



IDEA SUBMISSION

Welcome to the second phase of the **HARD-WAR 3.0, A Hardware Hackathon: Build it, to Win It** Hackathon!!

In this phase you will be explaining about your project and how are you planning to proceed working on it.

Please fill up the following details:

1) **Team ID –**

HWHCK-RLyWBi

2) **Team Name –**

Alpha

3) **Team Leader –**

Karandeep Singh Ghai

4) **Problem Statement –**

Students can also design their own problem statements within the given category, allowing for personalized and innovative solutions. **(HWPS-Edu-6):-**

The traditional game of chess, despite its rich strategic depth, faces challenges in the digital age, such as the loss of tactile engagement and issues like cheating on online platforms. To enhance educational experiences, we propose an IoT-based Automatic Chess Board (ACB) that preserves the authenticity of physical play and integrates AI for autonomous, skill-developing gameplay.



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5) **Project Brief Description/ Objective –**

Problem: The game of chess, originating in India nearly 1500 years ago, continues to captivate minds globally with its strategic depth and historical significance. However, traditional chess faces challenges in the digital age. Online platforms, while convenient, fail to replicate the tactile and strategic nuances of playing on a physical board. They are also susceptible to issues such as cheating, detracting from the authenticity of the experience and hindering skill development.

To address these challenges and enhance the traditional chess experience, we propose the development of an IoT-based Automatic Chess Board (ACB) system. This system consists of two interconnected physical chess boards, each equipped with sensors and LEDs. When a player makes a move on one board, sensors detect the movement and trigger LEDs (red and green indicators) on both boards to reflect the move in real-time. This synchronization ensures that players on both ends experience the physicality and immediacy of traditional chess, overcoming the limitations of online platforms.

In scenarios where only one player is present, the ACB seamlessly integrates an AI-powered chess engine. The computerized opponent, represented on the second board, responds autonomously to the human player's moves. This AI functionality not only provides a challenging solo gameplay experience but also serves as a valuable tool for learning and skill development. Players can engage in strategic practice sessions or explore new tactics against an intelligent virtual opponent, enhancing their understanding and enjoyment of the game.

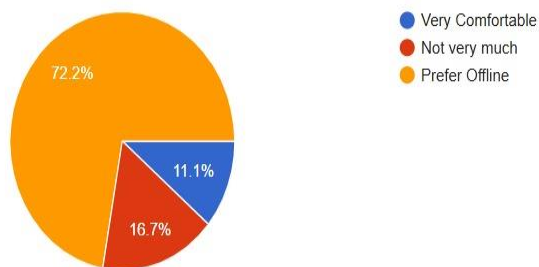
By harnessing IoT technology, our project aims to preserve the authenticity of physical chess while leveraging digital advancements to enrich gameplay experiences. The synchronized feedback and AI integration provided by the ACB offer a comprehensive chess experience that combines the benefits of traditional board play with the accessibility and intelligence of digital interfaces.

We conducted a survey and here is the result of the following:

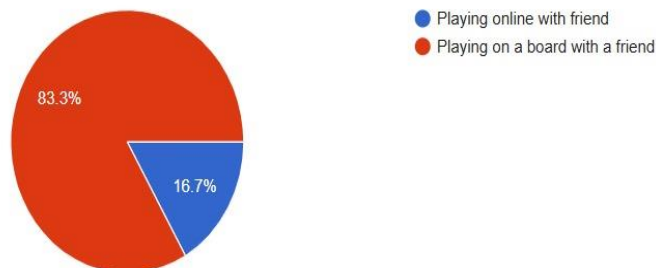


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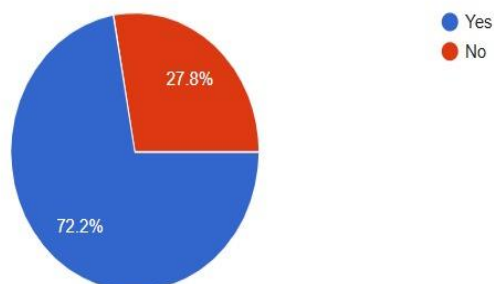
How comfortable are you with learning something online?



What do you think is a better way to learn/play chess?



Do you think cheating is a big problem in online chess?





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6) How will your project help overcoming the problem? (Methodology)

Our project, the IoT-based Automatic Chess Board (ACB) system, will overcome the challenges faced by traditional and online chess through the following methodology:

1. Interconnected Physical Boards:

- a. Equip two physical chess boards with sensors to detect piece movements.
- b. Use LEDs to indicate moves in real-time on both boards, ensuring synchronized gameplay.

2. Real-Time Synchronization:

- a. When a player makes a move on one board, sensors trigger LEDs on both boards.
- b. This provides immediate visual feedback, preserving the tactile and strategic engagement of traditional chess.

3. AI Integration for Solo Play:

- a. Incorporate a powerful AI chess engine to simulate an opponent on the second board when only one player is present.
- b. The AI responds autonomously to the human player's moves, offering a challenging and educational gameplay experience.

4. Enhanced Learning and Skill Development:

- a. Players can practice strategies and explore new tactics against the AI.
- b. The system facilitates a deeper understanding of the game through interactive and intelligent feedback.

5. Combining Physical and Digital Benefits:

- a. Maintain the physicality and authenticity of traditional chess while leveraging digital advancements.
- b. Ensure a comprehensive chess experience that is both accessible and enriched by modern technology.
- c. By implementing this methodology, our ACB system will provide a robust solution that enhances the traditional chess experience, promotes fair play, and supports educational development through intelligent and interactive gameplay.



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7) Resources you will be using –

To successfully develop and implement the IoT-based Automatic Chess Board (ACB) system, we will utilize the following resources:

1) **Hardware Components:**

- Chess Boards: High-quality physical chess boards for the base of the ACB system.
- Sensors: Pressure or optical sensors to detect piece movements.
- Microcontrollers: Arduino or similar microcontrollers to process sensor data.
- LEDs: Red and green LEDs to indicate moves and provide visual feedback.
- Motors: Stepper motors or similar for automated piece movements in the AI mode.
- Power Supply: Adequate power sources for all electronic components.

2) **Software and Algorithms:**

- AI Chess Engine: Integration of a powerful open-source AI chess engine like Stockfish for autonomous gameplay.
- Firmware Development: Programming microcontrollers to handle sensor inputs, control LEDs, and communicate between boards.
- Networking Protocols: IoT communication protocols (e.g., MQTT, WebSockets) for real-time synchronization between boards.
- Mobile/Desktop Application: Optional app for additional control and customization.

3) **Connectivity and Communication:**

- Wi-Fi/Bluetooth Modules: Modules to enable wireless communication between the interconnected boards.
- Cloud Services: For data storage, remote game tracking, and potential integration with online chess platforms.



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8) Uniqueness –

The IoT-based Automatic Chess Board (ACB) system stands out in several unique ways:

1) **Seamless Integration of Physical and Digital Chess:**

Unlike traditional online platforms, the ACB maintains the tactile experience of playing on a physical board while providing the convenience and connectivity of digital systems.

2) **Real-Time Synchronization:**

The ACB's use of sensors and LEDs to reflect moves in real-time on both interconnected boards ensures an immediate and synchronized experience, preserving the strategic depth and physical engagement of traditional chess.

3) **AI-Powered Autonomous Opponent:**

The incorporation of an AI chess engine for solo play is a significant enhancement. The AI responds to the player's moves on the physical board, offering a challenging and educational experience that goes beyond static puzzle-solving apps or digital-only opponents.

4) **Educational Focus:**

The ACB is designed not just for casual play but also for educational purposes. It provides a valuable tool for learning and skill development, enabling players to practice strategies and explore new tactics with intelligent feedback.

5) **Cheat-Resistant Design:**

By using physical boards connected through IoT technology, the ACB minimizes the risk of cheating, which is a common issue in online chess. The physical presence of the game adds a layer of authenticity and integrity.

6) **Enhanced User Engagement:**

The real-time visual feedback from LEDs and the physical interaction with the chess pieces create a more engaging and immersive experience compared to screen-based platforms.

7) **Versatility and Flexibility:**



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The ACB can be used in various scenarios, including two-player games, solo practice with AI, and even remote play with another ACB user, making it a versatile tool for different user needs.

8) Innovation in Traditional Gaming:

By blending IoT technology with the classic game of chess, the ACB introduces an innovative approach to enhancing traditional gaming experiences, setting a new standard for how classic games can evolve with modern technology.

These unique features collectively make the ACB system a groundbreaking solution that enriches the chess-playing experience while addressing the limitations of both traditional and digital platforms.