An Autonomous Over-the-Board Chess Solution for Players in Isolated Conditions

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Since the pandemic, online chess has seen unprecedented growth in its user base. This growth is largely due to players being unable to convene physically in quarantine and wanting to play games in isolation. However, a major problem documented in academic research is that players focus less in online chess games compared to over-the-board, physical chess games. The goal of this project was to design a fully autonomous chess board for a single player to play against various levels of computer bots with the ease of online play and the benefits of physical chess. To achieve this, the team designed and built a movement system consisting of 4-string, stepper motor controlled tension system to move an electromagnet. The system utilizes the electromagnet to move custom 3D printed magnetic pieces on the chess board from underneath the board. To detect the human player's moves, the team employed 64 hall effect sensors below the board on a PCB the team designed to detect the presence of a piece on each square. Moves detected by these sensors connected to Arduino UNO board are then sent to an onboard Orange Pi 5, which sends the optimal response back to the movement system using a chess engine program that the team wrote. Additionally, the Orange Pi instructs another Arduino to display information on a Liquid Crystal Display, and the Arduino sends the user's selections for engine settings back to the Orange Pi. The three subsystems, movement, sensing, and computing, were individually and collectively tested to determine their accuracy in order to ensure total system reliability. From the data collected and testing of the final product, the team concluded that the project successfully achieved its goal of providing an autonomous over-the-board alternative for a single player.

Awards Won:
Second Award of $2,000
Central Intelligence Agency: First Award: $1000 award