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Reinventing the wheel

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Let's face it, sometimes when you are riding a bicycle, gravity sucks.

Pedaling uphill can be a chore for anyone — with the possible exception of Lance Armstrong, of course.

On the flip side, heading downhill is wonderful, just so long as the brakes are working properly.

What if you could have the best of both worlds?

That's what the designers of the Copenhagen Wheel hope they've achieved. The Copenhagen Wheel, which was unveiled in December, allows any bicycle to be turned into a hybrid: part bicycle, part electric bike. The wheel harvests the energy you input while braking and cycling and stores it for when you need a bit of a boost. You know, for those hills.

"It uses a technology similar to the KERS (Kinetic Energy Recovery System), which has revolutionized Formula One racing over the past couple of years," said Carlo Ratti, director of the Senseable City Laboratory at the Massachusetts Institute of Technology. "When you brake, your kinetic energy is recuperated by an electric motor and then stored by batteries within the wheel, so you can get it back when you need it."

Best of all, the Copenhagen Wheel can be retrofitted to the rear wheel of any bicycle.

"The Wheel is a self-contained unit," Ratti said. "It can be plugged into any bike without requiring additional electronics or wires. It is fully controlled by your feet: when you pedal forward, the motor supplements your torque; when you pedal backwards to brake, the motor starts regenerating electric energy while reducing your speed."

The red hub of the Wheel, which contains the motor and batteries, also has sensors that collect information on air and noise pollution, congestion and road conditions. Additionally, there is a meter that records distances and a GPS unit that can remember routes.

All of the data is sent via a Bluetooth to a smart phone mounted on the handlebars.

"The bike wheel is an extension of your personal mobile device," said Assaf Biderman, associate director of the Senseable City Laboratory. "Controlled through your smart phone, the wheel recognizes you as you approach. While you ride, you can switch gears and motor modes using your phone, and receive real-time alerts automatically.

"The Wheel also has a smart security system: if someone rides away with it, the Wheel goes into a mode where the brake regenerates the maximum amount of power and sends you a text message with its location. So in the worst case, the thief will have fully charged your batteries before you get back your bike."

For more on the project, go to the MIT Senseable City Lab (senseable.mit.edu/copenhagenwheel/).

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