

YouLock

Brian Sinclair

University of Waterloo Capstone Design Project

Electromechanical self-locking bike rack



Longbow Prototype

My fourth year capstone design project pertaining to the creation of a self-locking bike rack; using mechanical, electrical, and software components. The premise of the rack is such that a user would simply roll their bike up onto the rack, tap their phone, and both wheels and frame would be safely locked.

I was responsible for all the mechanical design and SolidWorks modeling, as well as mechanical machining. Further developed experience using a microcontroller, sensor, servo motor system.



Crossbow Prototype

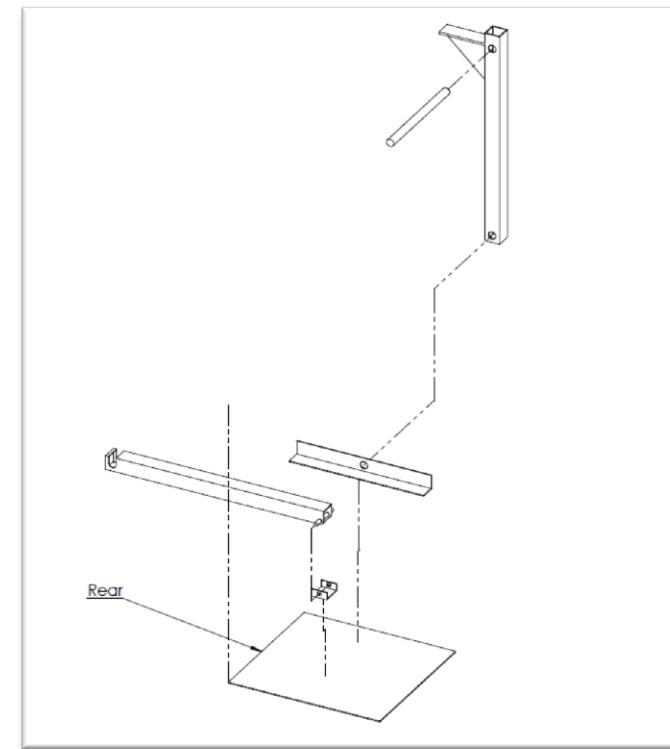
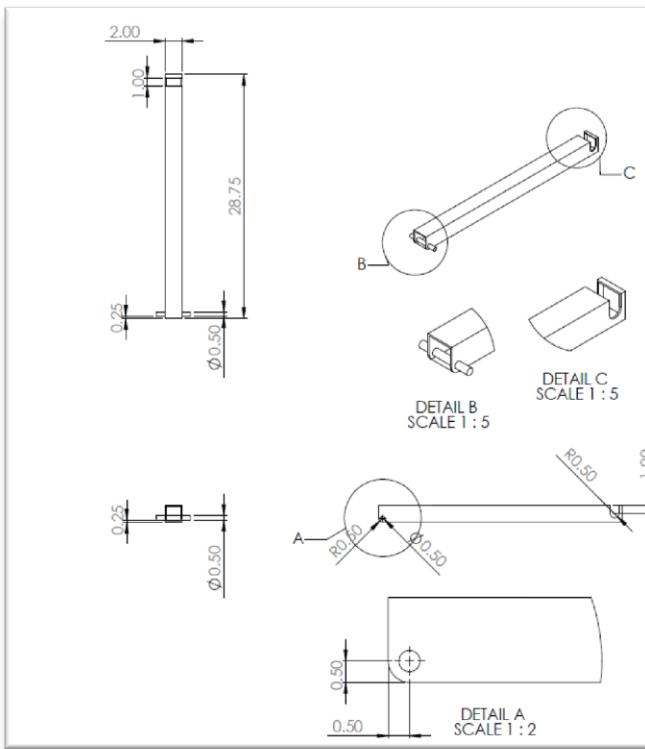
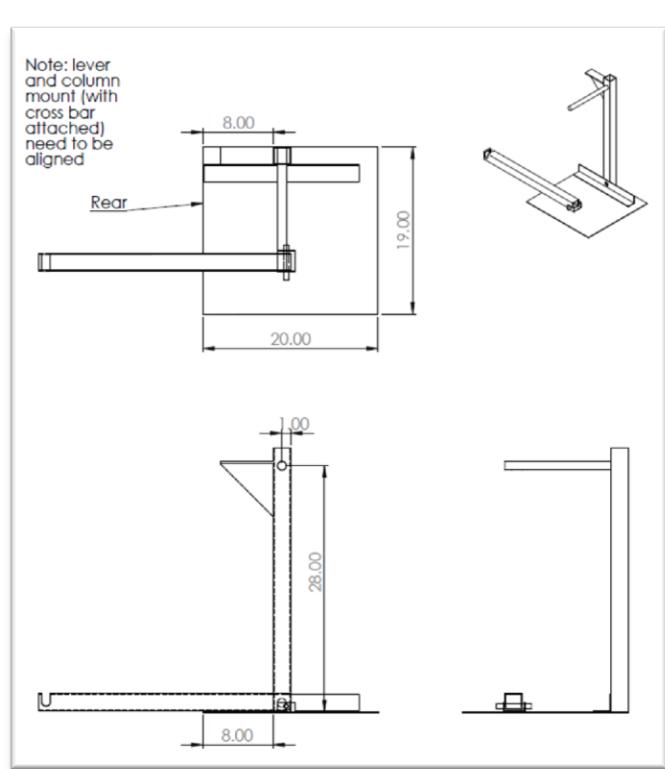


Longbow Lamp Post Configuration

The two renders shown highlight configurations for different infrastructure needs after a detailed user needs assessment was made.

The rear half of the rack was machined out of steel for a conference held at the University of Waterloo. A few key components are highlighted with detailed manufacturing drawings on the next page – which includes an exploded view.

Manufacturing Drawings





YouLock

Our mission is to give all cyclists a secure method of locking their bike, with the aim to reduce theft and eliminate the use of personal locks.

Over 200,000 commuters in Canada
-2011 StatsCan Census Report

Over 72,000 people commute to work by bicycle in Toronto
-2011 StatsCan Census Report

Over 44,000 bikes reported stolen in Canada
-2007 StatsCan Census Report

Largest cause for stolen bikes is through human error of incorrectly locking the bike
-Toronto Police Report

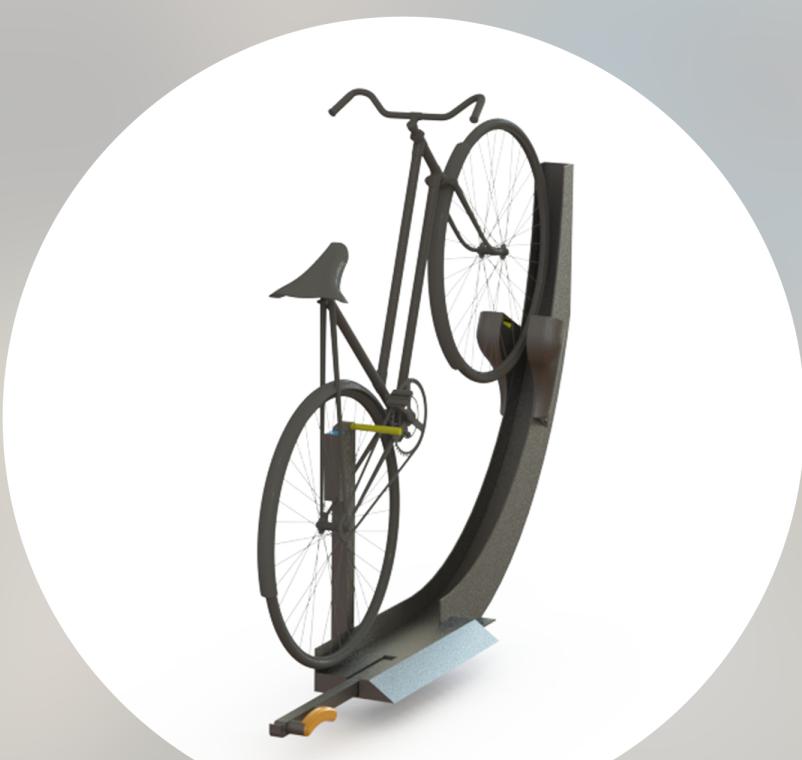
State of the Art



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Steps

1. Roll your bike up onto the rack
2. Pivot your bike such that the yellow bar extends through the rear wheel and frame
3. Lift the orange handle to secure your bike
4. Simply tap your phone or tag and safely lock your bike
5. When you're ready, tap your phone or tag again to unlock your bike and ride away



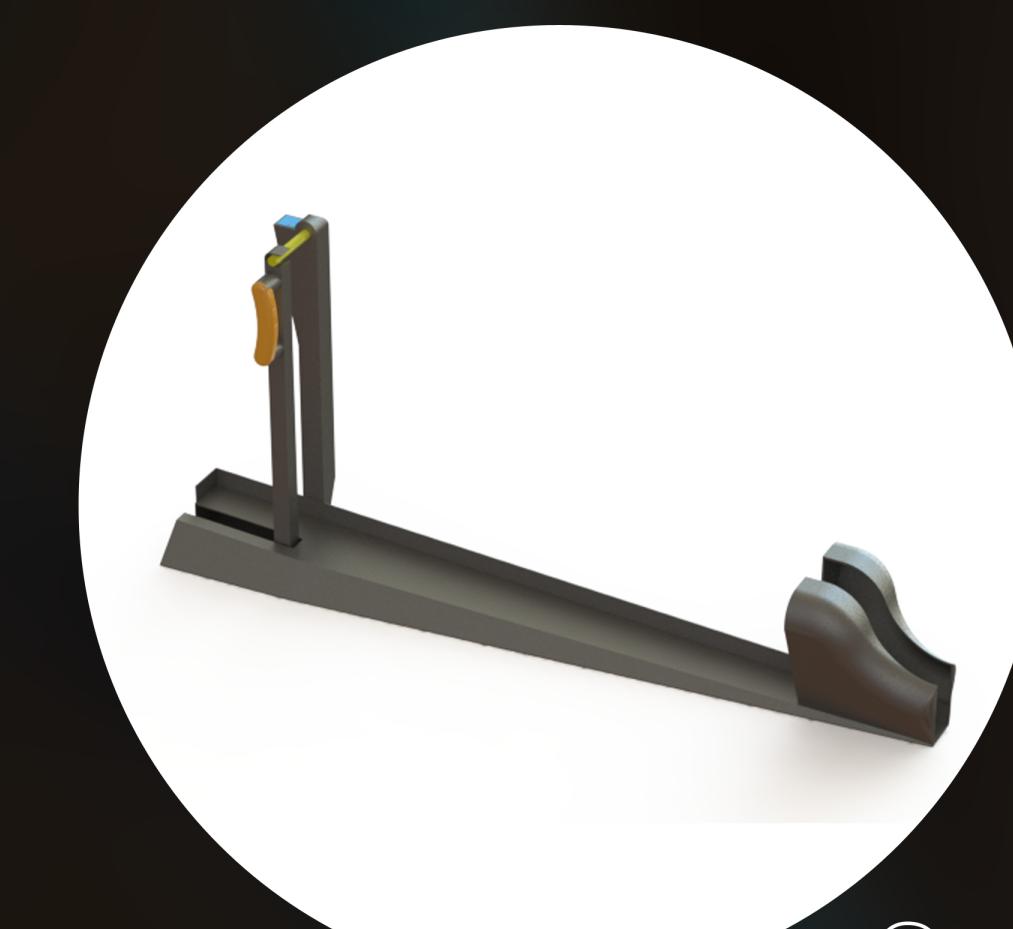
The Design

Challenges

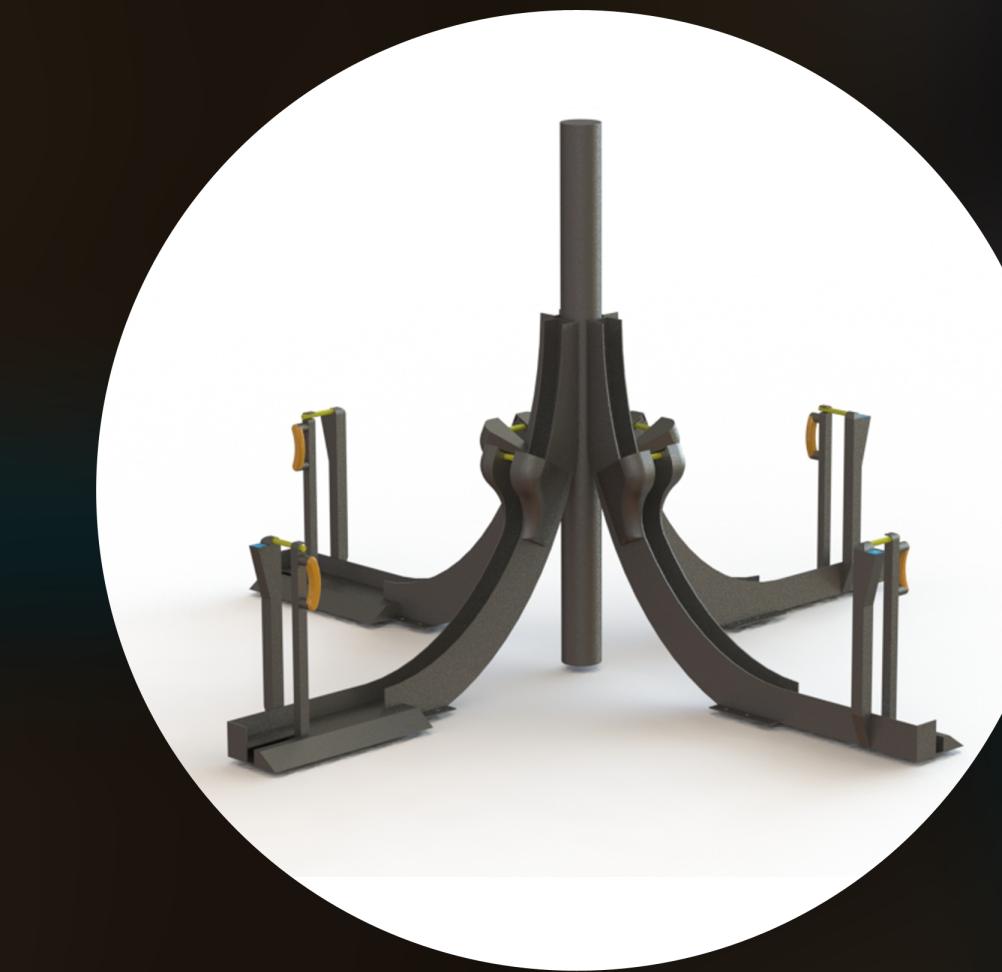
Global Design: Design for 5th and 95th percentile

Simplicity: Common geometric design for manufacturing

Aesthetics: A design that store owners, municipalities, and property owners would be proud of



Crossbow



Longbow
(Euler)

Security: Steel structure with reinforced high risk areas to ensure bike safety

User Interaction: Intuitive design for minimal instruction. User control, augmented with sensors to avoid damages to bike



Engineering Analysis

Requirements Assessment:

A detailed perspective on the necessary tolerances for mechanical, hardware, and software components

FEA: Structural enforcement in critical areas

- \$ Hit market strides with a superior product at a competitive price
- ⚡ Leverage existing solar technologies for power
- 🌐 Public/Private sector partnerships to assist with changing landscapes
- 💡 A business model that promotes low upfront capital costs

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Features

Go Lockless & Keyless

You no longer need to be burdened with a heavy lock in your bag, pannier, or pocket. Don't even worry about forgetting your key -- you won't need one. YouLock is NFC enabled to verify your identity with your compatible smart phone or any NFC tag.



Find an open bike rack before you get there. Our app has a map of all available racks so you can be rest assured we have a spot.



Locate

Share

YouLock allows you to share access to your bike and its location with your family, friends, roommates, and virtually anyone you wish. You can manage access to your bike through your personal app with access time, and number of uses.



Secure

YouLock is designed to lock the most valuable parts of your bike -- both your wheels and your frame. The Lock is made of steel and is stress tested to ensure safety.



Next Steps

1. Development of a secure front lock, scaled down to be less obtrusive.
2. In-house designed rear lock to ensure robustness with steel actuated locking bar.
3. Weather treated and reinforced hardened steel for key areas
4. Leverage state-of-the-art encryption to ensure security

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