

ABSTRACT

Airsoft is a military simulation game that highly emphasizes sportsmanship, yet it often faces issues with players who fail to acknowledge being hit—whether intentionally or unintentionally due to lack of awareness or the use of thick body protection. To address this problem, a Smart Vest system was developed using piezoelectric sensors and ESP32 microcontrollers to objectively and in real time detect the impact of BB pellets. The system is also equipped with an automatic gun-lock mechanism utilizing the ESP-NOW wireless communication protocol, ensuring that players who are “eliminated” can no longer fire their weapons. Testing results showed that the system could accurately detect hits at optimal distances of 5 to 10 meters, with the highest ADC values recorded near the sensor area and decreasing values in zones further away. Additionally, communication latency between devices averaged 1–2 milliseconds across 2000 samples, with a few outliers reaching up to 45 ms due to signal interference. The system displays the player’s remaining health via an OLED screen and provides immediate hit feedback through a buzzer, while all game data is transmitted to a server and displayed on a real-time monitoring dashboard. These findings indicate that the Smart Vest system successfully enhances objectivity, responsiveness, and fairness in airsoft gameplay, offering a more immersive and equitable experience aligned with the fundamental principle of honesty in the sport.

Keywords: SmartVest System, Airsoft Game, Piezoelectric Sensors, Gun Locking Mechanism, ESP-NOW Wireless Communication, Real-time Impact Feedback