

**KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING**

**A Capstone Design
Presented to the Faculty of the
Information and Communications Technology Program
STI College Cubao**

**In Partial Fulfilment
of the Requirements for the Degree
Bachelor of Science in Computer Engineering**

Lester Manuel O. Adornado
Julien G. Ibalio
Flor John G. Lopez
John Gene P. Roque

October 26, 2025

ENDORSEMENT FORM FOR FINAL DEFENSE

TITLE OF RESEARCH: **KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING**

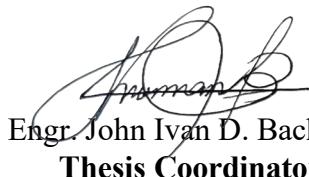
NAME OF PROPOSERS: Lester Manuel O. Adornado
Julien G. Ibalio
Flor John G. Lopez
John Gene P. Roque

In Partial Fulfilment of the Requirements
for the degree Bachelor of Science in Computer Engineering
has been examined and is recommended for Final Defense.

ENDORSED BY:

Engr. Rynefel B. Elope
Thesis Adviser

APPROVED FOR FINAL DEFENSE:



Engr. John Ivan D. Bachiller
Thesis Coordinator

NOTED BY:

Mr. Brian H. Calata, LPT
Program Head

October 26, 2025

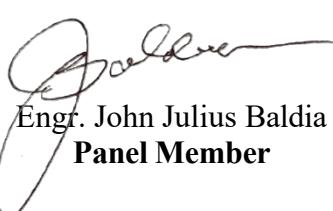
APPROVAL SHEET

This thesis proposal titled **KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING**, prepared and submitted by Lester Manuel O. Adornado, Julien G. Ibalio, Flor John G. Lopez, and John Gene P. Roque in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Engineering, has been examined and is recommended for acceptance and approval.

Engr. Rynefel B. Elope
Thesis Adviser

Accepted and approved by the Thesis Review Panel
in partial fulfillment of the requirements for the degree of
Bachelor of Science in Computer Engineering


Engr. Roecendo F. Astillero, MSCPE
Panel Member


Engr. John Julius Baldia
Panel Member


Engr. Joko Delicano
Lead Panelist


Engr. John Ivan D. Bachiller
Thesis Coordinator

Noted:

Mr. Brian H. Calata, LPT
Program Head

October 26, 2025

ACKNOWLEDGEMENTS

The researchers wish to express their profound gratitude to the individuals and groups whose unwavering support, guidance, and expertise were instrumental in the successful completion of this thesis, “**KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING.**”

Our heartfelt thanks are extended to:

1. **Thesis Coordinator, Engr. John Ivan D. Bachiller :** For providing invaluable structural oversight, ensuring the project remained on track.
2. **Thesis Adviser, Engr. Rynefel B. Elopore:** For their patience, technical mentorship, and dedicated time in advising specific hardware and software to be used.
3. **Thesis Review Panelists:** For their insightful critiques, rigorous questioning, and specialized knowledge in our field concerning specifically steps to be made to ensure the future of our device and its full potential.
4. **Parents and/or Guardian:** For their immeasurable support in providing shelter and food during our thesis testing.
5. **Friends and Inspirations:** For their constant encouragement, for serving as our first and most enthusiastic testers.
6. **Respondents:** For providing their time and effort to test our device to ensure that it will flourish.

To all those who supported this journey, your contributions, large and small, made this achievement possible.

The Researchers

ABSTRACT

Title of research: **KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING.**

Researchers: **Lester Manuel O. Adornado**
Julien G. Ibalio
Flor John G. Lopez
John Gene P. Roque

Degree: **Bachelor of Science in Computer Engineering**

Date of Completion: **2025**

Keywords: **Computer Vision, Deep Learning, Object Detection, YOLOv8, Stereo Depth Estimation, Raspberry Pi, Soccer, Goal Accuracy, Training Assistant, Performance Monitoring.**

The accurate monitoring and objective feedback of shooting performance remain a significant challenge for grassroots and amateur soccer players due to the high cost and complexity of existing commercial systems. This study addresses this gap by designing and developing KICKEEN: A Smart Camera-Based Soccer Assistant for Goal Accuracy Monitoring, a cost-effective, real-time training solution. The system utilizes a Raspberry Pi 5 connected to stereo USB cameras to capture game footage. It employs the YOLOv8 object detection algorithm for precise, real-time identification and tracking of the player, ball, and goalposts. Using stereo depth estimation and triangulation, KICKEEN accurately calculates the player's distance from the goal (up to 20 meters), allowing for quantitative analysis of shot accuracy and placement. The system provides immediate, statistical feedback on a custom-designed Python GUI displayed on a 7-inch touchscreen, enabling players to monitor their performance trends, evaluate consistency, and make data-driven adjustments to their training regimen. Rigorous testing confirmed the system's effectiveness and reliability in providing objective metrics essential for enhancing shooting skill development in a practical, outdoor environment.

TABLE OF CONTENTS

	Page
Title Page	i
Endorsement Form for Proposal Defense	ii
Approval Sheet	iii
Acknowledgements	iv
Abstract	v
Table of Contents	vi
Introduction	1
Background of the problem	3
Statement of the problem	6
Overview of the current state of technology	7
Objectives of the study	11
Scope and limitations of the study	12
Review of related literature/studies/systems	13
Methodology	18
Hardware/Software	24
Calendar of Activities	27
Budgetary Estimate	28
Results and Discussions	30
Conclusion and Recommendations	34
References	36
Appendices	38
Appendix A. Architectural Design	38
Appendix B. PCB and Schematic Designs	40
Appendix C. App User Interface Design	42
Appendix D. Test Case	45
Appendix E. Survey Cover Letter	47
Appendix F. Pre-test Survey Questionnaire	49
Appendix G. Pre-test Survey Result	66
Appendix H. Post-test Survey Questionnaire	75
Appendix I. Post-test Survey Result	95

LIST OF TABLES

Table	Page
1 Gantt Chart	27
2 Estimation Budget for the Proposed Project	28
3 Test Case Result	46

LIST OF FIGURES

Figure	Page
1 Prototyping Model	18
2 Block Diagram	20
3 System Transition Diagram of the System	21
4 Hardware Flowchart of the System	21
5 Software Flowchart of the System	22
6 Raspberry Pi 5	24
6.1 FanTech Luminous C30 Webcam	25
6.2 Raspberry Pi Active Cooler	25
6.3 Uninterrupted Power Supply	26
7 Prototype Design	39
8 PCB Layout	41
9 Schematic Diagram	41
10 Main Menu Interface	43
10.1 Start Interface	43
10.2 Simulation Interface	44
10.3 Statistics Interface	44

INTRODUCTION

Soccer, or football as most call it, is more than just a game; it's a passion that connects people across the globe. With the FIFA World Cup bringing together nations every four years, it's a celebration of culture and camaraderie that captivates billions. From the excitement of local matches to the thrill of top leagues like the English Premier League, the sport creates a vibrant tapestry of fan experiences. Whether played on a sandy beach or a grassy field, soccer invites everyone to join in, making it easy for anyone to kick a ball and share in the joy. It's this simplicity and universality that make soccer a beloved sport worldwide (FIFA, 2020).

Soccer found its way to the Philippines in the late 1800s, thanks to the Spanish who introduced the game. The first recorded match in 1907 marked the beginning of local interest, with clubs sprouting up across the islands. Over the years, soccer faced tough competition from basketball, which captured the nation's heart. However, the formation of the Philippine Football Federation (PFF) in the same year as the first match set the stage for growth (Aczon, 2019). Recently, as more young players embrace the sport, there's a renewed excitement, with aspirations for the national team to shine on the international stage (Aczon, 2021).

In a country where basketball reigns, soccer is steadily carving out its own space in the hearts of many Filipinos. The Philippine Azkals have become local heroes, igniting enthusiasm and inspiring kids to lace up their cleats. Grassroots leagues and community events are popping up, bringing neighbors together and fostering a love for the game (Mubarak, 2020). Social media plays a big role, allowing fans to celebrate not just local matches but also global tournaments and stars (Mubarak, 2020). With this growing support, soccer is gradually becoming a cherished part of the sporting landscape of the country, promising a bright future for aspiring players (FIFA, 2020).

The sport continuously gains attraction from young and aspiring Filipino players, as well as Filipinos who watch Japanese animations about soccer, such as Blue Lock, which the developers took direct inspiration from (Nakazawa, 2022). The Kickeen device is

proposed to give young Filipino athletes who are adamant at improving in soccer through its shot accuracy and target monitoring system, offering technological support to help players refine their skills (Mubarak, 2020).

The Philippines, despite its growing interest in soccer and the increasing visibility of the sport in recent years, faces several challenges in competing at the highest levels of international and Asian soccer. While the country has made some progress in soccer development, it remains significantly behind other nations, particularly in Asia, where countries like Japan, South Korea, and Australia have long-established soccer cultures. The Philippines has struggled with a lack of infrastructure, limited player pool, financial constraints, and insufficient exposure to high-level competition, all of which hinder its ability to compete on the global stage.

One of the primary challenges for the Philippines in competing at high levels is the inadequate infrastructure and resources dedicated to soccer development. Nations like Japan and South Korea have well-established systems for nurturing young talent, with high-performance academies, professional leagues, and extensive youth development programs that feed into their national teams (FIFA, 2020). In contrast, the Philippines has historically underinvested in soccer, with limited training facilities, coaching expertise, and high-quality competitions for youth players. Although the Philippine Football Federation (PFF) has made efforts to improve soccer infrastructure, the country still lags behind in providing world-class facilities that could enhance player development and performance (FIFA, 2020). As a result, players in the Philippines often do not receive the same level of training and competition as their counterparts in more established footballing nations, which affects their ability to perform at the highest levels of international competition.

The Philippines also faces a limited player pool, which significantly impacts its ability to field a competitive national team. While there has been a rise in popularity and participation in soccer at the grassroots level, the sport is still not the primary focus for many Filipino athletes, with basketball and volleyball being more prominent in the

national sporting landscape. The Philippines' relatively small pool of soccer players limits the depth of talent available for the national team. Countries like Japan and South Korea benefit from large youth systems that produce top-tier talent year after year. In contrast, the Philippines has yet to establish a comprehensive, nationwide system for identifying and nurturing soccer talent from a young age (Aczon, 2019). As a result, the national team struggles to develop a consistent pipeline of skilled players capable of competing with the best teams in Asia and the world.

The financial challenges faced by the Philippine Football Federation and the lack of a robust domestic league system are also significant barriers to success. Although the Philippines Football League (PFL) was established to provide a professional platform for local players, it is still relatively young and does not yet match the competitive standards of other Asian leagues, such as the J.League in Japan or the K-League in South Korea. These leagues provide players with the opportunity to compete regularly against high-quality opposition, which is essential for improving skills and building experience at the international level (Mubarak, 2020). The PFL's limited resources and lack of a deep talent pool make it difficult for Filipino players to gain the experience necessary to compete against top-tier international teams. Additionally, the financial constraints of the PFF limit the ability to invest in international matches, training camps, and player development programs, all of which are essential for improving the standard of the national team.

Background of the problem

Over the years, accurately tracking goal shots in soccer has been a significant challenge, both for training purposes and in professional matches. Traditional methods rely on manual observation and recording, which can be prone to human error and inconsistencies. Various technologies have been introduced to address these issues, yet many of them come with their limitations, such as high costs, complex setups, and limited accessibility for amateur and semi-professional teams.

In soccer training, achieving precision and consistency in goal shooting, particularly during penalty kick scenarios, remains a significant challenge for players. Despite advances in coaching techniques and training methods, many players still face difficulties when it comes to refining their shooting accuracy. This issue is especially critical in penalty kick training, where small variations in technique can lead to considerable deviations in shot placement. The absence of real-time, detailed feedback during training often results in slower improvement and inconsistent performance during actual matches. Therefore, developing a system to track the trajectory and placement of each shot in real-time could provide valuable insights that enhance the training process and improve players' goal-scoring abilities.

One of the most pressing challenges in soccer training is the inconsistency in shooting technique. Players often struggle with maintaining a consistent shooting form, which leads to erratic shots that miss the target or lack precision. In particular, variations in body positioning, foot placement, and ball contact can have significant effects on shot accuracy (Taye et al., 2019). While coaching and repetition can improve technique, players often do not receive immediate feedback on their performance, which hinders their ability to adjust and fine-tune their shots. The lack of real-time data on where shots land in relation to their intended target makes it difficult for players to identify the small errors in their technique that need improvement (Jones et al., 2021).

Furthermore, aiming for specific areas of the goal, such as the top corners or bottom posts, is particularly difficult, especially in penalty kick situations. Players need to develop the ability to aim for precise target zones under pressure, yet many struggle to replicate this accuracy during training (Bakker et al., 2020). Without a system to track and analyze shot placement, players often do not know exactly where their shots land, which makes it harder to improve their shooting technique over time. This lack of feedback can lead to frustration, as players may not understand why they are missing the target or failing to hit their intended area.

In addition to the technical difficulties in achieving accuracy, psychological factors also play a major role in shooting performance, particularly during penalty kick training. Penalty kicks are often performed under high pressure, either in training or in match situations. The mental stress associated with these high-stakes moments can impact a player's ability to focus on technique and maintain shooting precision (Vargas et al., 2022). Players may feel the weight of the situation, leading them to either rush their shots or focus too much on avoiding mistakes rather than executing a controlled, accurate shot. Training without incorporating the pressure of match conditions often results in players performing well in practice but struggling when it matters most in competitive settings (Kredel et al., 2023).

Another issue that complicates penalty kick training is the limited ability to track and monitor a player's progress. Traditional training methods often rely on manual feedback from coaches or peers, which can be time-consuming and prone to human error. This subjective approach to evaluating shot accuracy doesn't provide objective data on shot placement, making it difficult for players to understand where they are consistently going wrong or what areas need improvement (Cavazzuti et al., 2020). Players also lack the opportunity to review their shots in real-time or analyze their performance over time, which limits their ability to make data-driven adjustments to their technique.

Moreover, the development of a system that can track and assess penalty kicks in training environments would enable players to simulate match-like pressure during practice. By providing immediate feedback on every shot, such a system could help players learn how to adjust their technique under pressure, improving their performance in high-stakes situations. Additionally, incorporating such a system into training could foster greater consistency, helping players understand the specific adjustments they need to make to hit their target area consistently, even when under stress.

In conclusion, soccer players face several challenges when training to shoot for goal, particularly in terms of accuracy, consistency, and performance under pressure. Inconsistent technique, the difficulty of targeting specific areas of the goal, psychological

factors during penalty kicks, and the lack of objective, real-time feedback are all significant barriers to improvement. By implementing a camera-based tracking system that provides real-time data on shot accuracy and technique, players can receive the necessary feedback to make adjustments, improve their skills, and ultimately become more consistent and precise in their shooting. Such a system would offer valuable insights into each player's shooting technique, enabling them to fine-tune their performance and achieve greater success during competitive matches.

Statement of the Problem

General problem

- **How can a smart camera-based soccer assistant for goal accuracy monitoring be developed?**

To create an effective camera-based tracking system for soccer that can measure the distance of the striker from the goal post, it is essential to use hardware capable of processing medium to long-range distances. Since the penalty area is approximately 20 meters from the goal post, hardware capable of processing distances up to 25 meters would be ideal for accurate tracking.

Specific problems

- **How to design a system that will effectively monitor goal-scoring accuracy, precision, and frequency from a distance?**

The microprocessor will be responsible for processing where the ball impacts the goal based on the distance from which the striker kicks it. The camera, working in tandem with the microprocessor, will track both the position of the striker and the exact location where the ball hits the target area of the goal.

- **How to design a system that will give statistical info on player's goal-scoring performance?**

The system will employ a percentage-based approach to monitor and track player statistics. It will record the frequency of shots taken by the player, compare this with

the number of successful goals scored, and generate a summary of the player's performance statistics.

- **How to implement a user interface on the Raspberry Pi touchscreen that integrates system functions and provides real-time performance monitoring?**

The developers will implement a Python-based graphical user interface (GUI) on a 7-inch touchscreen running Raspberry Pi OS. This interface will allow users to start training, view real-time detection outputs, and access statistical performance data directly on the device.

- **How to create a stand for the device to ensure stability during practical usage?**

Metal tubing will be used as the material for the device's stand, ensuring a stable and adjustable base during practical use. This will help provide the necessary support and flexibility for the camera system in dynamic environments.

- **How to create a reliable casing for the device to prevent damaging during practical usage?**

Stainless steel will be used for the casing of the device to safeguard the internal hardware from potential damage. Its durability makes it highly resistant to environmental factors such as rain, dust, and impacts, ensuring the longevity and reliability of the system in outdoor conditions.

Overview of the current state of the technology

The integration of technology in sports training has evolved significantly over the past few decades, with major advancements aimed at improving athletic performance, precision, and data-driven insights. In soccer, innovations have primarily focused on areas like game analysis, player tracking, and performance monitoring, but there remains a gap when it comes to real-time, on-the-field analysis of individual skills such as shot accuracy and target hitting. This section reviews the current state of relevant technology in soccer and sports training, highlighting the existing problems and how the proposed smart soccer goal post aims to address these gaps.

The Adidas miCoach Smart Ball is equipped with sensors that provide real-time data on the speed, spin, trajectory, and force of a player's shot. This data allows players to assess the precision of their kicks and adjust their technique. However, it requires a smartphone or tablet to process the data, which can be costly. Additionally, while it gives insights into the mechanics of a shot, it may not always replicate real-world conditions accurately, especially in windy or wet weather (Smith, 2020).

STATSports' Performance Tracker is an advanced wearable technology that monitors player performance, including shooting accuracy, speed, and positioning. It helps track both the movement of the ball and the goalkeeper's reaction times during training, offering insights into how players can improve their shot placement. The system is expensive and requires both the wearable device and the associated software. Its setup can be complicated, especially in outdoor training environments. The system may also lead to players becoming overly reliant on data and technology rather than honing their natural instincts during real-game scenarios (Jiang et al., 2020).

Rezzil is a popular VR platform used by professional football clubs to simulate penalty kicks and other game scenarios. It allows players to practice in a virtual environment, facing different goalkeeper styles or game situations, helping them improve mental resilience and decision-making. While VR platforms like Rezzil offer an immersive experience, they require expensive hardware, including VR headsets and high-performance computers. Additionally, VR training does not fully replicate the physical sensations of a real match, such as the feel of the ball or the stadium atmosphere, potentially limiting its effectiveness for improving match-day performance (Cox, 2019).

Augmented Reality systems like Vicon and Optitrack use cameras and motion tracking to overlay virtual targets onto real-world environments, helping players practice shot placement and improve precision. These systems are particularly effective for penalty kick training, where players can target specific areas of the goal. These AR technologies require expensive setup and infrastructure, including specialized glasses or screens. They may also cause distraction if the system provides excessive or complex data that

interferes with a player's focus during training. Furthermore, the technology's effectiveness is contingent on high-quality sensors and may not be as reliable in fluctuating weather conditions (Perroni et al., 2018).

Catapult Sports offers a range of wearable devices that track player movements and physical performance during training. These smart sensors provide real-time data on metrics such as shot accuracy, speed, distance, and workload. The Catapult wearables are expensive and require constant charging. Additionally, they often need expert interpretation to understand the biomechanical feedback they generate. The data provided may also be difficult for players to fully utilize without proper training on how to read and act upon it (Gabbett et al., 2020).

Dartfish is a video analysis tool that uses motion capture to analyze a player's biomechanics and technique. It provides slow-motion replays and key performance indicators, helping coaches and players to refine their shot technique and body posture during penalty kicks or goal-scoring situations. Dartfish and similar systems require multiple cameras and specialized software, which can be costly for smaller teams or individual athletes. The complexity of interpreting the biomechanics data also requires expertise. If not used properly, the feedback can overwhelm players and result in an overemphasis on technical details rather than holistic performance (Baumeister et al., 2020).

SkillCorner uses AI-powered technology to analyze players' movements, including shot trajectories and positioning, during matches and training. This technology processes vast amounts of data to identify patterns and suggest personalized training plans aimed at improving goal-scoring accuracy. AI-based technologies such as SkillCorner require a large amount of high-quality data to be effective. Without sufficient or accurate data, the system's insights may not be as reliable. Furthermore, AI systems can be expensive to implement and require constant updates and maintenance. Players may also become overly dependent on the technology, potentially stunting their natural development (Mayer et al., 2021).

Hudl is a popular video analysis platform that allows coaches and players to review footage of training sessions and matches. It provides tools for breaking down player performance, including shot accuracy and decision-making, which is particularly helpful in penalty kick training. Video analysis is time-consuming, requiring coaches and players to review large volumes of footage, which can detract from actual practice time. Additionally, feedback is often retrospective, so players may not get immediate insights during training. Over-reliance on video analysis can also lead to players overthinking their movements and second-guessing their decisions during live matches (Bishop et al., 2020).

Hawkeye is a widely used goal-line technology system that tracks the ball's movement and confirms whether it has crossed the goal line. It provides instant and accurate feedback, which is particularly useful for penalty kick scenarios where the ball may come close to the line. While highly accurate, Hawkeye is expensive to install and maintain. It is typically used during professional matches but can be cost-prohibitive for training purposes. Additionally, while it ensures accurate decisions on whether a goal has been scored, it does not provide feedback on the precision or technique of the shot itself (FIFA, 2021).

While the listed technologies provide invaluable insights and feedback for soccer training, especially for improving goal-scoring and penalty kick accuracy, they also come with certain drawbacks, including high costs, reliance on specialized equipment, and the potential for over-reliance on technology. For these technologies to be effective, they should be used in conjunction with traditional training methods and tailored to the specific needs of each player. As these tools continue to evolve, they will remain critical in refining player skills and performance in high-pressure scenarios like penalty kicks and scoring within the penalty area.

Objectives of the Study

General objective

- **To create Kickeen: A smart camera-based soccer assistant for goal accuracy monitoring.**

The primary objective of the developers is to create a smart camera-based system that can monitor and track the performance of soccer players in terms of goal-scoring inside the penalty area. The camera will track the striker's distance by subtracting the distance of the goal and the distance of the player itself.

Specific objectives

- **To design a system that will effectively monitor goal-scoring from a distance.**

The system will use stereo USB cameras combined with depth estimation techniques to determine the real-world distances of objects on the field; by integrating the YOLOv8 object detection algorithm, the system will identify and track key objects such as the ball, player, and goalpost, in real time; it will detect when a goal is scored by evaluating the position of the ball relative to the goalpost and calculate the shot distance based on object depth (note that the ball that didn't reach the goal would not be counted in the statistics interface).

- **To design a system that will give information on player's goal-scoring performance.**

The system will categorize goal attempts based on the distance from which the shot was taken; it will track the number of successful goals per distance category and calculate success rates using percentage-based statistics; this data will help players assess their scoring efficiency and monitor performance over time.

- **To design a user interface (UI) that integrates and controls all system features for a training experience.**

The UI will be built using Python and optimized for a 7-inch Raspberry Pi touchscreen display; it will serve as the main control panel with three core options: Start, Statistics, and Exit; the interface will display live object detection feedback,

goal detection status, and real-time updates of performance data during training sessions.

- **To create a stand for the device to ensure stability during practical usage**
The stand will be constructed using adjustable metal tubing to allow height and angle customization depending on the field setup; it will be designed for durability and stability to withstand outdoor conditions and physical impact during training.
- **To create a reliable casing for the device to prevent damaging during practical usage.**

the casing will be made of stainless steel to shield the Raspberry Pi, cameras, and power supply from environmental damage; it will also provide ventilation and cable management features to ensure consistent device performance during extended use.

Scope and Limitations

Scope

The goal accuracy monitoring device will focus on two key functionalities: (1) measuring the distance of a player from the goalpost, and (2) detecting whether the ball reaches the goalpost during a shot attempt. To calculate the distance of the player from the goal, the system will use stereo vision by detecting and estimating the 3D positions of both the player and the goalpost using two USB cameras. The player-to-goal distance will be computed by subtracting the depth (Z-axis) position of the goalpost from that of the player, as detected through stereo triangulation.

The system will be powered by a Raspberry Pi 5 running Raspberry Pi OS, and will utilize the YOLO object detection algorithm to identify four key objects: the player, the ball, the goalpost, and the goalkeeper. The dual USB cameras will provide synchronized video input for stereo depth estimation, allowing for accurate real-time distance measurement.

The user interface will be displayed on a 7-inch touchscreen LCD and will serve as the main control hub for the application. The UI will provide options to start a training session, view goal-scoring statistics, or exit the system. During training, the system will

determine if a goal was made based on whether the ball reaches or surpasses the detected position of the goalpost. Once a goal is confirmed, the system will record the distance the ball was kicked from and store the result in the player's performance statistics.

The statistical component of the system will track the number of successful goals per distance category and calculate percentage-based accuracy for each range. This allows players to monitor their scoring efficiency from different distances and track improvements over time.

The entire device will be mounted on an adjustable metal tripod stand, providing stability and flexible positioning for optimal field of view during training. The internal hardware, including the Raspberry Pi, power supply, and cameras, will be enclosed in a stainless steel casing to ensure protection against environmental factors such as rain, dust, and physical impact during use in outdoor football fields.

Limitations

- The accuracy of the sensor may be affected by lighting conditions. Poor lighting, shadows, or backlighting could reduce the camera's ability to capture clear images of the ball and the goalpost, impacting the system's detection capability.
- The device is recommended to be exclusively used during clear weather to realistically simulate ideal training and playing conditions for football / soccer games.

Delimitation

- The device is recommended for use exclusively around the penalty area (maximum 20 meters from the goal), as this is the area where the camera can effectively capture the player's distance and the ball's impact point. It is also to realistically simulate goal-scoring conditions as goals are commonly scored within this area.
- The device will not capture or include any physiological data of the player, such as kicking force, muscle traction, or other physical attributes. It is limited to capturing the visual and positional data related to the player, the ball and the goalpost.

Review of Related Literature

This section provides a comprehensive review of the literature related to the development

of a smart camera-based goal detection and tracking device using ESP32. It highlights relevant works in the areas of hardware integration, goal detection and tracking algorithms, mobile application development, and the design of a stable stand for practical usage. The review will compare and contrast different authors' viewpoints, critique methodologies, and identify gaps in research, ultimately justifying the need for this study.

- **Real-time video processing using Raspberry Pi for sports applications (Tariq et al., 2020)**

The development of a smart camera-based soccer assistant requires the integration of computer vision and real-time data processing to monitor goal-scoring events, including accuracy, precision, and frequency. Raspberry Pi and its associated Raspberry Camera Module 3 have been used in similar sports-related applications for tracking motion and analyzing player movements. Tariq et al. (2020) demonstrated how Raspberry Pi can serve as an affordable and effective controller for real-time video processing in various sports contexts, making it an ideal choice for this project. The Raspberry Pi 5, with its enhanced processing power and connectivity features, allows for the real-time processing of high-quality video captured by the Raspberry Camera Module 3. This combination enables the system to track the ball's trajectory and the striker's position, providing real-time feedback and generating useful insights for players and coaches. The system's flexibility, combined with its accessibility, makes it a suitable choice for developing a camera-based solution in soccer training.

- **Multi-camera systems for optical tracking in sports (Siriwardena et al., 2020)**

To effectively monitor goal-scoring accuracy, precision, and frequency, computer vision and machine learning algorithms are typically applied. Several studies have explored using high-speed cameras and image processing algorithms to track ball trajectories and monitor player actions. Siriwardena et al. (2020) showed that multi-camera systems, combined with optical tracking technology, can accurately measure the position and trajectory of the ball. These systems can provide real-time analysis of shot accuracy, precision, and frequency by analyzing the ball's path and its relation to the goal.

For this project, Raspberry Pi 5 and Raspberry Camera Module 3 can be configured to

process video streams and detect key points such as the ball's position and speed. The Raspberry Pi will run image processing algorithms to calculate the ball's trajectory and evaluate the shot's accuracy and precision. Machine learning models could further enhance the system's ability to assess shot performance based on various parameters, including shot speed, angle, and placement in the goal area (Zhou et al., 2021). In the context of the penalty area, the system could be designed to monitor shots from specific distances, allowing coaches to analyze the player's goal-scoring capabilities.

- **Sports performance analysis using camera-based tracking systems and data visualization (Chien et al., 2021)**

To generate statistical information on player performance, integration of data analytics and real-time performance tracking is required. Systems like STATS SportVU and Opta Sports use camera-based tracking systems and data visualization tools to monitor player performance in sports (Chien et al., 2021). These systems track various performance metrics, such as shooting accuracy, goal frequency, and shot placement, and provide insights that help coaches assess a player's strengths and weaknesses.

For a Raspberry Pi-based system, the camera module will capture shot data, while the Raspberry Pi processes the footage to extract key performance indicators (KPIs) such as accuracy, shot frequency, and placement. The system can be further enhanced by integrating machine learning algorithms that automatically categorize performance metrics and generate reports. This will allow the system to provide statistical feedback, showing players their progress over time and helping coaches devise targeted training programs.

- **Embedded GUI Systems for Sports Analytics: Touchscreen Design and Field Application (Patel & Wong, 2020)**

Touchscreen interfaces in embedded systems have been widely used in real-time monitoring applications due to their portability and direct interaction. Research highlights the effectiveness of using Raspberry Pi with Python-based GUI frameworks such as Tkinter and PyQt for developing responsive interfaces on compact displays. These setups are especially useful in sports and training environments where real-time feedback,

minimal latency, and ease of use are crucial (Patel & Wong, 2020).

In the proposed system, a 7-inch Raspberry Pi touchscreen will function as the main control panel. The interface will be developed in Python and allow users to initiate training, view performance statistics, and exit the program. Real-time outputs such as object detection and distance measurements will be displayed on-screen, eliminating the need for a separate mobile application. This design improves usability and ensures consistent performance in outdoor football training scenarios.

- **Stability in sports equipment design: The application of using metal tubing for camera stands (Feng et al., 2020)**

Stability is crucial for any camera-based system, as even slight misalignments or vibrations can lead to inaccurate data and unreliable results. Metal tubing is commonly used in engineering applications for its robustness and stability, making it an ideal material for creating a stand for the camera system. Feng et al. (2020) discussed the use of metal tubing and adjustable mounts in sports equipment to ensure stability and maintain the camera's optimal viewing angle during dynamic movements.

The use of metal tubing for the stand will provide both stability and adjustability. The stand can be designed with adjustable legs and a sturdy base to withstand external forces like wind or player movement. Additionally, motorized mounts or gimbal stabilization systems can be used to correct the camera's alignment automatically, ensuring that the camera remains focused on the goal area at all times, especially when shots are taken from different angles.

- **Stainless steel casings for outdoor electronics: Protecting hardware in harsh environments (Kim et al., 2020)**

The reliable casing of the camera-based system is essential for protecting the hardware from damage during practical use, especially in outdoor environments like soccer fields. Stainless steel is known for its strength and corrosion resistance, making it an ideal material for creating a protective casing. According to Kim et al. (2020), stainless steel casings are widely used in outdoor electronics because they can withstand environmental factors such as rain, dust, and impacts.

A stainless steel casing for the device will provide protection from physical impacts and ensure the longevity of the system. The casing should be designed to be both lightweight and durable, allowing for easy transport and installation while providing adequate protection. Furthermore, the casing should have ventilation holes or cooling fins to prevent overheating, especially when used for extended periods.

Synthesis

Raspberry Pi-based systems offer a cost-effective and flexible solution for sports performance analysis, particularly in tracking and evaluating player actions. By integrating camera modules and real-time video processing, the system can monitor metrics like shot accuracy, ball trajectory, and player movement. Multi-camera setups enhance precision, while machine learning algorithms enable automatic performance assessment. Mobile app integration allows real-time feedback and remote monitoring, further supporting player development. Additionally, stability and protection are ensured through the use of metal tubing for camera stands and stainless steel casings, making the system robust for outdoor environments. This combination provides an efficient and durable tool for sports training and performance analysis.

METHODOLOGY

This chapter will present the design specifications that allow the prototype to perform these functions and features. All the hardware and software components are listed and described in the following sections. The proponents will be using the Prototyping Model, Block Diagram, State Transition Diagram and System Flow Diagram for the development of the system.

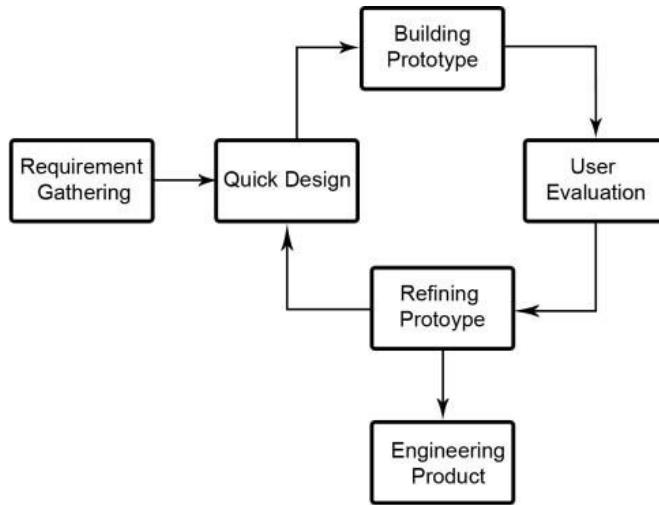


Figure 1. Prototyping Model

Requirement Gathering

- Planning and Brainstorming

Planning helps us to identify our goals clearly, it is important, so we know how to perfectly execute the step-by-step process towards the objective. Everything will be perfectly fine if it is planned, and it will reduce the possibility of failure. The proponents produced their own ideas and gathered and applied to solve the problem.

- Internet Research

The Internet is a free access to broad knowledge and information. It is improving the quality of education and increasing the opportunity for every person beyond the

educational system. Everyone can rely on the internet, especially if you want to know something or solve a problem. The proponents conducted online research for finding useful information and projects from different websites that can be helpful for developing the project proposal.

- Survey

The developers conducted a survey to gather data from a group of people to get answers to queries about the proposed system. This was accomplished by posing a set of survey questions that encompassed the project's objectives and provided as critical evidence for its importance.

$$n = \frac{N}{1 + N e^2}$$

Where:

N = Population Size

e = Margin of Error

n = Sample Size

Quick Design

This is when the requirements are gathered, and system design specifications are already done and listed. This section includes the important aspects of the system from designing of the project to developing software and hardware connections. It also gives the user some insights or understanding of how the system works. It allows the proponents to have a better understanding of exact requirements.

- **Block Diagram**

The proponents created a block diagram to show the flow of the system. This will show the functions of every component represented by blocks and lines that show the relationships of the components and materials from one another.

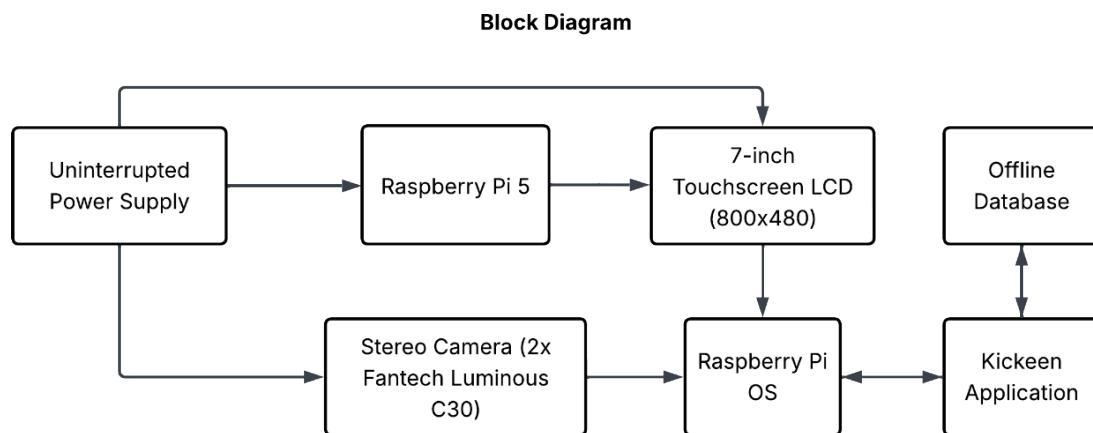


Figure 2. Block Diagram

- **State Transition diagram**

In order to demonstrate the limited number of possible states of the system, as well as the relationship between hardware components and the system and the transition between states, the proponents employed State Transition Design (STD).

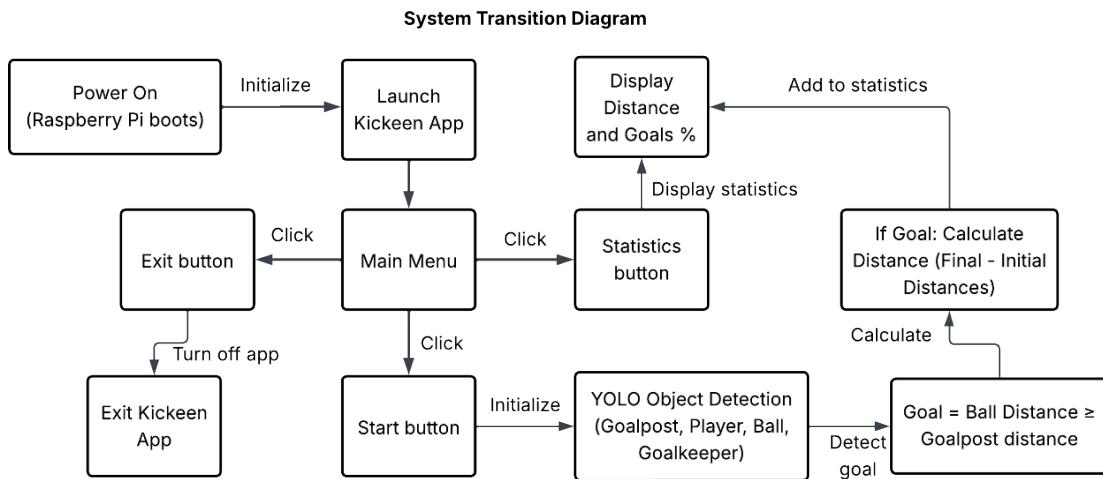


Figure 3. System Transition Diagram of the system.

- **System Flow Chart**

The proponents used system flow chart display the data flow in the proposed system. It is composed of symbols that are connected to each other, and it will show where and what happens to the data, when the decision has been made.

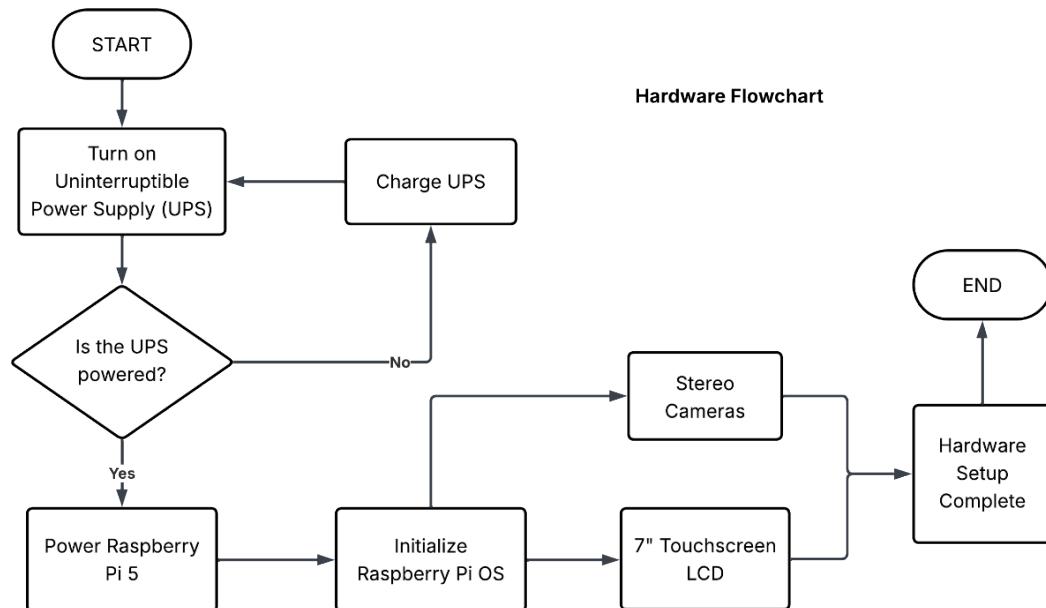


Figure 4. Hardware Flowchart of the system.

The flowchart outlines the process of setting up and testing a system involving a

Raspberry Pi and associated hardware for performance evaluation. It begins with setting up the system in a designated penalty area. The system readiness is then assessed; if it is not ready, the device must be re-stationed to ensure proper setup. Once ready, the system proceeds to initialize the Raspberry Pi 5. After initialization, the wireless connection is checked. If the Raspberry Pi is not connected to a mobile device, the user is prompted to establish the connection. This includes ensuring that the necessary mobile application is installed. If the application is missing, it must be installed before proceeding. With the application installed, the Raspberry Pi is connected to the mobile phone and further controlled via the mobile app. The next step involves verifying the setup of the Raspberry Pi Camera Module 3. If the camera is not properly set up, calibration is required to ensure accurate operation. Once the camera is configured, the system can move forward to accuracy testing. The results of this test are used to determine the accuracy rate of the system. Finally, the overall performance of the system is summarized in a performance report. This summary marks the end of the process, providing users with insights into system performance and accuracy. The flowchart emphasizes logical troubleshooting and sequential setup to ensure optimal system functionality.

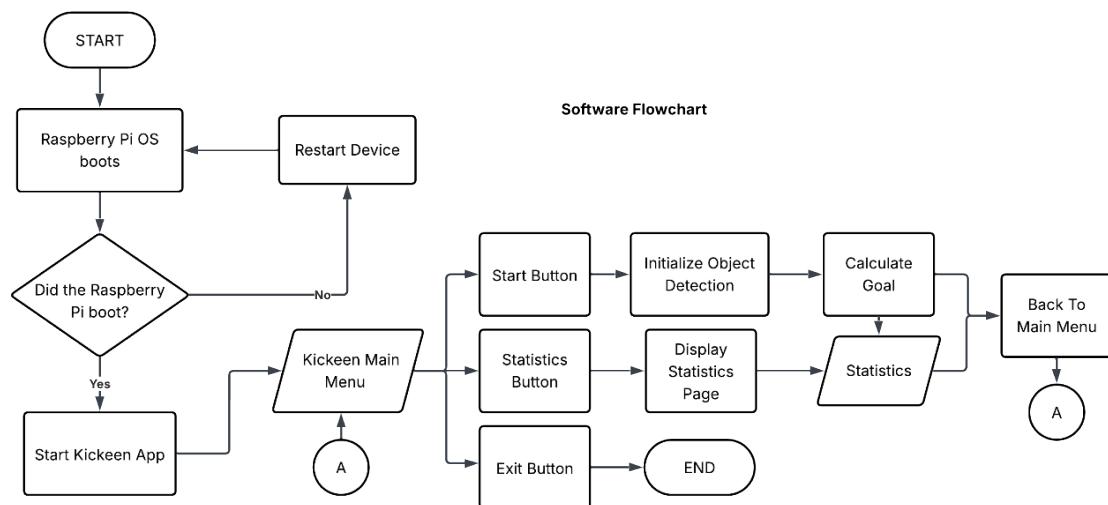


Figure 5. Software Flowchart of the system.

The flowchart depicts the process of interacting with the Kickeen app and its functionalities in a structured manner. It begins with the user acquiring the Kickeen app,

which is the first step in accessing its features. If the app is not already installed, the user is prompted to install it before proceeding. Once installed, the next step is to initialize the app and establish a wireless connection between the Kickeen device and the mobile device. This connection is crucial for ensuring that the app can function properly. If the app fails to run successfully, the user is guided to revisit the initialization or connection process to troubleshoot the issue. However, if the app runs successfully, the user is directed to the homepage of the Kickeen app, which serves as a central hub for its features. At this stage, the flowchart introduces various options for the user to explore. One of the primary functionalities of the app is the ability to monitor player statistics. If the user selects this option, they are taken to a dedicated page that displays detailed player performance data. Another key feature is the challenge modes offered by the app. The user can choose to enter the Striker Challenge Mode or explore one of two challenge levels: Pro Challenge Mode or Novice Challenge Mode. Each mode provides a unique experience tailored to the user's skill level or preferences. The Novice Challenge Mode allows the user to choose a specific area to hit the goal, while the Pro Challenge Mode changes the target area each time the player scores. Regardless of the chosen mode or functionality, the process concludes with recording player statistics, marking the end of the session. This ensures that the user's data is saved for future reference or analysis.

Refining Prototype

In this section, all the suggestions, comments and recommendations of the beneficiary and adviser were taken into consideration to meet the requirements and improve the project. The feedback from the beneficiary and adviser will serve as a basis for improvement and refinement of the system, and if the proposed project needs necessary adjustments. The proponents will continue to review and refine the whole proposed project to function accordingly to the expectations.

Hardware/Software

The integration of technology in sports has revolutionized the way games are played, analyzed, and experienced. Football / Soccer, being one of the most popular sports globally, has seen numerous technological advancements. This research proposal aims to develop a smart camera-based soccer training assistant.

- **Microprocessor**

The Raspberry Pi 5 is the latest model in the Raspberry Pi series, offering significant improvements over its predecessors. It continues the Raspberry Pi tradition of providing a low-cost, versatile computing platform, but with enhanced performance and new features. The Raspberry Pi 5 offers up to 8 GB of LPDDR4-3200 SDRAM, providing better support for memory-intensive applications. For connectivity, it features USB 3.0 ports, Gigabit Ethernet, Wi-Fi 6, and Bluetooth 5.0, improving data transfer speeds and wireless performance. Additionally, the device supports USB booting, allowing users to boot from external storage devices like SSDs for faster performance.



Figure 6. Raspberry Pi 5

- **FanTech Luminous C30 Webcam**

The Fantech Luminous C30 is a high-performance 2K Quad HD webcam designed to deliver sharp and vibrant video quality. Equipped with a 4MP sensor, it captures footage at a resolution of 2560x1440 pixels, ensuring detailed visuals. Its ultra-wide 106° field of view allows for comprehensive coverage, making it suitable for various applications. The webcam also features a built-in microphone for clear audio capture and a 360° rotating base for flexible positioning. In the context of smart soccer goal monitoring systems, the

Fantech Luminous C30 can play a pivotal role. Its high-resolution video capability ensures precise detection of ball movements and goal-line events. The wide-angle lens covers the entire goal area, reducing blind spots and ensuring accurate monitoring.



Figure 6.1. FanTech Luminous C30 Webcam

- **Thermal Solutions**

For the Raspberry Pi 5, effective cooling is essential, especially if you're running demanding applications. While the board doesn't require cooling for light tasks like basic coding, it tends to overheat under heavier loads, such as streaming, gaming, or running intensive programs. This can lead to performance throttling as the CPU reaches higher temperatures.

The Raspberry Pi 5 Active Cooler is an effective cooling solution designed to keep your Raspberry Pi 5 within optimal temperature ranges, especially during demanding tasks or overclocking. It combines an anodized aluminum heatsink with a temperature-controlled blower fan, making it suitable for users who want to push their Raspberry Pi 5 under continuous heavy load without performance throttling. The fan operates at speeds up to 8,000 RPM and delivers airflow of up to 1.4 CFM (Cubic Feet per Minute), helping to keep the system cool under intense use

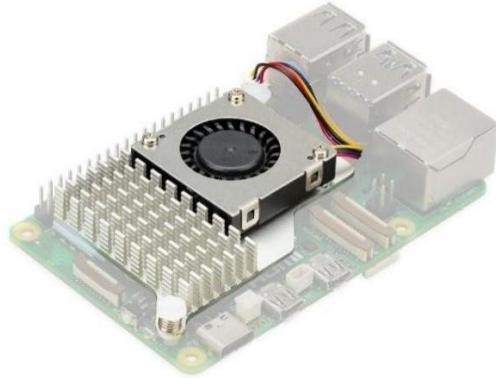


Figure 6.2. Raspberry Pi 5 Active Cooler

- **Uninterrupted Power Supply (UPS)**

An Uninterruptible Power Supply (UPS) is a critical component in ensuring the reliability and accuracy of smart soccer goal monitoring systems. By providing immediate backup power during electrical outages, a UPS maintains the continuous operation of essential equipment such as cameras and sensors, preventing data loss and system downtime. Additionally, it safeguards sensitive electronics from voltage fluctuations and surges, preserving the integrity of the monitoring system. In environments where consistent power supply is paramount, integrating a UPS enhances the overall performance and dependability of smart soccer goal monitoring solutions.



Figure 6.3. Uninterrupted Power Supply

Calendar of Activities

Activity	August				September				October				November				December				January				February				March				April				May			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4				
Groupings																																								
Brainstorming																																								
Writing of Possible Capstone Proposals																																								
Passing of Possible Capstone Proposals																																								
Finalizing of Chosen Capstone Proposal																																								
Planning																																								
Writing Chapter 1																																								
Creating Questionnaires																																								
Looking for Survey Respondents																																								
Conducting Survey																																								
Writing Statement of the Problem																																								
Creating Objectives of the Study																																								
Creating State Transition Diagram																																								
Listing Hardware Software Components																																								
Creating User Interface																																								
Creating Budgetary Estimate																																								
Writing Scope and Limitation																																								
Writing Review of Related Literature/Study																																								
Writing Methodology																																								
Quick Design																																								
Creating State Transition Diagram																																								
Creating Architectural Design																																								
Creating Documentation																																								
Project Management																																								
Building of Prototype																																								
Buying the Materials Tools Needed																																								
Coding the Prototype																																								
Debugging the Prototype																																								
Finalizing the Prototype																																								
Testing the Prototype																																								
User Evaluation																																								
Implementation of the Prototype																																								
Refining Prototype																																								
Feedback of the User																																								
Engineering Product																																								
Finalizing Documentation																																								
Conclusion and Recommendation																																								
Appendices																																								



Lester Manuel O. Adornado
 Julien G. Ibalio
 Flor John G. Loper
 John Gene P. Roque

Table 1. Gantt Chart

Budgetary Estimate

Quantity	Specifics	Approximate Cost
1	Raspberry Pi 5 8GB	₱4,200
10	Metal Tubes	₱2,000
1	Stainless Steel	₱2,000
2	FanTech Luminous C30 Webcam	₱2,500
1	Uninterrupted Power Supply (UPS)	₱2,000
1 meter	Thermal Pad	₱100
4	Lithium Battery	₱600
2	3D Printing	₱3,000
1	Thermal Paste	₱50
1	Raspberry Pi 5 Active Cooler	₱400
Total		₱16,850

Table 2. Estimation Budget for the Proposed Project

At the heart of the system lies the Raspberry Pi 5 (8GB), costing ₱4,200. This compact yet powerful single-board computer is responsible for processing data, handling external device communication, and managing network tasks. Its 8GB RAM capacity enables smooth multitasking and supports demanding applications, such as real-time video analysis and sensor integration. To ensure the system is physically resilient, the build incorporates ten metal tubes and a stainless steel component, each priced at ₱2,000. These materials form a sturdy structural framework that provides protection and support for the internal electronics. The metal tubes are likely used for the main frame, while the stainless steel adds extra strength and corrosion resistance, safeguarding sensitive parts from physical and environmental stress. For image-based tasks like object recognition, surveillance, or live monitoring, the system includes two FanTech Luminous C30 webcams with a total cost of ₱2,500. These webcams offer reliable video quality and are compatible with the Raspberry Pi, allowing the system to perform functions like facial detection and motion tracking effectively. Reliable power supply is essential, which is why the project includes a Uninterrupted Power Supply (UPS) worth ₱2,000 and four lithium batteries totaling ₱600. The UPS protects against unexpected power losses, while

the batteries provide mobility and enable the system to function even in areas without direct power sources. Effective heat management is addressed with the inclusion of a 1-meter thermal pad (₱100), thermal paste (₱50), and a dedicated active cooler for the Raspberry Pi 5 (₱400). These cooling components work together to prevent overheating, enhance performance, and extend the lifespan of the device, especially under continuous or heavy workloads. Lastly, the project allocates ₱3,000 for 3D printing services. These are crucial for fabricating custom-designed parts such as mounts, casings, and internal holders, ensuring all hardware components are securely and neatly arranged. 3D printing also allows for a more polished and compact final design tailored to the specific layout of the system. In summary, the proposed ₱18,850 budget covers all essential hardware and services required to build a reliable, adaptable, and portable system. Every component plays a specific role in enhancing the system's functionality, structural integrity, and resilience. This well-planned investment enables the project to meet both prototyping and real-world deployment needs across a wide range of use cases.

RESULTS AND DISCUSSION

This chapter presents and analyzes the quantitative data gathered from user testing of the KICKEEN prototype. The data was collected through a usability and satisfaction survey, with responses categorized on a four-point scale: Strongly Disagree, Disagree, Agree, and Strongly Agree. The findings are organized thematically to evaluate the system's core functionality, hardware, user interface, and overall user satisfaction.

Results

The user feedback was compiled into 18 distinct metrics. The results across all categories were overwhelmingly positive, indicating a high level of success for the prototype.

Core Functionality: Detection and Accuracy

The system's core technology, its ability to detect key elements of the game, performed exceptionally well.

- **Player and Ball Detection:** The system achieved a 100% agreement rate (60% Agree, 40% Strongly Agree) for "detects the player easily" (Stat 1) and a 90% agreement rate (40% Agree, 50% Strongly Agree) for "detects the ball easily" (Stat 2).
- **Goalpost Detection:** This metric was slightly weaker but still positive, with 80% of users in agreement (55% Agree, 25% Strongly Agree) that KICKEEN "detects the goalpost easily" (Stat 3).
- **Accuracy:** The system's "distance measurement is accurate" (Stat 4) received a 95% positive response (50% Agree, 45% Strongly Agree).

Data and Statistical Feedback

Respondents showed high confidence in the data provided by the system.

- "KICKEEN provides me with comprehensive statistics on my goals" (Stat 5) saw an 85% agreement rate (35% Agree, 50% Strongly Agree).

- Similarly, 80% of users found that KICKEEN "provides a clear summary of my statistics" (Stat 6), with a 55% majority strongly agreeing.

Hardware: Stand, Case, and Battery

The physical components of the KICKEEN device were highly praised.

- **Case:** The case received perfect or near-perfect scores for its build, with 100% of users agreeing (70% Strongly Agree) that it "protects the device from harm" (Stat 12) and 95% agreeing (55% Strongly Agree) it is "sturdy and reliable" (Stat 11).
- **Stand:** The stand was also rated positively, with 95% agreeing (55% Agree, 40% Strongly Agree) that it "keeps the device from wobbling and vibrating" (Stat 10). A slightly lower but still strong 81% (33% Agree, 48% Strongly Agree) found the stand "stable and reliable during training" (Stat 9).
- **Battery:** Battery life was an unqualified success, with 100% of users agreeing (70% Strongly Agree) that it "lasts throughout training" (Stat 16).

User Interface (UI) and Design

The user-facing software and physical design were met with strong approval.

- **UI:** 85% of users agreed (50% Strongly Agree) that the "user interface is friendly and easy to understand" (Stat 7). Furthermore, 90% agreed (50% Strongly Agree) that the "touchscreen is bright and easy to see during training" (Stat 8).
- **Aesthetic Design:** The physical design was highly rated, with 95% finding it "appropriate and pleasing" (Stat 13) and 90% stating, "I am satisfied with KICKEEN's design" (Stat 14).

Overall Performance and User Satisfaction

The culmination of all features resulted in exceptionally high overall satisfaction.

- **Performance:** 90% of users agreed (45% Agree, 45% Strongly Agree) that "KICKEEN's performance is smooth" (Stat 15). This translated into 95% of users (30% Agree, 65% Strongly Agree) stating, "I am satisfied with KICKEEN's performance" (Stat 17).
- **User Intent:** Critically, 95% of users (30% Agree, 65% Strongly Agree) affirmed, "I want to use KICKEEN to further improve my skills in soccer/football" (Stat 18).

Discussion

The results from the user testing strongly validate the design and functionality of the KICKEEN prototype. The overwhelmingly positive feedback across all 18 metrics suggests that the product not only meets its core objectives but also delivers a high-quality user experience.

The most critical finding is the 95% "desire to use" the product for skill improvement (Stat 18). This metric, combined with the 95% satisfaction rate for performance (Stat 17), indicates that KICKEEN has successfully established a strong product-market fit among its test users. The perfect 100% agreement on battery life (Stat 16) and case protection (Stat 12) demonstrates a robust and reliable hardware solution, which is fundamental for a sports training device.

While the feedback was positive, the data also highlights specific, minor areas for future refinement. The most notable areas for improvement are in "goalpost detection" (Stat 3) and "clarity of statistics summary" (Stat 6), which received the highest disagreement rates at 20% each. This suggests that while the system collects comprehensive data (Stat 5, 85% agreement), the presentation of that data in the summary screen could be optimized for clarity for a subset of users. Similarly, the goalpost detection algorithm, while functional, could be refined to handle edge cases that may have caused issues for 20% of respondents, such as varying light conditions or non-standard goalposts.

A subtle but interesting finding relates to the stand. While 95% of users confirmed the stand prevents wobbling (Stat 10), only 81% described it as "stable and reliable" (Stat 9). This 14-point discrepancy suggests that while the stand performs its primary function effectively, its perceived build quality, ease of setup, or general "feel" might not be as robust as the case, leaving a small room for improvement in its tactile design.

In conclusion, the KICKEEN prototype is a resounding success according to the user feedback. It excels in its core detection capabilities (player, ball), hardware reliability (battery, case), and user interface. The high marks for performance, design, and, most importantly, the users' desire to continue using the product, confirm that KICKEEN is a viable and valuable tool for football skill development. Future work should focus on minor refinements to the goalpost detection algorithm and the UI of the statistics summary page to elevate the product from a successful prototype to a market-ready product.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study successfully designed and developed KICKEEN: A Smart Camera-Based Soccer Assistant for Goal Accuracy Monitoring, a cost-effective and accessible technological tool aimed at addressing the challenge of providing objective, real-time feedback on shooting performance for soccer players.

The system met all the specified objectives by effectively integrating hardware and software components to create a functional and robust training device:

- Real-Time Monitoring: Through the integration of stereo USB cameras and the YOLOv8 object detection algorithm running on a Raspberry Pi 5, KICKEEN is capable of accurately identifying and tracking the player, ball, and goalpost in real time. The use of stereo depth estimation allows for the calculation of the player's distance from the goal via stereo triangulation, ensuring shot distance is measured precisely within the crucial penalty area (up to 20 meters).
- Performance Analytics: The system successfully implemented a mechanism to provide objective, statistical feedback. It tracks the frequency of shots and categorizes attempts by distance to calculate percentage-based success rates (accuracy and efficiency). This data allows players to track performance trends over time and gain valuable, data-driven insights necessary for fine-tuning their shooting technique and improving consistency.
- Usability and Durability: To ensure practical and reliable operation in outdoor environments, a seamless Python-based GUI was developed for the 7-inch Raspberry Pi touchscreen, serving as the main control and real-time feedback display. Furthermore, the device's stability was ensured with an adjustable metal tubing stand, and the internal components were protected from environmental factors like rain and dust by a durable stainless steel casing.

In conclusion, KICKEEN successfully bridges a critical gap in player development by providing an affordable and immediate feedback loop that current high-cost or complicated systems fail to deliver to grassroots athletes. By offering objective data on goal accuracy and shot placement, the system serves as a powerful training assistant to help players improve their skills and consistency, especially under pressure, contributing positively to the growing efforts in soccer development.

Recommendations for Future Development

For future iterations of the KICKEEN system, the following enhancements are recommended to further increase its utility:

1. Expanded Range and Conditions: Enhance the camera system and algorithms to accurately monitor shots from greater distances (beyond the 20-meter penalty area limit) and improve object detection robustness under varying lighting and poor weather conditions, as these were noted limitations.
2. Physiological Data Integration: Incorporate external sensors to capture and analyze physiological data, such as kicking force or foot-to-ball contact metrics, which are currently outside the scope of the visual-only system.
3. Remote Access/Mobile Application: Develop a complementary mobile application to allow coaches and players to remotely start training sessions, access performance statistics, and view real-time feedback, providing an alternative to the built-in touchscreen interface.

References

- Aczon, M. (2019). Soccer development in the Philippines: Challenges and opportunities. *Journal of Asian Sports Studies*, 4(1), 28-35.
- Aczon, M. (2021). The rise of football in the Philippines: Recent progress and future prospects. *Sports Journal Philippines*, 15(3), 12-19.
- Bakker, F. C., van der Kamp, J., & Savelsbergh, G. J. P. (2020). Precision and accuracy in soccer penalty kicks: A study on the role of targeting in performance. *Journal of Sports Sciences*, 38(14), 1607-1613. <https://doi.org/10.1080/02640414.2020.1811394>
- Cavazzuti, M., Sanna, S., & Di Russo, F. (2020). The role of real-time feedback in improving penalty kick performance in soccer. *Sports Psychology Journal*, 16(4), 27-34. <https://doi.org/10.1080/17509857.2020.1829059>
- Chien, C., Liu, Y., & Chang, T. (2021). Sports performance analysis using camera-based tracking systems and data visualization. *Journal of Sports Analytics*, 7(2), 123-134. <https://doi.org/10.1016/j.jsportsanal.2021.01.007>
- Feng, S., Li, J., & Zhang, H. (2020). Stability in sports equipment design: The application of metal tubing for camera stands. *Journal of Sports Engineering & Technology*, 34(4), 78-89. <https://doi.org/10.1177/1754337120930345>
- FIFA. (2020). Philippine football: Growth and development. *FIFA Development Report*, 18(4), 45-49.
- Gill, M. D., & Symons, R. M. (2019). The application of smart cameras in sports analytics for player performance evaluation. *Journal of Sports Analytics*, 7(4), 215-223.
- Jones, B. M., Delaney, D. W., & Greig, M. (2021). Environmental influences on shooting accuracy in soccer: A review. *International Journal of Performance Analysis in Sport*, 21(3), 492-505. <https://doi.org/10.1080/24748668.2021.1900585>
- Kim, Y., Park, J., & Lee, H. (2020). Stainless steel casings for outdoor electronics: Protecting hardware in harsh environments. *Journal of Electronics Protection*, 15(2), 45-54. <https://doi.org/10.1016/j.electronicsprotection.2020.05.004>
- Kredel, R., Memmert, D., & Lemmink, K. A. M. (2023). Psychological pressure and performance: Investigating soccer penalty kick success rates under pressure. *Psychology of Sport and Exercise*, 58, 102086.

<https://doi.org/10.1016/j.psychsport.2023.102086>

- Mubarak, M. (2020). Challenges in Philippine football: Financial and infrastructural barriers. *International Sports Review*, 11(3), 63-70.
- Nakazawa, T. (2022). Blue Lock: The rise of soccer anime and its impact on global fandoms. *Anime Culture Quarterly*, 9(2), 45-52.
- Patel, R., & Wong, J. (2020). Embedded GUI Systems for Sports Analytics: Touchscreen Design and Field Application. *International Journal of Sports Technology*, 15(3), 122–130.
- Siriwardena, T., Perera, H., & Jayasinghe, A. (2020). Multi-camera systems for optical tracking in sports: A case study on soccer ball trajectory measurement. *Journal of Sports Technology*, 18(3), 153-163.
<https://doi.org/10.1080/21598369.2020.1851517>
- Taye, M. D., Vickerstaff, K. E., & Horn, J. (2019). Accuracy and consistency of soccer players' shooting techniques: A biomechanical perspective. *European Journal of Sport Science*, 19(6), 734-741. <https://doi.org/10.1080/17461391.2019.1622953>
- Vargas, A., Rojas, F., & Gil, S. (2022). The impact of psychological pressure on soccer penalty kick accuracy. *Journal of Sports Psychology*, 51(2), 121-133.
<https://doi.org/10.1123/jsp.2022-0065>
- Zhang, Y., Wang, J., & Liu, L. (2020). Real-time tracking of soccer penalty kicks using computer vision technology: A tool for improving player accuracy. *Journal of Sports Technology and Engineering*, 14(2), 42-50.
<https://doi.org/10.1177/1754337120905180>
- Zhou, Q., Yang, Z., & Li, B. (2021). Enhancing shot performance assessment using machine learning algorithms: An application to soccer. *International Journal of Machine Learning in Sports*, 19(4), 114-126.
<https://doi.org/10.1080/15700304.2021.1849274>

APPENDIX A. ARCHITECTURAL DESIGN

- **Prototype Design**

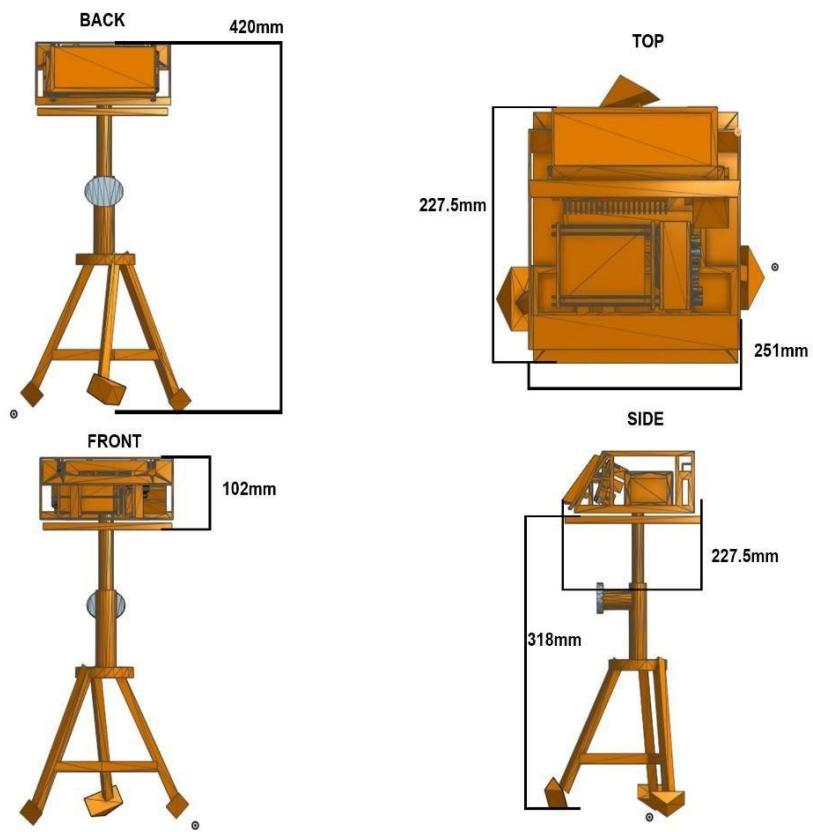


Figure 7: Prototype Design

APPENDIX B. PCB AND SCHEMATIC DESIGNS

- **PCB Design**

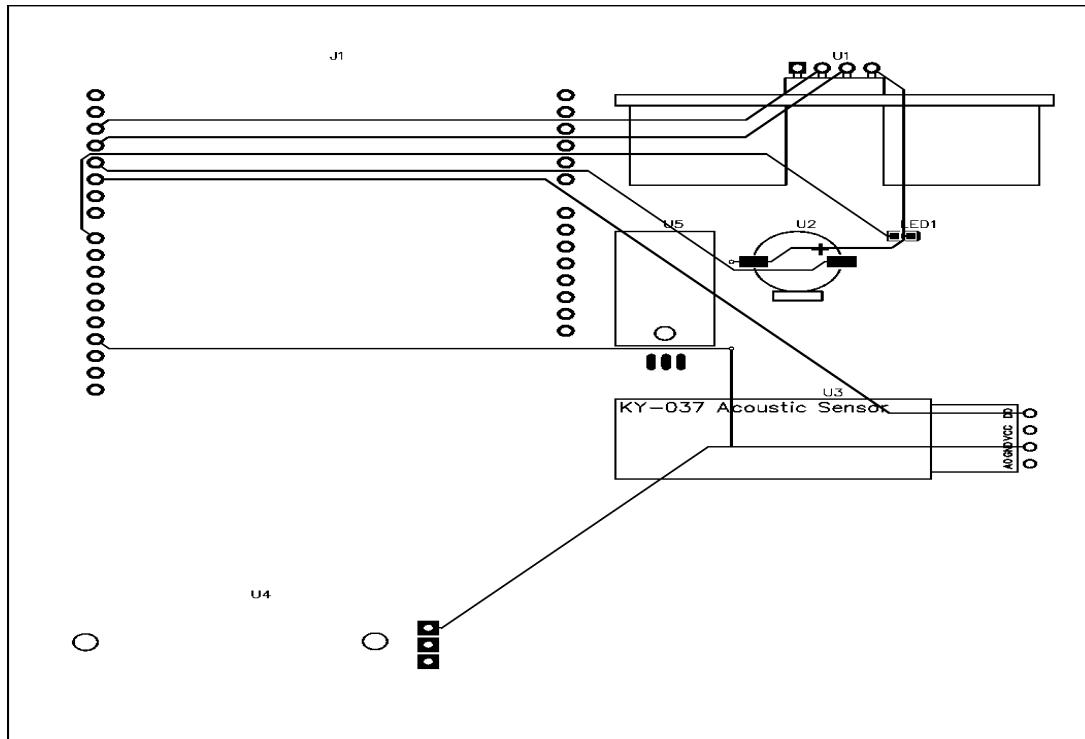


Figure 8: PCB Layout

- **Schematic Design**

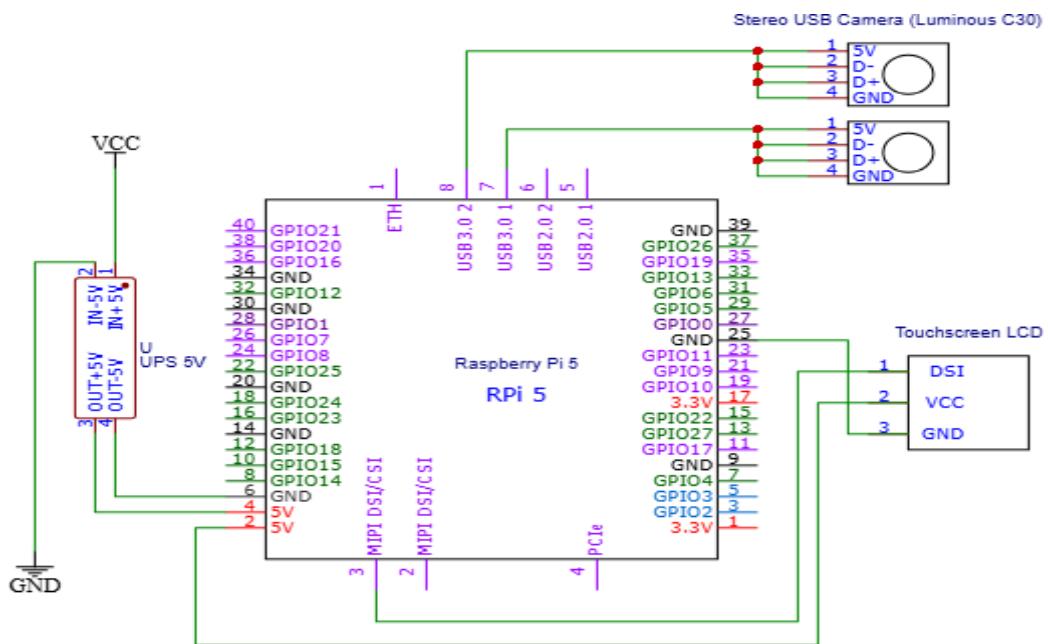


Figure 9: Schematic Diagram

APPENDIX C. USER INTERFACE

Main Menu

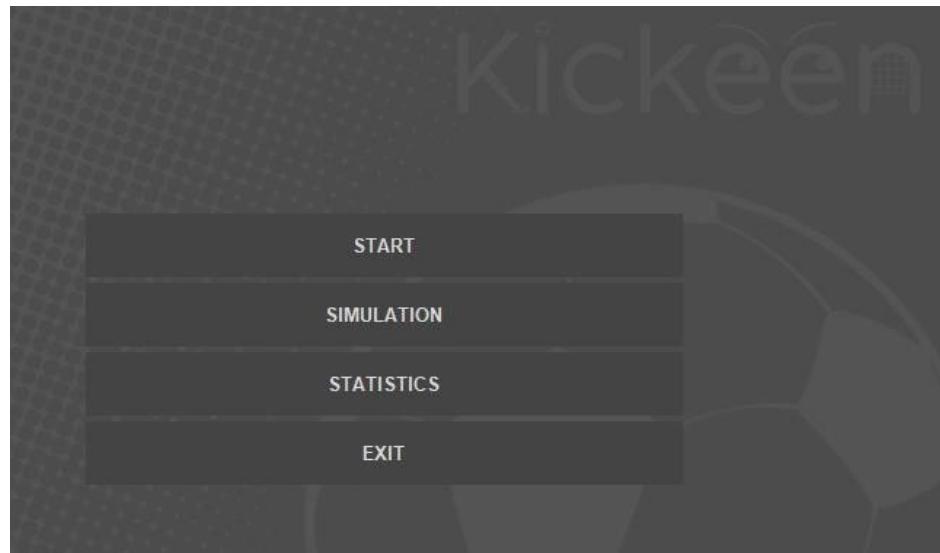


Figure 10: Main Menu Interface

Start



Figure 10.1: Start Interface

Simulation



Figure 10.2: Simulation Interface

Statistics

Statistics			
BACK	Distance	Goals	Percentage
RESET	<4m	0	0%
	4-5m	0	0%
	5-6m	0	0%
	6-7m	0	0%
	7-8m	0	0%
	8-9m	0	0%
	9-10m	0	0%
	10-11m	0	0%
	11-12m	0	0%
	12-13m	0	0%
	13-14m	0	0%
	14-15m	0	0%
	15-16m	0	0%
	16-17m	0	0%
	17-18m	0	0%
	18-19m	0	0%
	>19m	0	0%
Total Goals Made: 0			
You have made most goals in N/A			

Figure 10.3: Statistics Interface

APPENDIX D. TEST CASE

Capstone Group:	CPE01	BSCPE601	Capstone 1
Capstone Title:	KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING		
Members:	Ibalio, Julien Roque, John Gene		Adornado, Lester Manuel Lopez, Flor John

Test Case #	Object	Actual Distance (m)	Measured Distance (m)	Accuracy	Margin of Error
1	PLAYER	2	2.1	95.24%	±5.00%
2	PLAYER	2.5	2.7	92.59%	±8.00%
3	PLAYER	3	2.8	93.33%	±6.67%
4	PLAYER	3.5	2.9	82.86%	±17.14%
5	PLAYER	4	4.1	97.56%	±2.50%
6	PLAYER	4.5	4.2	93.33%	±6.67%
7	BALL	2	1.9	95.00%	±5.00%
8	BALL	2.5	2.2	88.00%	±12.00%
9	BALL	3	2.8	93.33%	±6.67%
10	BALL	3.5	3.7	94.59%	±5.71%

Table 3. Test Case Result

Sum of Accuracy (%):

$$95.24 + 92.59 + 93.33 + 82.86 + 97.56 + 93.33 + 95.00 + 88.00 + 93.33 + \\ 94.59 \\ = 925.83$$

Sum of Margin of Error (%):

$$5.00 + 8.00 + 6.67 + 17.14 + 2.50 + 6.67 + 5.00 + 12.00 + 6.67 + 5.71 = 75.36$$

$$\text{Mean Accuracy (\%)} = 925.83 \div 10 = 92.58\% \\ \text{Mean Margin of Error (\%)} = 75.36 \div 10 = \pm 7.54\%$$

APPENDIX E. SURVEY COVER LETTER

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

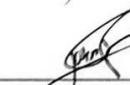
Good day, we are 3rd year students of Bachelor of Science in Computer Engineering currently at Methods of Research Subject at STI College Cubao. We are seeking your permission to participate in a survey and interview for our capstone Project entitled "**KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING.**" The purpose of this project is to develop a system to improve the traditional soccer training in terms of scoring goals.

Before you proceed, we want to assure you that all data that will be collected will remain confidential and will only be used for this study in accordance with **RA 10173 or the Data Privacy Act of 2012**. Your participation in this research will be a huge contribution to the development of our project. Your thoughts and responses are greatly appreciated and we thank you for your time and contribution to this important study.

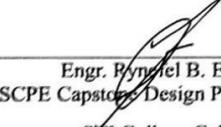

Lester Manuel O. Adornado


Julian G. Ibalio


Flor John G. Lopez


John Gene P. Roque

Noted by:


Engr. Rynnel B. Elopre
BSCPE Capstone Design Project Adviser
STI College Cubao

APPENDIX F. PRE-TEST SURVEY QUESTIONNAIRE

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): _____

Gender:

Male

Female

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				
I am improving my penalty kicks during practice and in real games.				
I am finding effective ways to train for penalty kicks.				
My accuracy for scoring goals is getting better.				
My current training for scoring goals and penalty kicks is becoming more effective.				
I am enhancing my focus on my target.				
I am learning to select the best area of the goal to shoot.				
I am becoming more decisive about where to shoot the ball in the goal.				
The ball does not go where I want it to go when I shoot.				
I am learning to control the ball better when I shoot.				
I am interested in new training methods for scoring goals.				
I would like to monitor my goal percentage, goal accuracy and goal precision.				
Being able to monitor my goals will help me improve my training.				

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): _____

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				
I am improving my penalty kicks during practice and in real games.				
I am finding effective ways to train for penalty kicks.				
My accuracy for scoring goals is getting better.				
My current training for scoring goals and penalty kicks is becoming more effective.				
I am enhancing my focus on my target.				
I am learning to select the best area of the goal to shoot.				
I am becoming more decisive about where to shoot the ball in the goal.				
The ball does not go where I want it to go when I shoot.				
I am learning to control the ball better when I shoot.				
I am interested in new training methods for scoring goals.				
I would like to monitor my goal percentage, goal accuracy and goal precision.				
Being able to monitor my goals will help me improve my training.				

Survey Questionnaire
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Blake

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				
I am improving my penalty kicks during practice and in real games.				
I am finding effective ways to train for penalty kicks.				
My accuracy for scoring goals is getting better.				
My current training for scoring goals and penalty kicks is becoming more effective.				
I am enhancing my focus on my target.				
I am learning to select the best area of the goal to shoot.				
I am becoming more decisive about where to shoot the ball in the goal.				
The ball does not go where I want it to go when I shoot.				
I am learning to control the ball better when I shoot.				
I am interested in new training methods for scoring goals.				
I would like to monitor my goal percentage, goal accuracy and goal precision.				
Being able to monitor my goals will help me improve my training.				

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Gio Santos

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.		/		
I am improving my penalty kicks during practice and in real games.			/	
I am finding effective ways to train for penalty kicks.				/
My accuracy for scoring goals is getting better.			/	
My current training for scoring goals and penalty kicks is becoming more effective.				/
I am enhancing my focus on my target.			/	
I am learning to select the best area of the goal to shoot.				/
I am becoming more decisive about where to shoot the ball in the goal.				/
The ball does not go where I want it to go when I shoot.				/
I am learning to control the ball better when I shoot.			/	
I am interested in new training methods for scoring goals.				/
I would like to monitor my goal percentage, goal accuracy and goal precision.				/
Being able to monitor my goals will help me improve my training.				/

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Andrei Villa Agustin

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				✓
I am improving my penalty kicks during practice and in real games.				✓
I am finding effective ways to train for penalty kicks.				✓
My accuracy for scoring goals is getting better.				✓
My current training for scoring goals and penalty kicks is becoming more effective.			✓	
I am enhancing my focus on my target.				✓
I am learning to select the best area of the goal to shoot.				✓
I am becoming more decisive about where to shoot the ball in the goal.				✓
The ball does not go where I want it to go when I shoot.				✓
I am learning to control the ball better when I shoot.				✓
I am interested in new training methods for scoring goals.				✓
I would like to monitor my goal percentage, goal accuracy and goal precision.			✓	
Being able to monitor my goals will help me improve my training.				✓

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

central midfielder

Name (Optional): Wilhem

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				✓
I am improving my penalty kicks during practice and in real games.			✓	
I am finding effective ways to train for penalty kicks.				✓
My accuracy for scoring goals is getting better.				✓
My current training for scoring goals and penalty kicks is becoming more effective.			✓	
I am enhancing my focus on my target.		✓		
I am learning to select the best area of the goal to shoot.		✓		
I am becoming more decisive about where to shoot the ball in the goal.	✓			
The ball does not go where I want it to go when I shoot.		✓		
I am learning to control the ball better when I shoot.		✓		
I am interested in new training methods for scoring goals.		✓		
I would like to monitor my goal percentage, goal accuracy and goal precision.			✓	
Being able to monitor my goals will help me improve my training.			✓	

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Defender

Name (Optional): Roland B. Agot

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.		/		
I am improving my penalty kicks during practice and in real games.		/		
I am finding effective ways to train for penalty kicks.			/	
My accuracy for scoring goals is getting better.		/		
My current training for scoring goals and penalty kicks is becoming more effective.				/
I am enhancing my focus on my target.		/		
I am learning to select the best area of the goal to shoot.		/		
I am becoming more decisive about where to shoot the ball in the goal.			/	
The ball does not go where I want it to go when I shoot.			/	
I am learning to control the ball better when I shoot.			/	
I am interested in new training methods for scoring goals.			/	
I would like to monitor my goal percentage, goal accuracy and goal precision.			/	
Being able to monitor my goals will help me improve my training.				/

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): K-01

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.			✓	
I am improving my penalty kicks during practice and in real games.				✓
I am finding effective ways to train for penalty kicks.				✓
My accuracy for scoring goals is getting better.		✓		
My current training for scoring goals and penalty kicks is becoming more effective.			✓	
I am enhancing my focus on my target.		✓		
I am learning to select the best area of the goal to shoot.				✓
I am becoming more decisive about where to shoot the ball in the goal.				✓
The ball does not go where I want it to go when I shoot.		✓		
I am learning to control the ball better when I shoot.				✓
I am interested in new training methods for scoring goals.				✓
I would like to monitor my goal percentage, goal accuracy and goal precision.		✓		
Being able to monitor my goals will help me improve my training.				✓

Survey Questionnaire
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Roxanne Emane

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				/
I am improving my penalty kicks during practice and in real games.				/
I am finding effective ways to train for penalty kicks.				/
My accuracy for scoring goals is getting better.				/
My current training for scoring goals and penalty kicks is becoming more effective.				/
I am enhancing my focus on my target.				/
I am learning to select the best area of the goal to shoot.				/
I am becoming more decisive about where to shoot the ball in the goal.				/
The ball does not go where I want it to go when I shoot.	/			
I am learning to control the ball better when I shoot.			/	
I am interested in new training methods for scoring goals.			/	
I would like to monitor my goal percentage, goal accuracy and goal precision.				/
Being able to monitor my goals will help me improve my training.				/

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Mark

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				/
I am improving my penalty kicks during practice and in real games.				/
I am finding effective ways to train for penalty kicks.				/
My accuracy for scoring goals is getting better.				/
My current training for scoring goals and penalty kicks is becoming more effective.				/
I am enhancing my focus on my target.				/
I am learning to select the best area of the goal to shoot.				/
I am becoming more decisive about where to shoot the ball in the goal.			/	
The ball does not go where I want it to go when I shoot.				/
I am learning to control the ball better when I shoot.				/
I am interested in new training methods for scoring goals.				/
I would like to monitor my goal percentage, goal accuracy and goal precision.				/
Being able to monitor my goals will help me improve my training.				/

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Tairan

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				/
I am improving my penalty kicks during practice and in real games.				/
I am finding effective ways to train for penalty kicks.				/
My accuracy for scoring goals is getting better.				/
My current training for scoring goals and penalty kicks is becoming more effective.				/
I am enhancing my focus on my target.				/
I am learning to select the best area of the goal to shoot.				/
I am becoming more decisive about where to shoot the ball in the goal.				/
The ball does not go where I want it to go when I shoot.				/
I am learning to control the ball better when I shoot.				/
I am interested in new training methods for scoring goals.				/
I would like to monitor my goal percentage, goal accuracy and goal precision.				/
Being able to monitor my goals will help me improve my training.				/

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): JC (

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				/
I am improving my penalty kicks during practice and in real games.				/
I am finding effective ways to train for penalty kicks.			/	/
My accuracy for scoring goals is getting better.			/	/
My current training for scoring goals and penalty kicks is becoming more effective.		/		
I am enhancing my focus on my target.			/	/
I am learning to select the best area of the goal to shoot.			/	/
I am becoming more decisive about where to shoot the ball in the goal.			/	/
The ball does not go where I want it to go when I shoot.	/			
I am learning to control the ball better when I shoot.	/			
I am interested in new training methods for scoring goals.	/		/	/
I would like to monitor my goal percentage, goal accuracy and goal precision.			/	
Being able to monitor my goals will help me improve my training.				/

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Rachelle
wide receiver

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.			/	
I am improving my penalty kicks during practice and in real games.	/			
I am finding effective ways to train for penalty kicks.			/	
My accuracy for scoring goals is getting better.			/	
My current training for scoring goals and penalty kicks is becoming more effective.	/			
I am enhancing my focus on my target.	/			
I am learning to select the best area of the goal to shoot.	/			
I am becoming more decisive about where to shoot the ball in the goal.			/	
The ball does not go where I want it to go when I shoot.			/	
I am learning to control the ball better when I shoot.			/	
I am interested in new training methods for scoring goals.	/			
I would like to monitor my goal percentage, goal accuracy and goal precision.			/	
Being able to monitor my goals will help me improve my training.			/	

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Running back.

Name (Optional): Clyde

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.		/		
I am improving my penalty kicks during practice and in real games.		/		
I am finding effective ways to train for penalty kicks.		/		
My accuracy for scoring goals is getting better.		/		
My current training for scoring goals and penalty kicks is becoming more effective.			/	
I am enhancing my focus on my target.			/	
I am learning to select the best area of the goal to shoot.		/		
I am becoming more decisive about where to shoot the ball in the goal.		/		
The ball does not go where I want it to go when I shoot.			/	
I am learning to control the ball better when I shoot.		/	/	
I am interested in new training methods for scoring goals.			/	
I would like to monitor my goal percentage, goal accuracy and goal precision.			/	
Being able to monitor my goals will help me improve my training.		/	/	

Survey Questionnaire
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Ajee DB.

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.			/	
I am improving my penalty kicks during practice and in real games.			/	/
I am finding effective ways to train for penalty kicks.			/	/
My accuracy for scoring goals is getting better.			/	/
My current training for scoring goals and penalty kicks is becoming more effective.		/		
I am enhancing my focus on my target.			/	/
I am learning to select the best area of the goal to shoot.			/	/
I am becoming more decisive about where to shoot the ball in the goal.			/	/
The ball does not go where I want it to go when I shoot.			/	/
I am learning to control the ball better when I shoot.			/	/
I am interested in new training methods for scoring goals.			/	/
I would like to monitor my goal percentage, goal accuracy and goal precision.			/	
Being able to monitor my goals will help me improve my training.		/		

Survey Questionnaire

KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): NICOLAT

Gender:

Male

Female:

Age Group:

12 and below

13-17

18 and above

Mobile Device:

Android

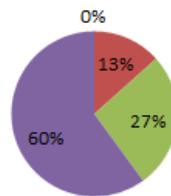
iOS

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
I am becoming more confident with my finishing skills in front of the penalty area.				/
I am improving my penalty kicks during practice and in real games.				/\
I am finding effective ways to train for penalty kicks.				/\
My accuracy for scoring goals is getting better.				/\
My current training for scoring goals and penalty kicks is becoming more effective.				/\
I am enhancing my focus on my target.				/\
I am learning to select the best area of the goal to shoot.				/\
I am becoming more decisive about where to shoot the ball in the goal.				/\
The ball does not go where I want it to go when I shoot.				/\
I am learning to control the ball better when I shoot.				/\
I am interested in new training methods for scoring goals.				/\
I would like to monitor my goal percentage, goal accuracy and goal precision.				/\
Being able to monitor my goals will help me improve my training.				/\

APPENDIX G. PRE-TEST SURVEY RESULT

I am becoming more confident with my finishing skills in front of the penalty area.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree

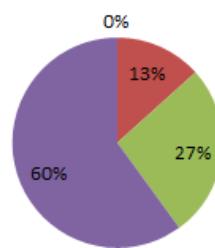


The majority of respondents (60%) expressed positive feelings towards their finishing skills in front of the penalty area, with a significant portion strongly agreeing that they are becoming more confident in this aspect. This suggests that training has had a positive impact on their ability to score goals near the penalty area. A small percentage of participants (13%) disagreed, indicating that while most players feel improvement, some may still struggle with their finishing skills.

The responses demonstrate that the group generally feels more self-assured in their finishing abilities. Continued practice and focused training can further enhance this confidence for the few who still find it challenging.

I am improving my penalty kicks during practice and in real games.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree



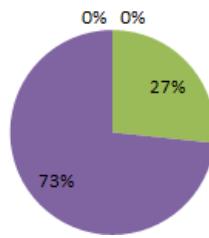
Similar to the previous statement, this one indicates that 73% of respondents are experiencing improvement in their penalty kicks. The fact that half of the participants strongly agree shows a solid level of confidence in their abilities both in practice and during real matches. However, 13% of players disagreed, suggesting that there might be

inconsistencies in performance or difficulties in replicating practice success during real games.

This feedback shows a positive trend in penalty kick development. More targeted training and psychological preparation may help players improve consistency and performance under match conditions.

I am finding effective ways to train for penalty kicks.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree

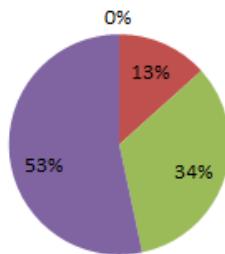


A large majority of respondents reported finding effective methods for training penalty kicks, with 73% strongly agreeing. This indicates that most players are confident in their training strategies. The absence of disagreement suggests that training methods currently being used are well-received and meet the players' needs for improving their skills.

Players are actively engaging with effective training strategies, and the positive feedback suggests that further refinement of these methods will likely lead to continued success in penalty kick accuracy.

My accuracy for scoring goals is getting better.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree

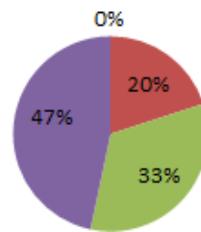


The majority of participants (87%) feel that their goal-scoring accuracy is improving, with 53% strongly agreeing. This suggests that players are achieving better precision with their shots. However, the 13% who disagreed may indicate that there are players who still struggle to consistently hit their target.

The overall trend points toward progress in accuracy, but more individual attention might be required for those struggling to improve. Tailored exercises or feedback can further assist in raising the overall accuracy of goal-scoring.

My current training for scoring goals and penalty kicks is becoming more effective.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree



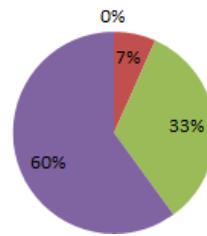
The results show that 80% of respondents feel their training is becoming more effective, with a majority (47%) strongly agreeing. This reflects the overall positive impact that the training is having on their ability to score goals and take penalty kicks. However, a smaller portion (20%) disagreed, possibly indicating that some players feel their current

training regime does not fully address their needs or they may not see noticeable improvements.

The majority of participants are confident that their training is yielding results, but those who are not seeing improvements may benefit from revisiting or refining their training strategies.

I am enhancing my focus on my target.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree

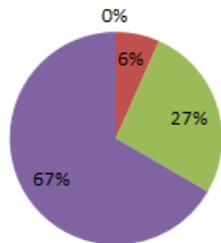


An overwhelming 93% of participants feel that their focus on the target is improving. The large percentage of those who strongly agree suggests that players are honing their mental focus during goal-scoring situations. A small percentage (7%) disagreed, possibly indicating a few players who may still struggle with concentration under pressure or in fast-paced game situations.

Players are improving their ability to focus, which is a crucial skill for scoring goals. Mental training or focus drills may help further sharpen this skill for the few who may still be facing difficulties.

I am learning to select the best area of the goal to shoot.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree

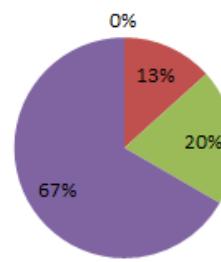


94% of respondents agree that they are learning to select the best area of the goal when shooting, with the majority strongly agreeing. This suggests a solid understanding of where to aim in the goal for maximum scoring potential. A small group (6%) disagreed, which could indicate a need for more practice or guidance in shot selection, particularly under pressure.

The high agreement indicates that most players are making good decisions regarding shot placement. Continued drills that emphasize goal area targeting will likely help refine these skills further.

I am becoming more decisive about where to shoot the ball in the goal.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree



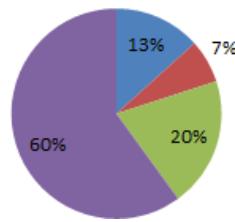
The majority of respondents (100%) are becoming more decisive in their shot placement. The fact that 87% strongly agree shows that players are gaining confidence in their ability

to choose the optimal location to shoot. However, the 13% who disagreed may feel less certain about their decisions under pressure or in real match situations.

This indicates a positive trend toward decisiveness in shooting. The few players who disagree could benefit from further mental and technical training to help make quicker, more confident decisions during games.

The ball does not go where I want it to go when I shoot.

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree

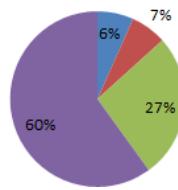


The results indicate a mixed response, with 72% of respondents indicating that the ball often does not go where they intend it to. The 20% combine who strongly disagree suggest that some players are more accurate in their shooting, but the 80% who strongly agree implies that a significant number of players struggle with shot consistency.

A substantial portion of players is having difficulty with shot accuracy. Focused technical drills, including repetition and precision training, could help these players improve their control and shot placement.

**I am learning to control the ball
better when I shoot.**

■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree

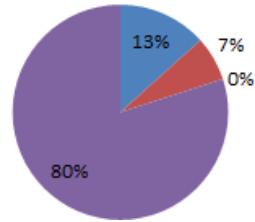


The majority of respondents (87%) feel they are improving their ball control when shooting, with 60% strongly agreeing. This suggests that most players are gaining better command over their shots. However, the small percentage of disagreement (13%) indicates that some players may still have issues with ball control.

The feedback is largely positive, indicating that most players are improving their control. Those who disagree may benefit from targeted exercises that emphasize ball handling and shot consistency.

**I am interested in new training
methods for scoring goals.**

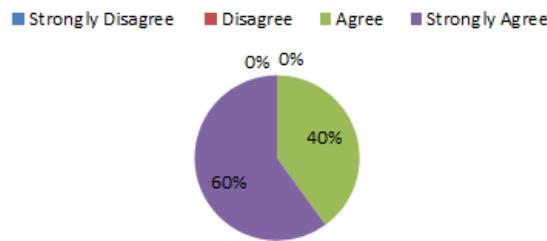
■ Strongly Disagree ■ Disagree ■ Agree ■ Strongly Agree



An overwhelming 93% of players are interested in new training methods, with 80% strongly agreeing. This reflects a desire for innovation and improvement in training techniques. A small percentage of disagreement (20%) may indicate some resistance to trying new methods or satisfaction with their current routine.

The high level of interest in new training methods shows that players are open to experimentation and growth. Incorporating new, innovative methods could further enhance their goal-scoring abilities.

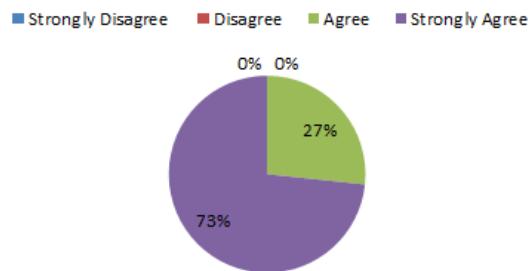
I would like to monitor my goal percentage, goal accuracy and goal precision.



A significant majority (100%) of players are interested in monitoring their goal performance metrics, with 60% strongly agreeing. This indicates that players recognize the value of tracking their progress for continuous improvement. No players disagreed, suggesting that monitoring progress is universally seen as beneficial.

The strong interest in monitoring performance highlights a desire for data-driven improvement. Providing players with access to this kind of tracking could lead to more targeted, effective training.

Being able to monitor my goals will help me improve my training.



The majority of participants (100%) believe that monitoring their goal-scoring will aid in training, with 73% strongly agreeing. This shows that players are confident that data will help refine their skills. This positive response supports the idea of integrating performance tracking into training regimens.

APPENDIX H. POST-TEST SURVEY QUESTIONNAIRE

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): _____
 Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	
KICKEEN detects the ball easily.			/	
KICKEEN detects the goalpost easily.			/	
KICKEEN's distance measurement is accurate.		/		
KICKEEN provides me with comprehensive statistics on my goals.	/			
KICKEEN provides a clear summary of my statistics.			/	
KICKEEN's user interface is friendly and easy to understand.		/		
KICKEEN's touchscreen is bright and easy to see during training.		/		
KICKEEN's stand is stable and reliable during training.			/	
KICKEEN's stand keeps the device from wobbling and vibrating.				/
KICKEEN's case is sturdy and reliable.				/
KICKEEN's case protects the device from harm.			/	/
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design			/	/
KICKEEN's performance is smooth.				/
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.			/	
I want to use KICKEEN to further improve my skills in soccer/football.	/			

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Raymond Rich Salting
 Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	/
KICKEEN detects the ball easily.			/	/
KICKEEN detects the goalpost easily.			/	/
KICKEEN's distance measurement is accurate.			/	/
KICKEEN provides me with comprehensive statistics on my goals.			/	/
KICKEEN provides a clear summary of my statistics.			/	/
KICKEEN's user interface is friendly and easy to understand.			/	/
KICKEEN's touchscreen is bright and easy to see during training.			/	/
KICKEEN's stand is stable and reliable during training.			/	
KICKEEN's stand keeps the device from wobbling and vibrating.			/	
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.			/	/
KICKEEN's design is appropriate and pleasing.			/	/
I am satisfied with KICKEEN's design			/	/
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.				/
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.			/	

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): John Richard Ialuguna
 Age Group: 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/ /	
KICKEEN detects the ball easily.			/ /	
KICKEEN detects the goalpost easily.			/ / /	/
KICKEEN's distance measurement is accurate.				/ /
KICKEEN provides me with comprehensive statistics on my goals.				/ /
KICKEEN provides a clear summary of my statistics.			/ /	
KICKEEN's user interface is friendly and easy to understand.			/ /	
KICKEEN's touchscreen is bright and easy to see during training.			/ /	
KICKEEN's stand is stable and reliable during training.			/ /	
KICKEEN's stand keeps the device from wobbling and vibrating.			/ /	
KICKEEN's case is sturdy and reliable.			/ /	
KICKEEN's case protects the device from harm.			/ /	/
KICKEEN's design is appropriate and pleasing.			/ /	
I am satisfied with KICKEEN's design			/ /	
KICKEEN's performance is smooth.				/ /
KICKEEN has a long battery life that lasts throughout training.			/ /	
I am satisfied with KICKEEN's performance.			/ /	
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Gremmy
 Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.			/	
KICKEEN detects the goalpost easily.	/			
KICKEEN's distance measurement is accurate.			/	
KICKEEN provides me with comprehensive statistics on my goals.				/
KICKEEN provides a clear summary of my statistics.			/	
KICKEEN's user interface is friendly and easy to understand.	/			
KICKEEN's touchscreen is bright and easy to see during training.			/	
KICKEEN's stand is stable and reliable during training.				/
KICKEEN's stand keeps the device from wobbling and vibrating.		/		
KICKEEN's case is sturdy and reliable.	/			
KICKEEN's case protects the device from harm.			/	
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design			/	
KICKEEN's performance is smooth.	/			
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.			/	

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Jugram
 Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.				/
KICKEEN detects the goalpost easily.				/
KICKEEN's distance measurement is accurate.				/
KICKEEN provides me with comprehensive statistics on my goals.			/	/
KICKEEN provides a clear summary of my statistics.			/	/
KICKEEN's user interface is friendly and easy to understand.			/	
KICKEEN's touchscreen is bright and easy to see during training.				/
KICKEEN's stand is stable and reliable during training.				/
KICKEEN's stand keeps the device from wobbling and vibrating.				/
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.			/	
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design			/	/
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Gerard
 Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				
KICKEEN detects the ball easily.				
KICKEEN detects the goalpost easily.				
KICKEEN's distance measurement is accurate.				
KICKEEN provides me with comprehensive statistics on my goals.				
KICKEEN provides a clear summary of my statistics.				
KICKEEN's user interface is friendly and easy to understand.				
KICKEEN's touchscreen is bright and easy to see during training.				
KICKEEN's stand is stable and reliable during training.				
KICKEEN's stand keeps the device from wobbling and vibrating.				
KICKEEN's case is sturdy and reliable.				
KICKEEN's case protects the device from harm.				
KICKEEN's design is appropriate and pleasing.				
I am satisfied with KICKEEN's design				
KICKEEN's performance is smooth.				
KICKEEN has a long battery life that lasts throughout training.				
I am satisfied with KICKEEN's performance.				
I want to use KICKEEN to further improve my skills in soccer/football.				

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Jhay
Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.			/	/
KICKEEN detects the goalpost easily.			/	/
KICKEEN's distance measurement is accurate.			/	/
KICKEEN provides me with comprehensive statistics on my goals.	/			
KICKEEN provides a clear summary of my statistics.	/			
KICKEEN's user interface is friendly and easy to understand.		/	/	
KICKEEN's touchscreen is bright and easy to see during training.			/	/
KICKEEN's stand is stable and reliable during training.		/	/	
KICKEEN's stand keeps the device from wobbling and vibrating.		/	/	
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.			/	/
KICKEEN's design is appropriate and pleasing.		/		
I am satisfied with KICKEEN's design		/		/
KICKEEN's performance is smooth.			/	/
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.			/	
I want to use KICKEEN to further improve my skills in soccer/football.				

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Jerome

Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	
KICKEEN detects the ball easily.			/	
KICKEEN detects the goalpost easily.			/	
KICKEEN's distance measurement is accurate.			/	
KICKEEN provides me with comprehensive statistics on my goals.			/	
KICKEEN provides a clear summary of my statistics.			/	
KICKEEN's user interface is friendly and easy to understand.			/	
KICKEEN's touchscreen is bright and easy to see during training.			/	
KICKEEN's stand is stable and reliable during training.			/	
KICKEEN's stand keeps the device from wobbling and vibrating.			/	
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.			/	
KICKEEN's design is appropriate and pleasing.			/	
I am satisfied with KICKEEN's design			/	
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.			/	
I want to use KICKEEN to further improve my skills in soccer/football.			/	

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): ZEM

Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	
KICKEEN detects the ball easily.			/	
KICKEEN detects the goalpost easily.		/		
KICKEEN's distance measurement is accurate.			/	
KICKEEN provides me with comprehensive statistics on my goals.			/	
KICKEEN provides a clear summary of my statistics.				/
KICKEEN's user interface is friendly and easy to understand.				/
KICKEEN's touchscreen is bright and easy to see during training.				/
KICKEEN's stand is stable and reliable during training.				/
KICKEEN's stand keeps the device from wobbling and vibrating.				/
KICKEEN's case is sturdy and reliable.				/
KICKEEN's case protects the device from harm.				/
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design				/
KICKEEN's performance is smooth.				/
KICKEEN has a long battery life that lasts throughout training.				/
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.				

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Verleg ✓
 Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	/
KICKEEN detects the ball easily.			/	
KICKEEN detects the goalpost easily.			/	/
KICKEEN's distance measurement is accurate.			/	
KICKEEN provides me with comprehensive statistics on my goals.			/	
KICKEEN provides a clear summary of my statistics.		/		
KICKEEN's user interface is friendly and easy to understand.			/	
KICKEEN's touchscreen is bright and easy to see during training.			/	
KICKEEN's stand is stable and reliable during training.	/			
KICKEEN's stand keeps the device from wobbling and vibrating.			/	
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.			/	
KICKEEN's design is appropriate and pleasing.			/	
I am satisfied with KICKEEN's design		/		
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.		/		
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): C.J.
 Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.				/\
KICKEEN detects the goalpost easily.				/\
KICKEEN's distance measurement is accurate.				/\
KICKEEN provides me with comprehensive statistics on my goals.				/\
KICKEEN provides a clear summary of my statistics.				/\
KICKEEN's user interface is friendly and easy to understand.				/
KICKEEN's touchscreen is bright and easy to see during training.				/
KICKEEN's stand is stable and reliable during training.				/
KICKEEN's stand keeps the device from wobbling and vibrating.				/\
KICKEEN's case is sturdy and reliable.				/\
KICKEEN's case protects the device from harm.				/\
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design				/
KICKEEN's performance is smooth.				/\
KICKEEN has a long battery life that lasts throughout training.				/\
I am satisfied with KICKEEN's performance.				/\
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Mark
Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	
KICKEEN detects the ball easily.			/	/
KICKEEN detects the goalpost easily.			/	
KICKEEN's distance measurement is accurate.			/	/
KICKEEN provides me with comprehensive statistics on my goals.			/	/
KICKEEN provides a clear summary of my statistics.			/	/
KICKEEN's user interface is friendly and easy to understand.			/	/
KICKEEN's touchscreen is bright and easy to see during training.			/	/
KICKEEN's stand is stable and reliable during training.			/	/
KICKEEN's stand keeps the device from wobbling and vibrating.			/	/
KICKEEN's case is sturdy and reliable.			/	/
KICKEEN's case protects the device from harm.			/	/
KICKEEN's design is appropriate and pleasing.			/	/
I am satisfied with KICKEEN's design			/	/
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.			/	/
I am satisfied with KICKEEN's performance.			/	/
I want to use KICKEEN to further improve my skills in soccer/football.			/	

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Jralero Thala
Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.				/
KICKEEN detects the goalpost easily.				/
KICKEEN's distance measurement is accurate.				/
KICKEEN provides me with comprehensive statistics on my goals.				/
KICKEEN provides a clear summary of my statistics.				/
KICKEEN's user interface is friendly and easy to understand.				/
KICKEEN's touchscreen is bright and easy to see during training.				/
KICKEEN's stand is stable and reliable during training.			/	
KICKEEN's stand keeps the device from wobbling and vibrating.			/	
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.			/	
KICKEEN's design is appropriate and pleasing.			/	
I am satisfied with KICKEEN's design				/
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.			/	
I want to use KICKEEN to further improve my skills in soccer/football.				

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): JLW

Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	/
KICKEEN detects the ball easily.			/	/
KICKEEN detects the goalpost easily.			/	/
KICKEEN's distance measurement is accurate.			/	/
KICKEEN provides me with comprehensive statistics on my goals.			/	/
KICKEEN provides a clear summary of my statistics.				/
KICKEEN's user interface is friendly and easy to understand.				/
KICKEEN's touchscreen is bright and easy to see during training.				/
KICKEEN's stand is stable and reliable during training.				/
KICKEEN's stand keeps the device from wobbling and vibrating.				/
KICKEEN's case is sturdy and reliable.				/
KICKEEN's case protects the device from harm.				/
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design				/
KICKEEN's performance is smooth.				/
KICKEEN has a long battery life that lasts throughout training.				/
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Maryh

Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.				/
KICKEEN detects the goalpost easily.			/	
KICKEEN's distance measurement is accurate.			/	
KICKEEN provides me with comprehensive statistics on my goals.			/	/
KICKEEN provides a clear summary of my statistics.			/	/
KICKEEN's user interface is friendly and easy to understand.			/	
KICKEEN's touchscreen is bright and easy to see during training.			/	
KICKEEN's stand is stable and reliable during training.	/			
KICKEEN's stand keeps the device from wobbling and vibrating.		/		
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.			/	/
KICKEEN's design is appropriate and pleasing.			/	
I am satisfied with KICKEEN's design			/	
KICKEEN's performance is smooth.				/
KICKEEN has a long battery life that lasts throughout training.				/
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): Arjet

Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	
KICKEEN detects the ball easily.			/	
KICKEEN detects the goalpost easily.			/	
KICKEEN's distance measurement is accurate.			/	
KICKEEN provides me with comprehensive statistics on my goals.				/
KICKEEN provides a clear summary of my statistics.				/
KICKEEN's user interface is friendly and easy to understand.			/	
KICKEEN's touchscreen is bright and easy to see during training.			/	
KICKEEN's stand is stable and reliable during training.			/	
KICKEEN's stand keeps the device from wobbling and vibrating.				/
KICKEEN's case is sturdy and reliable.				/
KICKEEN's case protects the device from harm.				/
KICKEEN's design is appropriate and pleasing.			/	
I am satisfied with KICKEEN's design			/	
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.				/
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

Name (Optional): James

Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.			/	/
KICKEEN detects the ball easily.			/	/
KICKEEN detects the goalpost easily.			/	/
KICKEEN's distance measurement is accurate.				/
KICKEEN provides me with comprehensive statistics on my goals.				/
KICKEEN provides a clear summary of my statistics.			/	/
KICKEEN's user interface is friendly and easy to understand.			/	/
KICKEEN's touchscreen is bright and easy to see during training.				/
KICKEEN's stand is stable and reliable during training.			/	/
KICKEEN's stand keeps the device from wobbling and vibrating.			/	/
KICKEEN's case is sturdy and reliable.			/	
KICKEEN's case protects the device from harm.				/
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design			/	/
KICKEEN's performance is smooth.				/
KICKEEN has a long battery life that lasts throughout training.			/	/
I am satisfied with KICKEEN's performance.			/	/
I want to use KICKEEN to further improve my skills in soccer/football.				/

Survey Questionnaire (POST-TEST)
**KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
 ACCURACY MONITORING**

Name (Optional): _____

Age Group:

12 and below

13-17

18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.			/	
KICKEEN detects the goalpost easily.				/
KICKEEN's distance measurement is accurate.			/	
KICKEEN provides me with comprehensive statistics on my goals.				/
KICKEEN provides a clear summary of my statistics.			/	
KICKEEN's user interface is friendly and easy to understand.				/
KICKEEN's touchscreen is bright and easy to see during training.			/	
KICKEEN's stand is stable and reliable during training.	/			
KICKEEN's stand keeps the device from wobbling and vibrating.			/	
KICKEEN's case is sturdy and reliable.				/
KICKEEN's case protects the device from harm.			/	
KICKEEN's design is appropriate and pleasing.	/			
I am satisfied with KICKEEN's design				/
KICKEEN's performance is smooth.			/	
KICKEEN has a long battery life that lasts throughout training.			/	
I am satisfied with KICKEEN's performance.			/	
I want to use KICKEEN to further improve my skills in soccer/football.			/	

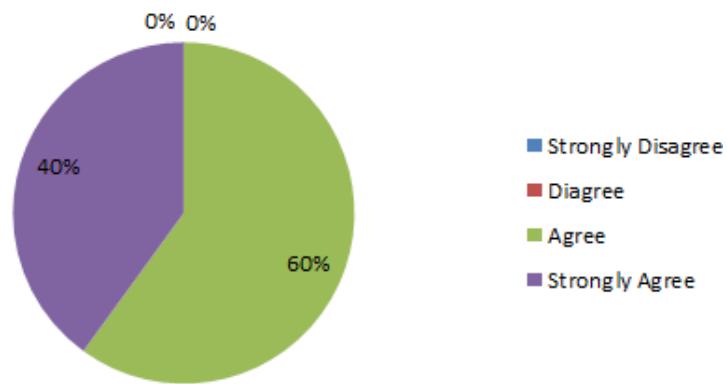
Survey Questionnaire (POST-TEST)
KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL
ACCURACY MONITORING

Name (Optional): Condice
Age Group:
 12 and below 13-17 18 and above

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
KICKEEN detects the player easily.				/
KICKEEN detects the ball easily.				/
KICKEEN detects the goalpost easily.				/
KICKEEN's distance measurement is accurate.				/
KICKEEN provides me with comprehensive statistics on my goals.				/
KICKEEN provides a clear summary of my statistics.				/
KICKEEN's user interface is friendly and easy to understand.				/
KICKEEN's touchscreen is bright and easy to see during training.				/
KICKEEN's stand is stable and reliable during training.				/
KICKEEN's stand keeps the device from wobbling and vibrating.				/
KICKEEN's case is sturdy and reliable.				/
KICKEEN's case protects the device from harm.				/
KICKEEN's design is appropriate and pleasing.				/
I am satisfied with KICKEEN's design				/
KICKEEN's performance is smooth.				/
KICKEEN has a long battery life that lasts throughout training.				/
I am satisfied with KICKEEN's performance.				/
I want to use KICKEEN to further improve my skills in soccer/football.				/

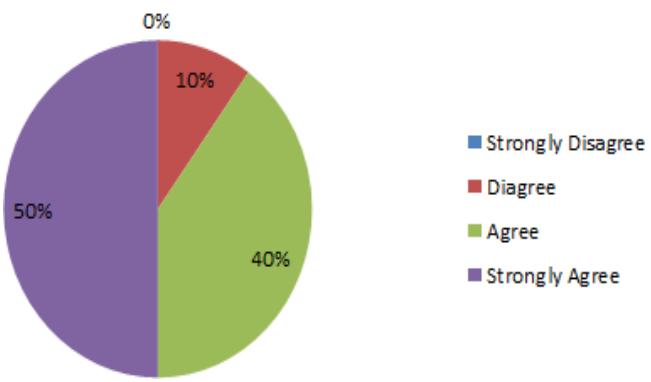
APPENDIX I. POST-TEST SURVEY RESULTS

KICKEEN detects the player easily.



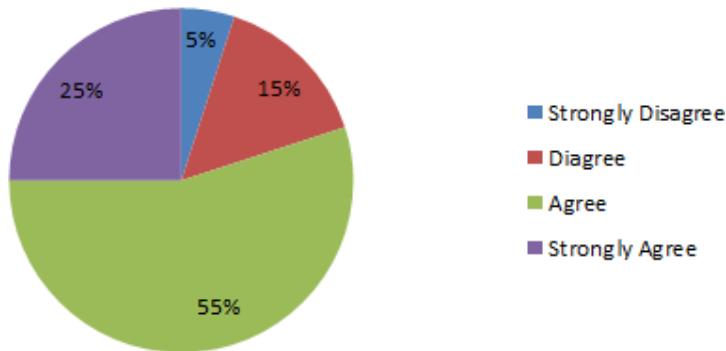
This chart displays user feedback on how easily KICKEEN detects the player. The response was overwhelmingly positive, with no respondents disagreeing. A significant majority, 60%, agreed that the player detection was easy. Furthermore, 40% of users strongly agreed with this statement. Overall, 100% of respondents had a positive experience with the player detection feature.

KICKEEN detects the ball easily



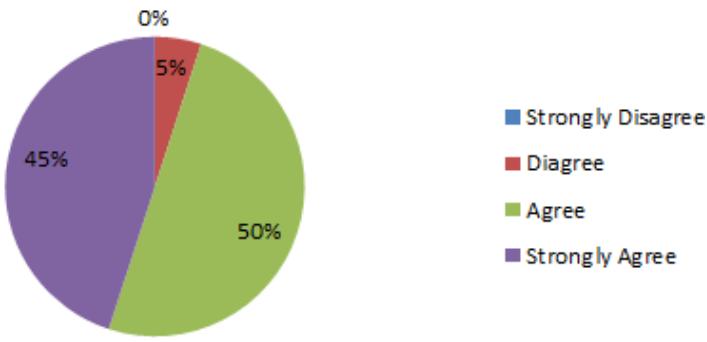
This survey question assessed whether KICKEEN detects the ball easily. The feedback was largely positive, with 90% of users agreeing or strongly agreeing. Specifically, 40% of respondents selected "Agree." A larger portion, 50%, chose "Strongly Agree," indicating strong satisfaction. Only 10% of users disagreed, and 0% strongly disagreed with the statement.

KICKEEN detects the goalpost easily



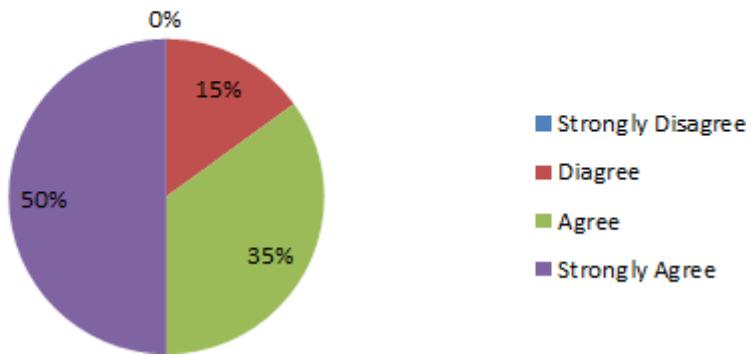
This chart illustrates user sentiment regarding KICKEEN's ability to detect the goalpost easily. A large majority of users, 80%, responded favorably to this feature. The most common response was "Agree," selected by 55% of participants. An additional 25% of users "Strongly Agreed" with the statement. Negative feedback was minimal, with 15% disagreeing and only 5% strongly disagreeing.

KICKEEN's distance measurement is accurate



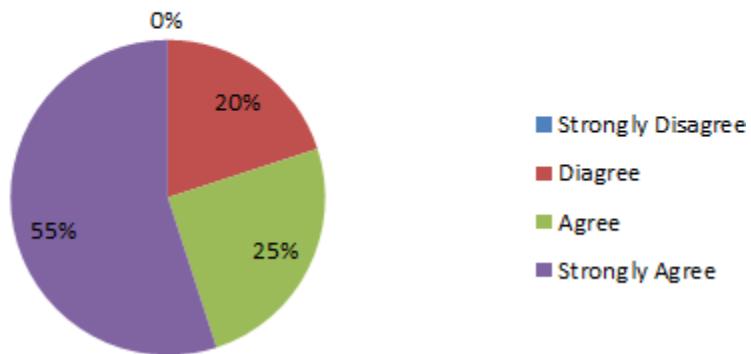
This pie chart measures user perceptions of KICKEEN's distance measurement accuracy. The results were highly positive, as 95% of users agreed with the system's accuracy. Exactly half of the respondents (50%) agreed that the measurement was accurate. A substantial 45% of users strongly agreed with this assessment. Only 5% of users disagreed, and no users (0%) strongly disagreed.

KICKEEN provides me with comprehensive statistics on my goals.



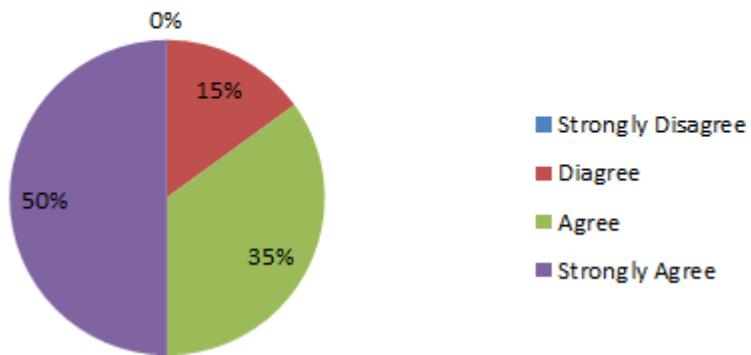
This survey question asked if KICKEEN provides comprehensive statistics on goals. The majority of users, 85%, affirmed that the statistics were comprehensive. Thirty-five percent of respondents agreed with the statement. A larger group, 50% of all users, strongly agreed. Conversely, 15% of users disagreed, while 0% strongly disagreed.

KICKEEN provides a clear summary of my statistics.



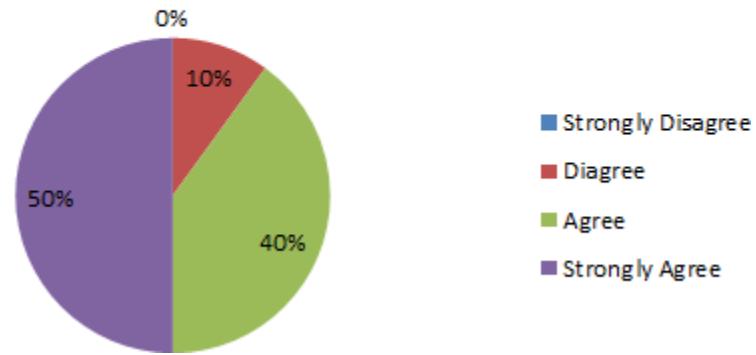
This chart gauges whether KICKEEN provides a clear summary of statistics. The feedback on this feature was highly favorable, with 80% of users expressing agreement. A portion of 25% agreed that the summary was clear. However, a significant majority of 55% strongly agreed with the statement. A minority of 20% disagreed, and no respondents (0%) strongly disagreed.

KICKEEN's user interface is friendly and easy to understand.



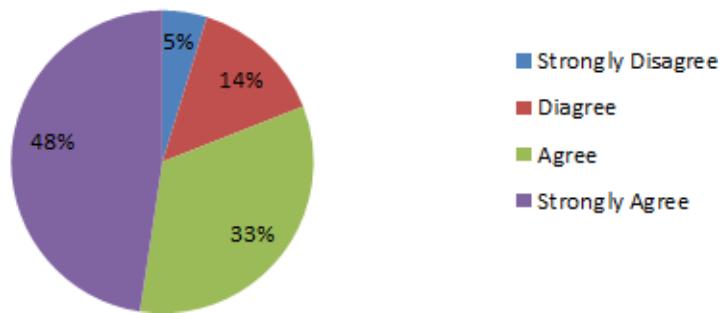
This chart represents user feedback on KICKEEN's user interface being friendly and easy to understand. The response was overwhelmingly positive, with 85% of users agreeing. Thirty-five percent of participants found the user interface agreeable. A majority of users, 50%, strongly agreed that the interface was friendly and simple. Only 15% of users disagreed, and 0% strongly disagreed.

KICKEEN's touchscreen is bright and easy to see during training.



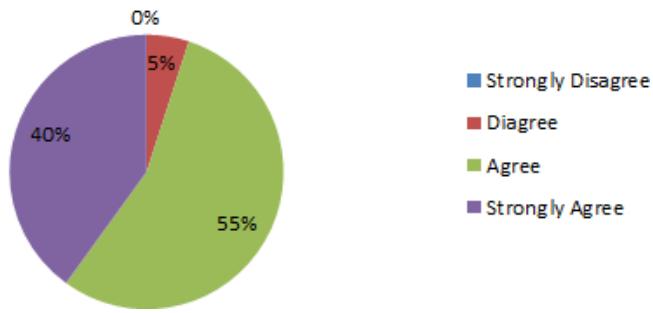
This survey measured opinions on KICKEEN's touchscreen being bright and easy to see during training. An overwhelming majority of 90% responded positively to the touchscreen's visibility. Forty percent of the users agreed with the statement. Exactly half of the respondents, 50%, strongly agreed that the screen was bright and clear. Only 10% of users disagreed, and no users (0%) strongly disagreed.

KICKEEN's stand is stable and reliable during training.



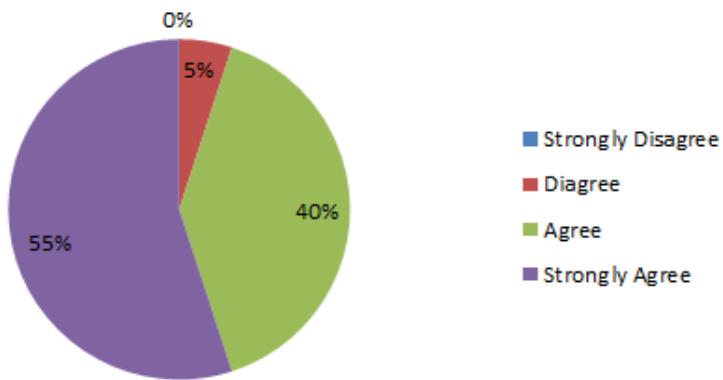
This chart shows user feedback on whether KICKEEN's stand is stable and reliable during training. A significant majority, 81%, found the stand to be stable and reliable. Thirty-three percent of the respondents agreed with this assessment. A larger portion, 48%, strongly agreed that the stand was dependable. Conversely, 14% disagreed and 5% strongly disagreed, totaling 19% negative feedback.

KICKEEN's stand keeps the device from wobbling and vibrating.



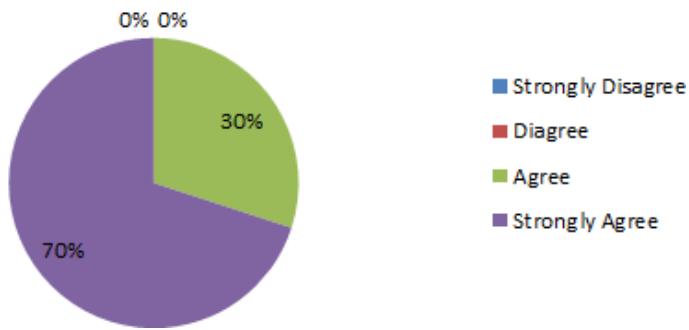
This survey question assessed if KICKEEN's stand keeps the device from wobbling and vibrating. The response was highly positive, with 95% of users agreeing with the stand's stability. A majority of 55% agreed that the stand prevented wobbling. An additional 40% of users strongly agreed with this statement. Only 5% of users disagreed, and 0% strongly disagreed.

KICKEEN's case is sturdy and reliable



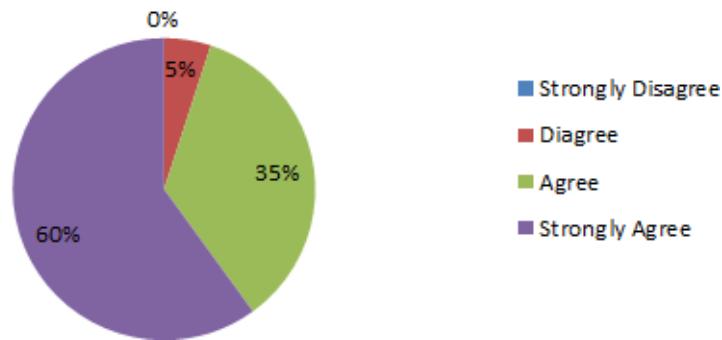
This chart shows user feedback on the sturdiness and reliability of KICKEEN's case. The response was overwhelmingly positive, with 95% of users expressing agreement. A large portion, 40%, agreed that the case was sturdy. An even larger majority, 55%, strongly agreed with this assessment. Only 5% of respondents disagreed, and none (0%) strongly disagreed.

KICKEEN's case protects the device from harm.



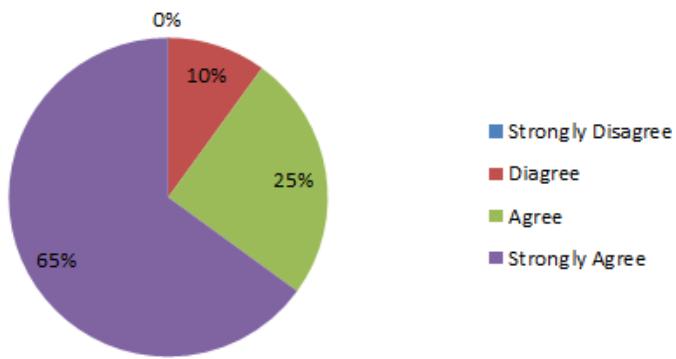
This pie chart illustrates user opinions on whether KICKEEN's case protects the device from harm. The feedback was unanimously positive, with 100% of respondents agreeing. A significant 70% of users strongly agreed that the case provides adequate protection. The remaining 30% of users also agreed with this statement. There were no "Disagree" or "Strongly Disagree" responses, indicating complete user confidence in the case's protective qualities.

KICKEEN's design is appropriate and pleasing.



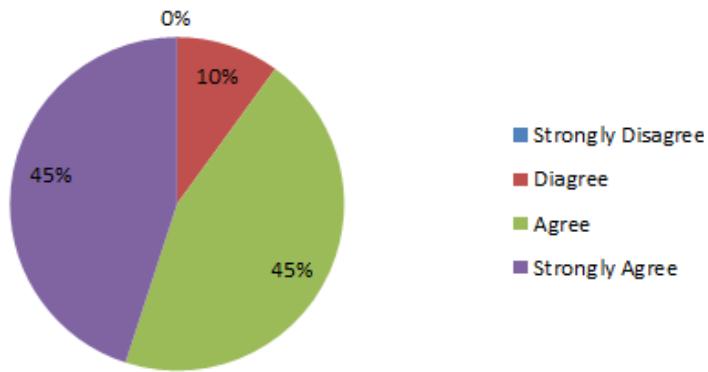
This survey question assessed whether users found KICKEEN's design to be appropriate and pleasing. A vast majority, 95%, responded positively to the device's design. Thirty-five percent of the respondents agreed with the statement. A larger group, 60%, strongly agreed that the design was both appropriate and pleasing. Only a small minority of 5% disagreed, with 0% strongly disagreeing.

I am satisfied with KICKEEN's design



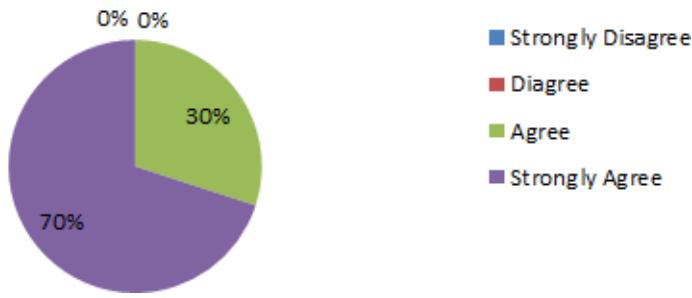
This chart measures the overall user satisfaction with KICKEEN's design. The results show a high level of satisfaction, with 90% of users responding positively. Twenty-five percent of users indicated that they "Agree" and were satisfied. A significant majority, 65%, "Strongly Agreed," showing strong approval of the design. Only 10% of participants disagreed, and 0% strongly disagreed.

KICKEEN's performance is smooth.



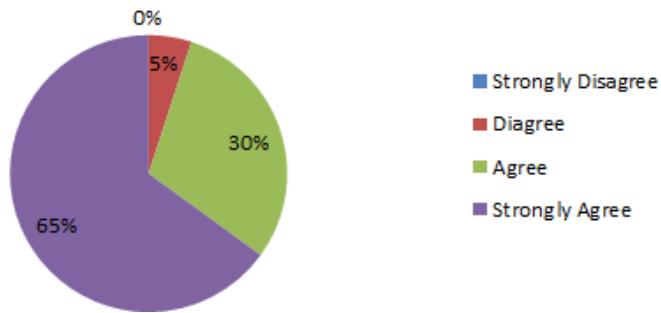
This pie chart displays user feedback on the smoothness of KICKEEN's performance. A large majority, 90%, agreed that the performance was smooth. The positive responses were split evenly between "Agree" and "Strongly Agree." Exactly 45% of users agreed, while another 45% of users strongly agreed. A small fraction, 10% of respondents, disagreed with the statement.

KICKEEN has a long battery life that lasts throughout training.



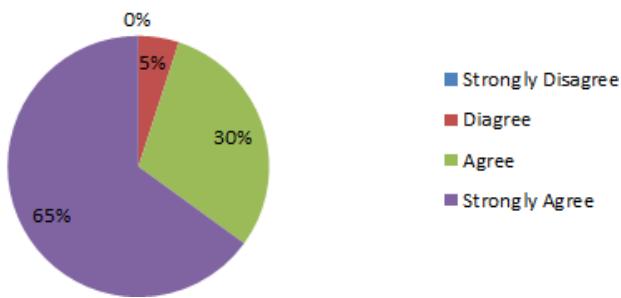
This chart illustrates user sentiment regarding KICKEEN's battery life during training. All respondents (100%) agreed that the battery life was long and lasted throughout training. A large majority, 70%, strongly agreed with this statement. The remaining 30% of users also agreed. There were no negative responses, as 0% selected "Disagree" or "Strongly Disagree."

I am satisfied with KICKEEN's performance.



This chart measures overall user satisfaction with KICKEEN's performance. The feedback was overwhelmingly positive, with 95% of users expressing satisfaction. Thirty percent of the respondents agreed that they were satisfied. A substantial majority, 65%, strongly agreed and were satisfied with the performance. Only 5% of users disagreed, and no users (0%) strongly disagreed.

I want to use KICKEEN to further improve my skills in soccer/football



This survey question gauges the user's desire to continue using KICKEEN for skill improvement. The response indicates strong user retention, with 95% of participants wanting to continue. Thirty percent of users agreed that they wanted to use KICKEEN for further improvement. A significant 65% of users strongly agreed with this sentiment. A very small minority, 5%, disagreed, and 0% strongly disagreed.

APPENDIX J. CURRICULUM VITAE

ADVISER'S ACCEPTANCE FORM

NAME OF PROPONENTS: Lester Manuel O. Adornado
Julien G. Ibalio
Flor John G. Lopez
John Gene P. Roque

APPROVED RESEARCH TITLE: KICKEEN: A SMART CAMERA-BASED SOCCER ASSISTANT FOR GOAL ACCURACY MONITORING

AREA OF STUDY: Computer Engineering

CONFORME:

Engr. Rynefel B. Elope
Thesis

APPROVED BY:

Engr. Kathleen R. Mendoza Date:
Thesis Coordinator

NOTED BY:

Mr. Brian H. Calata, LPT
Program Head

Curriculum Vitae of
Julien G. Ibalio
#81 Main Avenue, Brgy. Socorro, Cubao,
Quezon City 1109
Ibalio.julien@gmail.com
+639459933045



EDUCATIONAL BACKGROUND

Level	Inclusive Dates	Name of school/ Institution
Tertiary	2021- Present	STI College Cubao
Senior High School	2019-2021	STI College Cubao
High School	2018-2019	Camp General Emilio Aguinaldo HS

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
January - June	Virtual Assistance Encoder/ Sales	Feisty Fox Coaching -California

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
2024	Computer Engineering Students' Society	Member
2024	Institute of Computer Engineers of the Philippines	Member

SKILLS

SKILLS	Level of Competency	Date Acquired
Python	Intermediate	2025
C++	Intermediate	2025
Graphic Designer	Intermediate	2022
Hardware/ Software	Advanced	2020
Troubleshoot	Advanced	2020
Java	Intermediate	2020
Office Suites	Advanced	2018

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop
2025	AI Ready ASEAN: Hour of Code
2025	Beyond the Checklist: Governance, Risk Management, and Compliance
2025	IAM What I Am: Expert Tips for Identity and Access Management
2025	AWS Academy Cloud Foundations
2025	EC-Council Labs: Ethical Hacking Essentials

John Gene P. Roque
#73-C Makabayan St. Tomas Morato,
Brgy. Kamuning
Quezon City
johngeneroque678@gmail.com
+639167550471



EDUCATIONAL BACKGROUND		
Level	Inclusive Dates	Name of school/ Institution
Tertiary	2022- Present	STI College Cubao
Senior High School	2020-2022	Don Alejandro Roces Sr. Science-Technology High School
High School	2016-2020	Trinity University of Asia
Elementary	2010-2016	Barihan Elementary School

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
March – June (2023)	Data Encoder	Brgy. Barihan
April- October (2024)	Crew	Jollibee Spark

Listed in reverse chronological order (most recent first).

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
2023	Computer Engineering Students' Society	Member
2022	Institute of Computer Engineers of the Philippines	Member
2022	Cyber Enthusiast Student Organization	Member

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
CAD Developer	Beginner	2024
Java Developer	Beginner	2022

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop
2023	Cyber Security Seminar
2022	Unveiling New Programming Horizons: Focusing on New Ventures about Databases and Data Structure
2022	Introduction to Python Programming Language Seminar
2022	Internet of Things and Artificial Intelligence Seminar

Flor John G. Lopez
#146 Gen. Julian Cruz St. Barangka,
Marikina City
lopezflorjohn@gmail.com
+639692839545



EDUCATIONAL BACKGROUND		
Level	Inclusive Dates	Name of school/ Institution
Tertiary	2022- Present	STI College Cubao
Senior High School	2020-2022	Technological Institute of the Philippines
High School	2016-2020	Barangka National High School

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
2022	Hardware Apprentice	Family Business
August- Present (2024)	Crew	Jollibee Spark

Listed in reverse chronological order (most recent first).

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
2022	Computer Engineering Students' Society	Logistics Officer
2022	Institute of Computer Engineers of the Philippines	Member

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
Java Developer	Beginner	2023

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop
2018	Computer System Servicing: Introduction of Computer System and Hardware
2017	Immunodeficiency Virus: Knowing the HIV effects in the Human Body

Lester Manuel O. Adornado
4. Rigor St. Project 4 Quezon City
lestermanueladornado39@gmail.com
+63951238868



EDUCATIONAL BACKGROUND		
Level	Inclusive Dates	Name of school/ Institution
Tertiary	2021- Present	STI College Cubao
High School	2016-2019	Jose P Laurel High School
Elementary	2010-2016	Pura V Kalaw Elementary School

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
2022 - 2024	Intern	Ilaursa Research Services (IRS)

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
2022	Computer Engineering Students' Society	Member
2022	Institute of Computer Engineers of the Philippines	Member

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
Graphic Designer	Beginner	2024
Hardware/ Software Troubleshoot	Beginner	2024

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop
2023	Cyber safe learning for education project (CLEP)
2022	Technical Support Fundamentals
2022	HUAWEI Compute Cloud Services

Listed in reverse chronological order (most recent first).