

2. Requirements, Constraints, And Standards

2.1 REQUIREMENTS & CONSTRAINTS

Functional Requirements

- Object detection system to locate a softball at its maximum height during a pitch.
- Detect an illegal pitch when a softball's maximum height is higher than the specific maximum height or below the specific minimum height. (constraint)
- Create an audible sound indicating an illegal pitch

Physical Requirements

- The device cannot be physically obstructive to the game.
- The device must be portable to set up on a softball field.

Environmental Requirements

- The device must accommodate different fields, lighting, and balls.
- The device cannot be visually or audibly distracting to the game.

UI Requirements

- The device must have a guided and simple setup.
- The device must have user-adjustable settings for the maximum and minimum height for pitches. (constraint)

Constraints

- Maximum height (in feet) the softball can reach on a serve.
- Minimum height (in feet) the softball must reach on a serve.
- The device cannot be physically obstructive to the game.

2.2 ENGINEERING STANDARDS

The Importance of Engineering Standards (Q1)

Engineering standards are important because people interact with engineering products every day. If there were no engineering standards, that would not only compromise the desired quality of engineering products but also affect things like the safety of everyday people. For example, people interact with civil engineering like bridges and buildings, and non-physical structures like apps and programs. A lack of requirements for these products could result in catastrophic failures of civil structures or a breach of confidential personal data from an insecure application. Engineering standards help ensure that these types of issues are avoided so people can continue to use these products to improve their lives and the lives of others.

Published Engineering Standards (Q2)

IEEE 1857.9-2022 provides standards for methods of video encoding/decoding and analyzing. These standards are applicable to all forms of video manipulation, spanning from areas such as network video transmission over services such as UDP to computer vision topics such as object detection.

IEEE P3110 provides the standards for the necessary API requirements in a computer vision implementation. These API abstractions interface with various machine learning algorithms and are used in the development of computer vision solutions such as OpenCV.

IEEE 1008-1987 provides guidelines for proper unit testing with a codebase. Specifically, guidelines exist for proper categories of testing (unit, integration, etc.), code coverage reporting, among other testing related requirements.

Engineering Standards Relevancy (Q3)

After reviewing the three standards, I believe each has varying relevance to our project. Since our primary focus is on computer vision, IEEE P3110 is highly applicable. This standard provides guidelines for API requirements in computer vision and will help us ensure our project adheres to best practices when working with machine learning algorithms like OpenCV. It offers a strong foundation for structuring our computer vision solution.

IEEE 1008-1987 also holds some relevance, as it provides useful guidelines for software testing. While our project's smaller scale, incorporating structured unit testing can still improve code reliability. On the other hand, IEEE 1857.9-2022 is less applicable since it focuses more on video encoding and compression, which isn't central to our object detection work.

Other Applicable Standards (Q4)

Some of the standards we found that were different from the ones provided that might be at least somewhat applicable to our project are below.

IEEE Standard Digital Interface for Programmable Instrumentation. This standard is applicable because we are using equipment and information that takes in different measurements. We will use different types of instrumentation that may be programmable to detect the softball.

IEEE Standard for Application Programming Interfaces (APIs) for Deep Learning (DL) Inference Engines. This engineering standard is applicable because we are programming a solution to consistently and accurately find the height of a softball, including deep learning and AI-based detection algorithms.

IEEE Standard Letter Symbols for Units of Measurement (SI Customary Inch-Pound Units, and Certain Other Units). This standard is applicable because it ensures that we incorporate the appropriate symbols for our measurement and that it is understood clearly using accurate measurements and symbols.

Modifying Our Project to Incorporate Engineering Standards (Q5)

Since our design is not finalized as we continue to test and prototype different designs, we don't need to make any modifications now. However, several of these standards must be considered as we proceed with our design. Firstly, as we develop the software component of the project, we will need to keep in mind IEEE 1008-1978 regarding unit testing. We need to ensure that we are writing the software in a way that can be easily tested. We will also need to consider IEEE P3110 which covers standards with computer vision. Since many of us have never built an official project using computer vision, it is not natural to consider these standards. Moving forward, standards like this one must be considered during design.