

**Problem Statement:**

During training, track runners are often required to run for specific distances in specific time frames as a form of conditioning, however due to how tracks work it can be difficult to get exactly the required distance at the right pace. While there are automated systems to assist with this they cost over 10,000 dollars and thus are out of reach of places like colleges and high schools. Our goal is to develop a low cost method of pacing these types of runs.

**Requirements and Constraints:**

Number	Fr/NFR/Constraint	Area	Constraint/Requirement
1.1.1	FR	Rabbit	The rabbit shall have an emergency stop function
1.1.2	FR	Rabbit	When the rabbit is in motion it shall accelerate and decelerate similar to a real runner
1.1.3	FR/NFR	Rabbit	The rabbit shall be directed by an app and controlled directly by an onboard microcontroller system
3.1.1	FR	Navigation	The rabbit shall have the ability to stay within the lanes on a track
2.1.1	FR	App	The app shall have options for distance per set, number of sets and time to complete each set
1.2.1	NFR	Rabbit	The rabbit shall be able to work continuously for at least 1 hour
1.2.2	NFR	Rabbit	The Rabbit shall be able to match the pace of a human runner

2.2.1	NFR	App	The app shall respond to input in less than 5 milliseconds on average
1.3.1	Constraint	Rabbit	The rabbit shall cost less than 1000 dollars
2.3.1	Constraint	App	The app shall be available for both IOS and Android devices

**Engineering Standards (linked to making sure we meet the requirements in a safe and valid way)**

Standard	Item	Justification
IEEE 1625-2008	Battery Standard	We are using batteries to power both the rabbit and the microcontrollers, so we need to comply with standard maintenance and safety.
IEEE 802.15.1	Bluetooth	We are using bluetooth to send data from the phone to the rabbit to give it the user input. We will need to comply with IEEE bluetooth standards by using hardware that complies with this standard. This standard is for a specification for a short range radio frequency.

**Intended Users and Uses:**

This product is designed to be used as a low cost training bot for various levels of track athletics. The product will be cheap enough for public middle and high schools to purchase and advanced enough to be used to train collegiate and professional athletes. The application platform provided would be used by coaches and athletes to design training routines that the Rabbit would then autonomously lead. By using the Rabbit the coaches and athletes have complete control over precise pacing and can maximize athletic performance.

**Use Cases:**

- Multiple Rabbits are used to create separate training plans for long and short distance runners.

- Multiple Rabbits are used to train athletes at different levels (Ex. varsity and JV) with different intensities.
- A Rabbit is used to pace a runner so the effect of the training program is maximized (Ex. runners who are “feeling good” don’t overexert in the early sets and tire themselves out for the later sets).
- A Rabbit is used to train runners on the most efficient pace to keep for different sections of a race/set.
- The Rabbit mimics running against a real competitor and therefore gives the runner something tangible to pace themselves against.