# Electric Skateboard

Max Leblang, Elijah Tolton, Jamez Lynch

October 2020

## Executive Summary

For our Engineering capstone project, we will be building an electric powered skateboard that's controlled by a phone app. This system will implement machine learning to increase intelligence, functionality, and stability.

To construct the longboard, we will first have to build the physical longboard system with motor and braking system, testing to see if adaptive baking is something that is plausible and efficient to implement. Next, we'll build the app to control the board, either for iPhone using Xcode or Android using OSCLayout. Next, we will train an image processing model on pictures of shoes to be able to recognize and follow shoes. We will then build and implement the follow feature into the board. Finally, if we find it plausible, we will build a virtual model of the board to train a reinforcement learning model to make an adaptive braking model so the board can deccelerate as smooth as possible

Our goal is to have all of our board assembled by winter break. Then, implement the motor and braking systems on the board by the beginning of quarter three. By the beginning of quarter four, we'll have a fully working app to control the longboard, and the basics of our follow feature. By the end of the year, we'll have finished the follow feature and implemented the smart braking model to fully complete the baord.

## Contents

# 1 Introduction

## 1.1 Context

In the beginning, humans utilized their feet to travel places. Next, they realized that they could ride horses, making travelling easier and faster. Soon, the car was introduced, making travelling even easier and faster, and less expensive and more efficient, as humans no longer had to deal with hungry and tired horses. Today, we strive to make transportation as easy and efficient as possible, making transportation more accessible and smarter.

## 1.2 Background

Being high school students, especially in such a small, connected city, we love quick and easy ways to get places. Also, in a world where the environment is deteriorating and fossil fuels burned by cars pollute the atmosphere, greener transportation options have increased in popularity. Bikes, skateboards, scooters, and hover-boards surround our lives. This is why we've decided to make an electric powered longboard prioritizing these three things:

- Fast and Efficient

- Easy

- Fun

- Green

# 2 Objectives

## 2.1 Fast, Easy, and Efficient

Longboards, pennyboards, and skateboards have recently become very popular, especially amongst teens. This is due to their relatively small size which

allows them to be easily grabbed and used. This longboard will be something that someone can just grab from their garage, put on the ground, and ride. By powering the longboard with motors, we can make travel faster, as an electric powered longboard can travel up atleast 20 mph. Finally, implementing a computer and machine learning will make riding easier, as increased stability will allow beginners to ride the board with ease.

## 2.2  Green

The electric powered transportation industry has grown vastly during the past decade in order to combat the enormous carbon footprint that comes from driving gas powered cars. This longboard will be a viable and green alternative to making quick trips in a car. We will implement regenerative braking, which will allow for braking to charge the battery and making it last longer, thus requiring less charging.

## 2.3  Fun

In an age where so many modes of transportation are available, why shouldn't getting from point A to point B be as fun as possible. As Ralph Waldo Emerson once said, "It's not the Destination, it's the journey." Riding skateboards and longboards has become a pass time that many people enjoy. This longboard will be fun to ride. Riding around fast on a longboard is fun and exhilarating, and the added security of control and stability will make this more enjoyable. Also, with the added follow and call feature, you can focus on other things without worrying about carrying around the longboard, and when you're ready to leave, you can call it to you, jump on, and ride off!

# 3  Planning

## 3.1  Origin of the Idea

When we first started thinking about what to build for our Capstone project, we wanted some that implemented machine learning or AI. This was important to us because it would give our project intelligence and utility beyond anything we could build without ML. Also, ML is a fast growing field, and learning about it now will give us a leg up in college and the technology industry. Next, we decided we wanted some form of transportation involved. We started off thinking about doing a cooler robot that could ride around and deliver drinks. However, we decided that the impact and usability of a cooler bot was significantly less than an electric powered skateboard, which still implemented the same concept of controlling a wheel powered machine.

## 3.2 Final project

Our final plan is to build an eclectic powered longboard that's powered by two motors in the back. The longboard will also have a regenerative braking system which utilizes a circuit that switches the polarity of the motors when we want to brake, allowing us to control how much force the brakes apply. Also, we will develop a phone app to control the speed and braking of the longboard. Finally, we will implement two ML aspects to the board for increased functionality:

- Follow and Call using **object detection**. We will mount cameras to the board, and train a model to identify shoes. This will allow the model to follow a user's shoes, and drive up next to them when they're ready to go.

- Adaptive Braking using **reinforcement learning**. We will create a virtual model of the board on a computer and train a **Q-Learning model** to maximize smooth and stable braking. We will then upload this model to the longboard to utilize.

# 4 Deliverables

# 5 Methodology

# 6 Impact

# 7 Project Management

# 8 Budget

# 9 Risks and Countermeasures

# 10 Team Qualification

# References