not be occupied by the other piece. consecutive rule for pawn movement is it moves one sq. diagonally to capture the opponent's piece.

Two-dimensional array Y[ ][ ] is employed for the LED show purpose. the info of Y[ ][ ] is transferred to the SIPO register so as to show the potential destinations of this chessman by lighting of LED. The analysis of valid destinations of pawn is programmed into Arduino victimisation if statement. The flow chart of the program for analysis of valid destinations of pawn is shown in Fig. demonstrates the stream diagram of the program for white pawn, while demonstrates the stream graph of program for dark pawn.

3.9 AI(Stockfish Program)

Stockfish could be a free and open-source UCI chess engine, available for various desktop and mobile platforms. it's developed by Marco Costalba, Joona Kiiski, Gary Linscott, Stéphane Nicolet, and Tord Romstad, with many contributions from a community of open-source developers Stockfish is consistently ranked first or near the highest of most chess-engine rating lists and is that the strongest open- source conventional chess engine within the world It won the unofficial world computer chess championships in seasons 6 (2014), 9 (2016), 11 (2018), 12 (2018), 13 (2018), 14 (2019),and 16 (2019). It finished runner-up in season 5 (2013), 7 (2014), 8 (2015), and 15 (2019).

4. RESULT AND ANALYSIS

The electronic set is meant to point out properly the valid destinations of the chessboard. Fig. twelve shows the results of the doable destinations for a pawn. Fig. demonstrates the pawn is put at position 'f2',whereas Fig. shows the crystal rectifier at the positions 'f3' and 'f4' square measure switched ON to show the doable destinations for the pawn once it's upraised from this position.

Table one shows the accuracy of the electronic set in term of position detection and role recognition of every chessman. It shows that the image has less accuracy for chessman recognition that is eighty.95%. not with standing, the electronic set is capable to notice the chess pieces' position properly.

5. CONCLUSION

Taking everything into account, we have accomplished the target of building up a chess set utilizing electronic circuits and MATLAB programming for chess instruction. The created model set is able to do: (I) distinguishing the position and kind of the chess piece, (ii) appearing legitimate goals for the present chess piece and (iii) showing the genuine circumstance of the chess diversion in PC screen. With this model, This model can be used as an intriguing youngsters amusement that is skilled to give down to earth chess preparing utilizing genuine equipment contrasted with PC diversions in a virtual mode.

5. ACKNOWLEDGMENT

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