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| Feasibility Study on Data Collection | | | | | | |
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Appendix

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# ‎Introduction

A feasibility study is conducted to assess the practicality, viability, and potential success of a proposed project. The primary purpose of a feasibility study is to provide decision-makers with comprehensive information and analysis, helping them determine whether to proceed with the project or abandon it.

## Objective

#### The aim of this feasibility study was to furnish details regarding sensors suitable for implementing the envisioned functionalities, namely detecting when a ball is out of the field and determining which team last touched the ball.

# Sensors

## Sound Sensor

A sound sensor, also known as a sound detector or microphone sensor, is a device that can detect and measure sound levels in the surrounding environment. One example of a sound sensor is the "Sound Detection Sensor Module" commonly used in electronic projects. This module typically includes a small microphone that captures sound waves and converts them into electrical signals.

### Advantages

* Low-cost
* Can give accurate decision if the ball touch or not
* Can differentiate type of collision

### Disadvantages

* Complicated processing
* Difficult placements
* Need multiple sensors
* Not able to implement all the required functions independently

## Temperature Sensor

A temperature sensor is a device or instrument designed to measure and provide information about the temperature of an object, environment, or substance. There are several types of temperature sensors, each utilizing different principles to measure temperature. Common types of temperature sensors were thermocouples, resistance temperature detectors, thermistors, infrared sensors, bimetallic temperature sensors, and semiconductor temperature sensors.

### Advantages

* Low-cost
* Can give accurate decision if the ball touch or not

### Disadvantages

* Difficult placements
* Can have complicated algorithms
* Need multiple sensors
* Not able to implement all the required functions independently

## Force Sensor

A force sensor, also known as a force transducer or load cell, is a device designed to measure the force applied to it. These sensors are used in various applications to quantify the force exerted on an object.

### Advantages

* Can be Low-cost
* Can give accurate decision if the ball touch or not

### Disadvantages

* Can have complicated algorithms
* Need multiple sensors
* Not able to implement all the required functions independently

## Radar Sensor

A radar sensor, short for "radio detection and ranging" sensor, is a technology that uses radio waves to detect and determine the range, angle, velocity, and other characteristics of objects in its vicinity. Radar sensors operate based on the principle of sending out radio frequency (RF) waves and detecting the echoes reflected off objects. The sensor emits electromagnetic waves and analyses the signals that bounce back. The time it takes for the signal to return, as well as changes in frequency or phase, provides information about the distance, speed, and other characteristics of the objects.

### Advantages

* Able to implement all the required functions independently
* Can get data with less interferences

### Disadvantages

* Can have complicated algorithms
* Need multiple sensors
* Limited resolution
* Can interfere with other devices functionality

## Ultra-WideBand Sensor

An Ultra-Wideband (UWB) sensor is a type of sensor technology that uses extremely low-energy, short-duration pulses or waveforms to transmit and receive data. UWB signals have a very wide bandwidth, spanning several gigahertz, allowing for precise ranging, imaging, and communication capabilities.

### Advantages

* Able to implement all the required functions independently
* Can get data with less interferences
* High precision

### Disadvantages

* Can have complicated algorithms
* Need multiple sensors
* Limited Range
* Expensive
* Need to modify rules of RoboCup

## CCTV Cameras Sensor

A Closed-Circuit Television (CCTV) camera, often referred to simply as a security camera, is a surveillance device used to capture video footage and transmit it to a monitoring or recording system. CCTV cameras play a crucial role in enhancing security and monitoring activities in various settings.

### Advantages

* Able to implement all the required functions independently
* Many developed modules

### Disadvantages

* Can have complicated algorithms
* Need multiple sensors
* Can be obstructed
* Less precision and accurate

## Stereo Cameras Sensor

A stereo camera sensor, also known as a stereoscopic or 3D camera, consists of two or more cameras positioned to mimic human binocular vision. These cameras capture images or video from slightly different perspectives, enabling the system to perceive depth and create three-dimensional representations of the observed scene.

### Advantages

* Able to implement all the required functions independently
* Many developed modules
* Able to give better prediction than normal cctv cameras

### Disadvantages

* Can have complicated algorithms
* Need multiple sensors
* Can be obstructed
* Less precision and accurate
* Expensive

## Time-of-Flight Cameras Sensor

Time-of-flight (ToF) cameras, also known as depth cameras or 3D cameras, are sensors that measure the distance to objects by calculating the time it takes for light or other electromagnetic waves to travel from the camera to the object and back.

### Advantages

* Able to implement all the required functions independently
* Many developed modules
* Good accuracy

### Disadvantages

* Can have complicated algorithms
* Need multiple sensors
* Can be obstructed
* Expensive

## Infrared Cameras + Passive Retroreflective Markers Sensor

Optical-passive motion capture used infrared cameras to track passive retroreflective markers on the objects in three-dimensional space. It used synchronized multiple cameras to capture 2D images. From these images, the 2D positions are calculated, and the overlapping position data are compared to compute the 3D positions via triangulation.

### Advantages

* Able to implement all the required functions independently
* High accuracy and precision
* Simplified algorithms

### Disadvantages

* Need to use multiple infrared cameras
* Can be obstructed
* Need to place and maintain retroreflective markers
* Very expensive

# Conclusion

From the provided information, the chosen sensor was using infrared cameras with passive retroreflective markers sensor. The reasons were:

* The sensor has been set in the robot soccer field at Tech United.
* It gives the best precision and accuracy
* The algorithm can be treated as black box since the system has been developed by OptiTrack
* Easy to comprehend