

eWARPE – Energy-efficient Weather-aware Route Planner for Electric Bicycles

Irina Tal , Aida Olaru and Gabriel-Miro Muntean
Performance Engineering Lab
Dublin City University, Ireland

Outline

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Motivation

- ❑ Cycling – one of the most sustainable mean of transportation
- ❑ **Electric bicycles** a modern form of cycling (green + increased comfort – e.g. in hilly terrains scenario)
 - ❑ Most popular among electric vehicles
 - ❑ Their popularity is on the rise
 - ❑ **Issues:**
 - ❑ battery range + battery charging periods
 - ❑ weather conditions affect cyclists

Solution – eWARPE

- ❑ Weather not only affects cyclists
 - ❑ listed among the main cycling demotivators
- ❑ ... but also the energy consumption
 - ❑ especially the wind (both components: speed and direction)

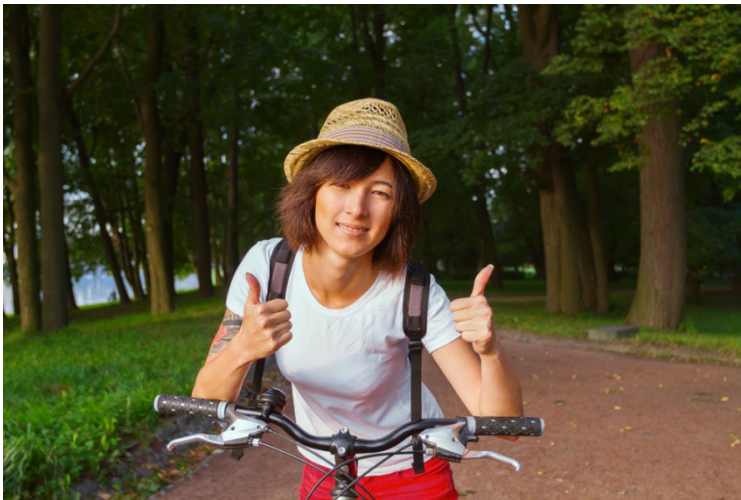
=> eWARPE



eWARPE

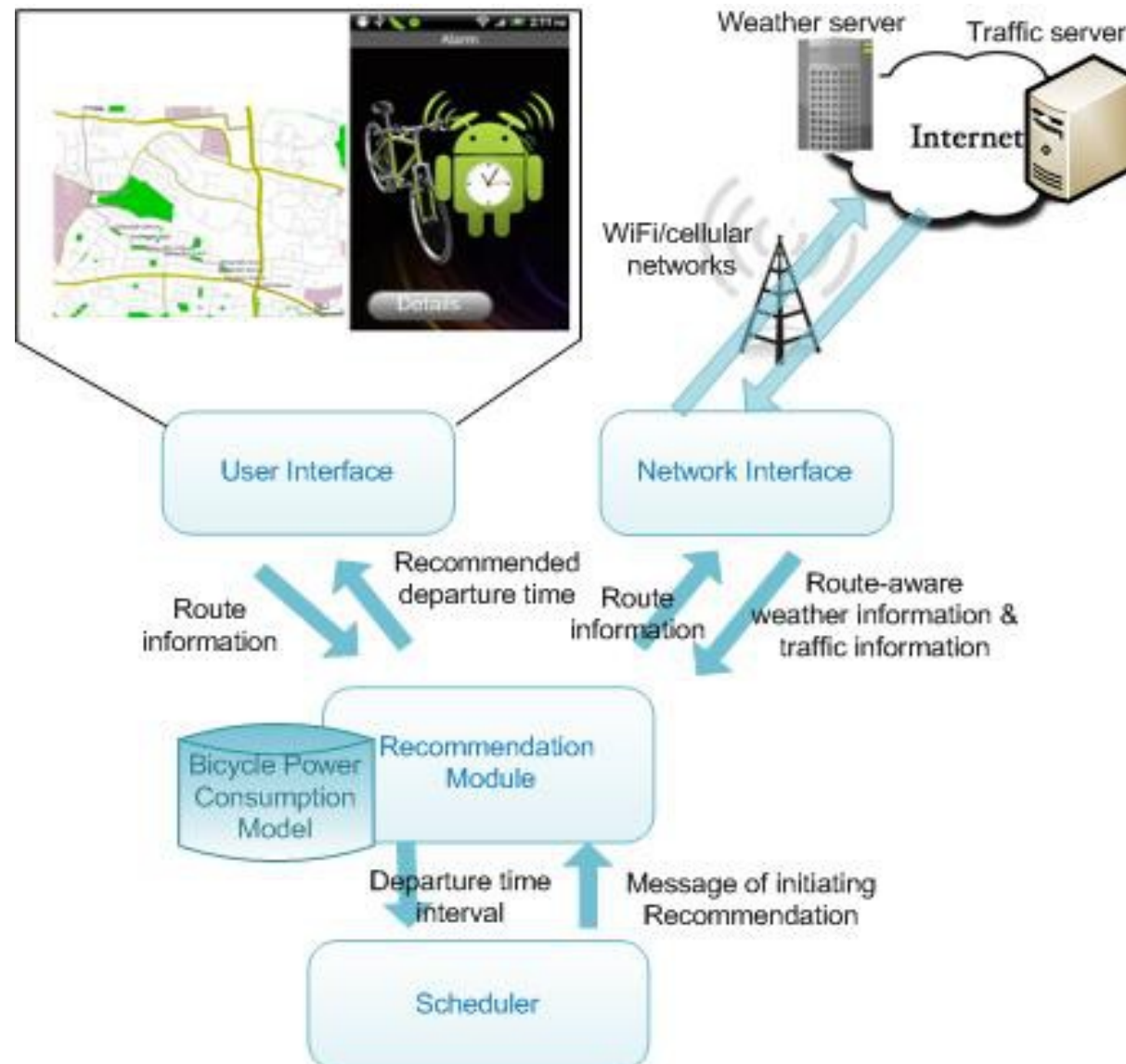
- Step forward for cycling route planners:
 - departure – destination route
 - weather-aware **departure time** – planning when to start the route in order to avoid adverse weather conditions

=>



- Constraint – some flexibility in the departure time

eWARPE – Architecture



Survey

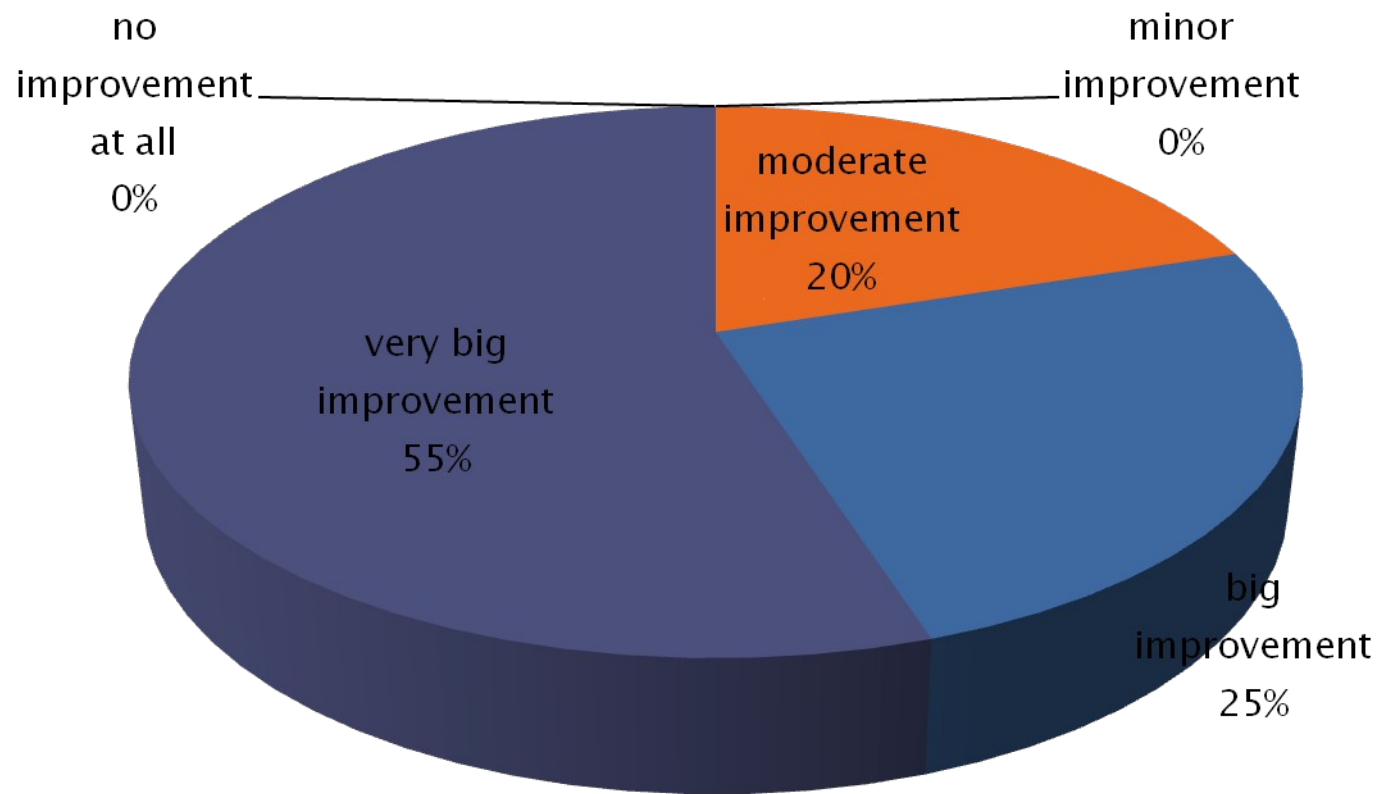
- ❑ Methodology: interview with 20 participants (M = 11; F = 9)
- ❑ Goals:
 - ❑ to demonstrate the existence of the problem: poor weather conditions affect cyclists
 - ❑ to determine the dimensions of the problem and consequently to measure the need for the proposed solution
 - ❑ to validate the cyclists' interest in the proposed solution
 - ❑ to measure the benefits of the proposed solution

Survey – Analysis

- ❑ Main disadvantages of cycling:
 - ❑ Negative impact of poor weather, rain & wind mainly (50% of the subjects)
 - ❑ Safety issues (45%)
 - ❑ Cycling is uncomfortable and others $\leq 10\%$
- ❑ Main factors that negatively influence cycling:
 - ❑ Poor weather conditions (55% of the subjects)
 - ❑ Drivers' behavior (25%)
 - ❑ Not enough cycling facilities (25%)

Survey – Analysis

□ eWARPE benefits on improving cycling experience



Survey – Extension

- ❑ Online Survey – 1 83 participants
- ❑ Some data:
 - ❑ Poor weather conditions first in the top of negative factors influencing cycling
 - ❑ Interest in eWARPE: 5 – 38%, 4 – 32%; 3 – 15%; 2–9%; 1 – 5% (5–very interested – 1 – not interested at all)
 - ❑ Cycling experience improvement: 5 – 20%, 4 – 42% 3 – 24% , 2–7%, 1 – 7%
 - ❑ 48% from participants will be more inclined to cycle being provided with the solution

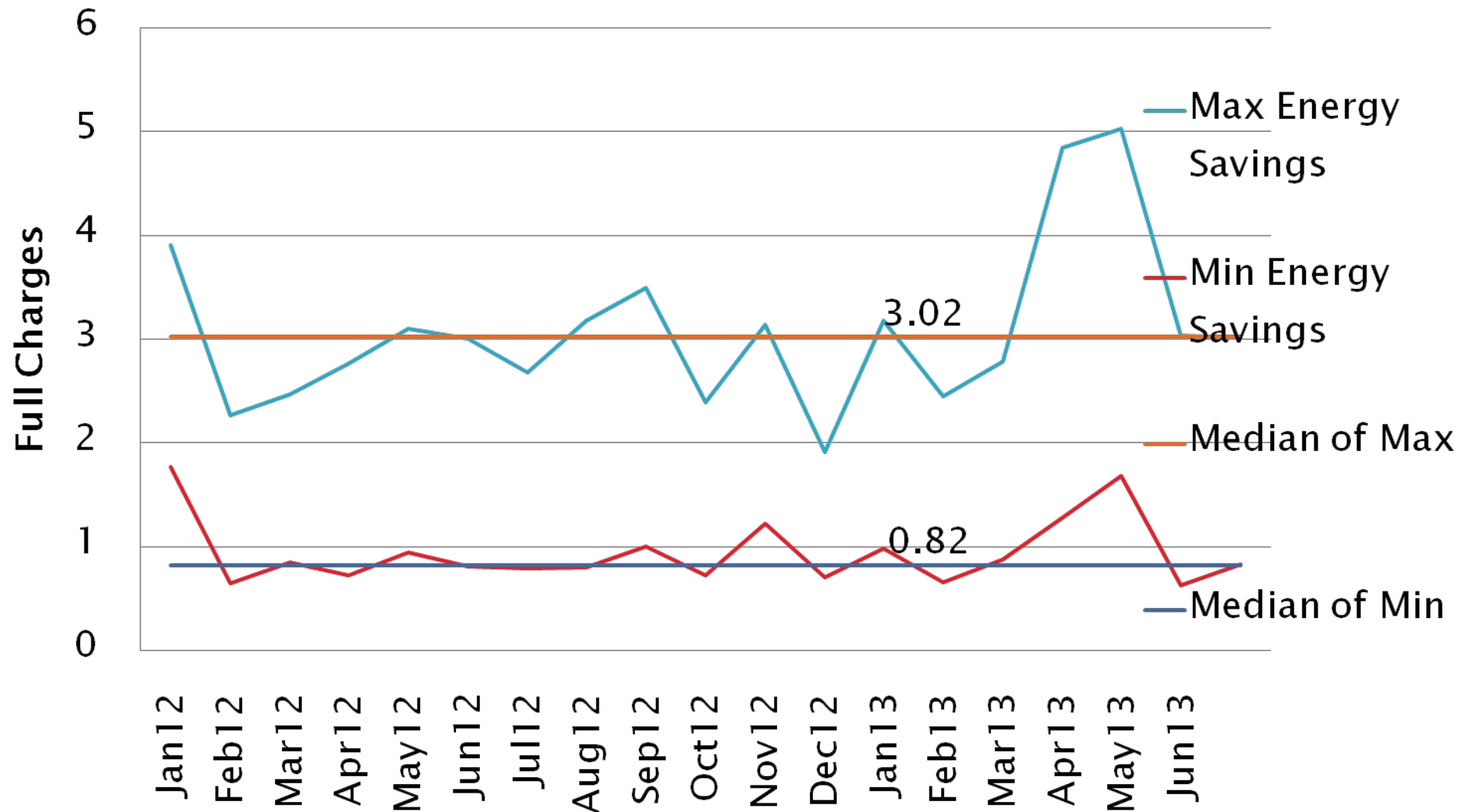
Case Study

- ❑ Scenario analyzed:
 - ❑ Route: Subject' Home – DCU and back
 - ❑ Departure time interval, Monday to Friday [7:30 – 9:00] and [17:30 – 19:00]
 - ❑ Time period: January 2012 – June 2013 (18 months); public holidays were excluded

Case Study



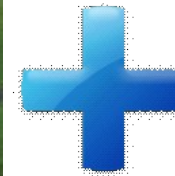
Case Study – Results



Future work



Recommendation
Module



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Questions

