Team #23 - Air Trecks

by

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Objective and Motivation

- Recent years of innovation have lead to electrifying many recreational forms of transportation. Skateboards, bikes and scooters have been electrified. However, there has yet to emerge an electric set of inline skates. We want to change that. Our product will allow users to enjoy electrically powered inline skates that can assist or fully propel the user.

Subsystems Options

- Power
- Propulsion
- Sensing
- Physical
- Controller/Computation
- Safety
- Bonus
  - Phone app

System Specifications

1. User Experience
    a. Attaches securely to the user's feet (product can be *worn*)
    b. Attaches to each foot of the user independently (product comes in a pair)
    c. Completely attach and detach from user in less than 20 seconds
    d. Insensitive to user foot/shoe size (it is sensitive to foot size because that's how we will map out where the pressure sensors will go)
2. Propulsion system
    a. reaches a maximum speed of at least 10 mph with a load of 250 lbs
    b. Reaches max speed in 3 seconds under max load
    c. Does not use a hand held controller
    d. Features brakes reducing a user's speed from max to >1 mph in 20 feet under max load
1. Power System
    a. Uses a rechargeable battery
    b. Allows for 1 mile of continuous operation at max speed and 75% of max load
    c. Recharge to 100% in 5 hours
    d. Can be turned off and on
2. Safety and control systems
    a. User can control the speed of each blade independently
    b. Emergency motor shut down/off
    c. Battery precautions
    d. Element and impact resistant

Power System

- **Specs**
  - 20-25v
  - 5000-6000 mAh
  - >30A output

Propulsion System Options (Belt vs Hub)

2 Torque 6355 - 190kV brushless Motor

- **Max Power:** 2450W
- **Idle Current:** 1.7A
- **Shaft Diameter:** 8mm
- **Diameter:** 63mm
- **Height:** 55mm
- **RPM/Volt:** 190

Computation/Controller Options

Electronic Stability Control (ESC): used to control how much power goes from the power supply to the motor via a controller.

- Amperage: 50A
- Control from Arduino with PWM signal

Arduino takes input from pressure sensors, safety system and decides how much power to send to motors

Sensor System Options

- Pressure sensor options
  - https://www.adafruit.com/product/1361?gclid=CjwKCAjwoKDXBRAAEiwA4xnqv76u-BErmB818SkZz4gXHTZfhAr76TCyn4Vgnd9Ml4hT5lb_ICM4dRoCfRIQAvD_BwE
  - Flexible and cheap

- Accelerometer
- Gyroscope
  - can improve sensing with the use of accelerometers along With the gyroscopes

Physical System Options

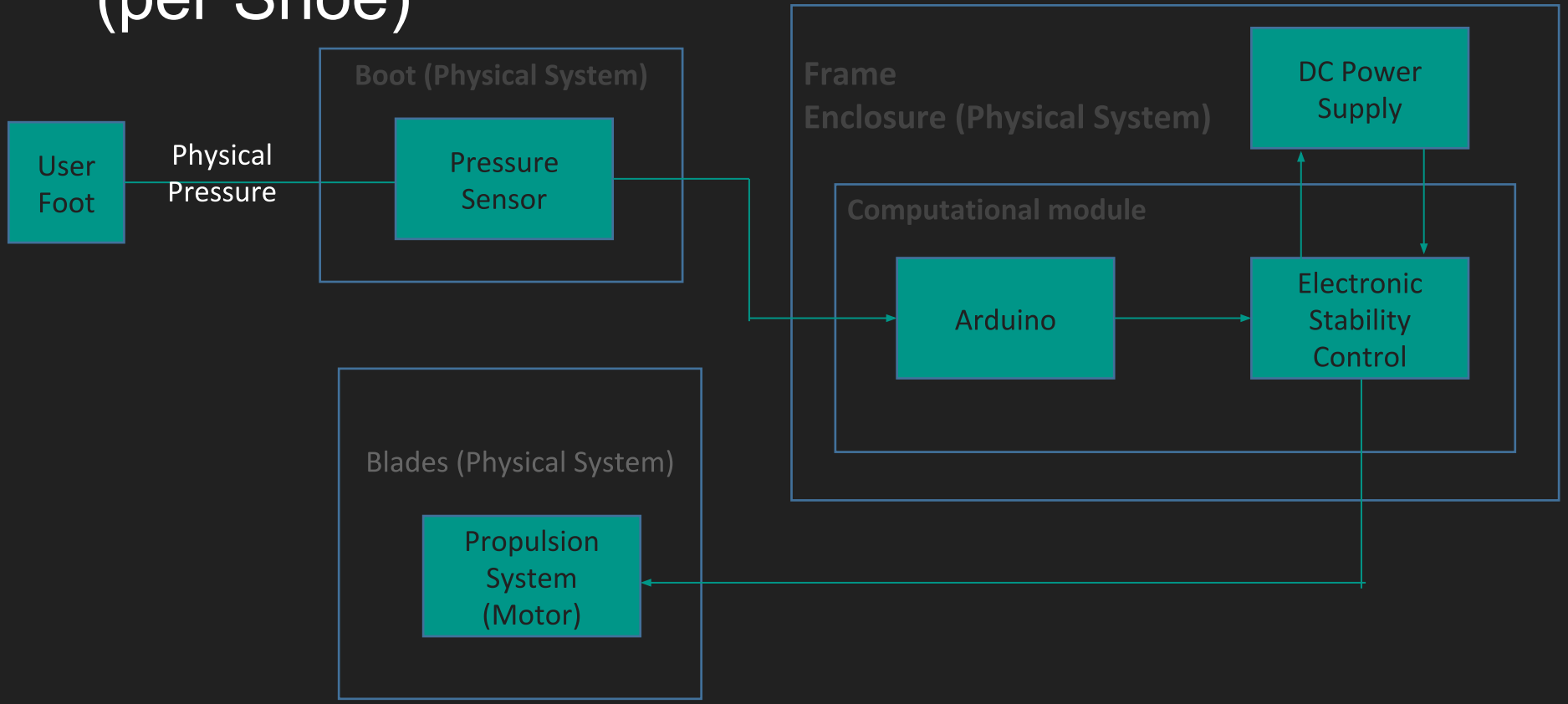
Hockey Inline Skates and Wheels

- **Two wheel system**
- **Wheel Diameter:** 76mm (3 inches)
- **Frame:** DIY *We will have to create our own wheel fixture to makes space for propulsion, power and computation system

Safety Systems Options

a. Pressure sensors all over the sole as well as a gyroscope at the center of the shoe to give us a redundant sensing system for increased accuracy as well as sensing mid-air movements.
b. Program an association between the shift in weight sensed and desired control (ex. A shift in weight forward would activate the wheel and move forward.
c. A system to recognize the rapid shifts in weight associated with falling or losing control and initiate the breaks
d. Bluetooth between the two shoes to allow communication between each shoe and allow for separate commands activated at the same time

System Design: Block Diagram (per Shoe)



Significant Custom Hardware Design

Our custom hardware component will be creating an interface between the pressure sensor and arduino. This interface will also be suited with a power management system to power the sensor, arduino and ESC safely and compactly in a inline skate configuration.