Making a robot that actively tries to run into objects:

The SoccerBot (translated “Futbot”)

Group 2

Dalyn Dalton

Jonothan Crandall

Alex

October 12, 2022

# **Executive Summary**

Our project aims to create a robot that can act as the perfect goalie (within our technical limitations). By setting up a controlled field using only a skid steer model robot and a camera, we plan on configuring a robot capable of detecting players, soccer balls, and calculating the path to intercept the ball.

By configuring a simple field with a defined goal, an external camera on the robot as well as a camera monitoring the field of play, the robot will be able to process the feeds in tandem to calculate the speed, trajectory, and position of the ball at a given moment, and calculate the movements needed in order to prevent the ball from entering the defined goal area. Furthermore, our project has room to grow into not just a goalie, but into a robot capable of scoring a goal as well.

## **Problem Statement**

From the period of 2000 to 2017, obesity prevalence in the United States rose by 11 percent, to an estimated 41 percent of Americans struggling with obesity. While many alternatives to combat obesity, such as technological improvements in dietary plans and exercise equipment can help curve the problem for active Americans, keeping them entertained during the process has continued to be an ever-increasing dilemma.

Concurrently, video games such as *Rocket League*, *Mario Tennis*, and other similarly themed “sport-centric” games have seen an unprecedented spike in popularity. These games all feature single player models that can adapt the opponents AI to the difficulty level of the player at a given time, constantly giving them room to improve.

Our project aims to combine the single player, addictive aspects of these games with the activity level required to play a game such as soccer, manipulating our AI to reward the player while also creating enough difficulty to raise their overall activity level.

## **Relevance and Importance of the Project**

As we move forward into the second quarter of the 12st century, improvement in the consumer market for robotics is estimated to explode. Using robotics such as these for exercise and entertainment is a new and rapidly growing field, and our project aims to capitalise on this crucial time period. We believe that the use of AI and robotics in gyms, homes, and training facilities will help the rising generation of athletes and gamers.

## **Conclude**

Over the course of our project, we aim to both determine the feasibility of incorporating simple robotic solutions into the athletics market, as well as discover a new method of combating childhood obesity through consumer entertainment products such as our Soccer Bot. By setting up a simple automation using consumer products such as web cameras and cheap skid steer model robots, we aim to make our Soccerbot both fun and affordable.

# **Literature review**

The [literature review](https://www.scribbr.com/dissertation/literature-review/) summarizes, compares, and critiques the most relevant alternative sources on the topic. There are many different ways to structure a literature review, but it should explore:

## **Key Concepts, Theories, and Studies**

Compare, contrast, and establish the theories and concepts that will be most important for your project.

## **Key Debates and Controversies**

Identify points of conflict and situate your position.

## **Gaps in Existing Knowledge**

Show what is missing and how your project will fit in.

**Project design and methods**

As our desire is to understand the feasibility and limitations of robotics in athletics environments, we will be direct in our research. We will design a robotic system capable of moving along a flat surface in two dimensions, with the sensors necessary to determine its own location relative to a ball and the goal.

## **Project design**

The research will be primarily qualitative, as it is mostly based on whether the robot is succeeding in its goal or not, and our adjustments needed to make it succeed more frequently. This consists of descriptions of the iterations we go through in order to accomplish our goal. The quantitative portion of the research is success rates for each iteration of the system to maintain a record of quantifiable improvement throughout the project. Thus, we will be collecting our data ourselves through experimenting with the system and adjusting it to meet our goals.

## **Methods and Sources**

TODO

Describe the tools, procedures, participants and sources of the research. When, where and how will you collect, select and analyze data?

Data collection will happen through repeated tests, using the following format:

* Place the robot at a constant start location (x,y) relative to the goal.
* Place the ball at a variable, but predetermined, location.
* Kick the ball towards the opening of the goal.
* Record the response of the robot in its attempt to intercept the ball, and determine the success of this attempt.
* Repeat a significant number of times in order to understand the current state of the robot, its failures and successes. Change the starting location of the ball regularly according to the predetermined set of locations.
* Make necessary changes to the system to improve response and increase success rate.

Data collection can happen at any sufficiently safe, flat, and consistent location to run the tests. Adjustments to the system can happen on site if necessary.

## **Practical Considerations**

Our main limitation for our project is the platform on which we have to operate. Due to the increased cost of legged systems and difficulty of control, we have opted for the skid steer model. This will, however, prevent our robot from leaving the ground, which may be required in many cases in order to stop the projectile on its calculated course.

We may also run into issues with dual video feeds relaying conflicting / out of sync information to our calculation system. With the computer required to run multiple computer vision models concurrently, an outside compute module will be used and commands will be relayed to the robot. This relay over a distance may also pose issues with latency and the required reaction time needed for quicker ball movements.

# **Implications and contributions to knowledge**

TODO

Finish the proposal by emphasizing why your proposed project is important and what it will contribute to practice or theory.

## **Practical Implications**

TODO

Will your project or findings help improve a process, inform policy, or make a case for concrete change?

## **Theoretical Implications**

Will your work help strengthen a theory or model, challenge current assumptions, or create a basis for further research?

**References**

Centers for Disease Control and Prevention. (2022, May 17). *Adult obesity facts*. Centers for Disease Control and Prevention. Retrieved October 12, 2022, from https://www.cdc.gov/obesity/data/adult.html

*Rocket league*. Steam Charts. (n.d.). Retrieved October 12, 2022, from https://steamcharts.com/app/252950

AuthorLastName, FirstInitial., & Author LastName, FirstInitial. (Year). Title of article. Title of Journal, Volume(Issue), Page Number(s). https://doi.org/number

AuthorLastName, FirstInitial., & Author LastName, FirstInitial. (Year). Title of article. Title of Journal, Volume(Issue), Page Number(s). https://doi.org/number

AuthorLastName, FirstInitial., & Author LastName, FirstInitial. (Year). Title of article. Title of Journal, Volume(Issue), Page Number(s). https://doi.org/number

AuthorLastName, FirstInitial., & Author LastName, FirstInitial. (Year). Title of article. Title of Journal, Volume(Issue), Page Number(s). https://doi.org/number

AuthorLastName, FirstInitial., & Author LastName, FirstInitial. (Year). Title of article. Title of Journal, Volume(Issue), Page Number(s). https://doi.org/number

# **Research schedule**

| **Research phase** | **Objectives** | **Deadline** |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |