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Challenges in the Interpretation of Crowdsourced Road Condition Data

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Tampere University of Technology (TUT), Pori

- Pori is town of 85 000 citizens, students and modern enterprises and also one of the leading Finnish cities in happenings.
- TUT Pori is located in University Consortium of Pori (UCPori).
- Laboratory: Pervasive Computing
- Group: SEIntS - Software Engineering and Intelligent Systems

Challenges in the Interpretation of Crowdsourced Road Condition Data

Content of presentation

- Background
- Developed System and it's architecture
- Field tests
- Results, Findings and conclusion
- Future work

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Background

•Several projects – Main idea is piloting prototype ideas

•IoT -projects

– Sensor-node collects data
– Data is sent to the cloud
– The processing and editing of data are done in the cloud
– Used devices: Raspberry Pi, Mobile phones

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Examples of past prototype development research

- J. Grönman, P. Rantanen, M. Saari, P. Sillberg, and H. Jaakkola, “Lessons Learned from Developing Prototypes for Customer Complaint Validation.” Software Quality Analysis, Monitoring, Improvement, and Applications (SQAMIA), Serbia, August 2018.
- P. Rantanen, P. Sillberg, and J. Soini, “Towards the utilization of crowdsourcing in traffic condition reporting,” 2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2017 - Proceedings, pp. 985–990, Croatia, May 2017
- Mika Saari, Ahmad Muzaffar bin Baharudin, Pekka Sillberg, Petri Rantanen, and Jari Soini. 2016. Embedded Linux controlled sensor network. In 2016 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO). IEEE, 1185–1189.
- Mika Saari, Pekka Sillberg, Petri Rantanen, Jari Soini, and Haruka Fukai. 2015. Data collector service - practical approach with embedded Linux. In 38th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2015, 25-29 May 2015, Opatija, Croatia (International convention on information and communication technology, electronics and microelectronics). IEEE, 1037–1041.
- And several others…

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The latest prototype – "Shockapp"

- This paper introduces a study that utilizes data collected by smartphone sensors for detecting variations in road surface conditions.
- The data were collected by a group of users driving on actual roads in western Finland.
- The paper presents the test setup and preliminary results of the study, including the description of the web user interface used to illustrate the data....

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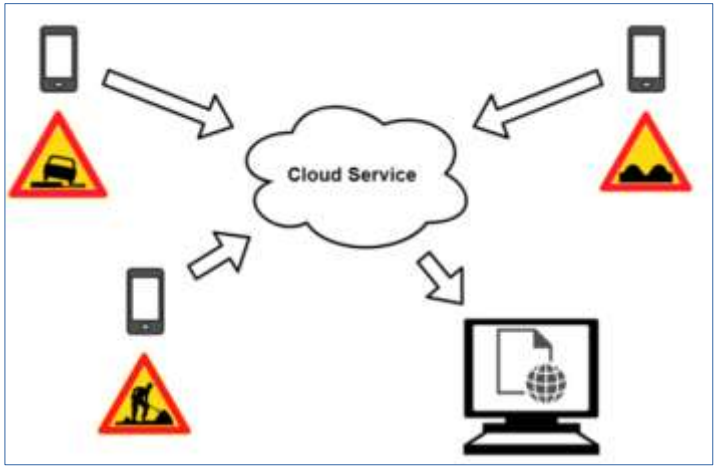
System architecture - Test scenario

- Smartphone – Android -based devices
- "ShockApp" -Android application collects data: (1 datapoint / second)
  - Acceleration(X,Y, and Z acceleration from gyroscope)
  - Location
  - Direction
  - speed
  - Timestamp
  - Data are sent to the cloud
- Cloud and software – Linux based server
- Data processing …
- Visualization with Google Maps and OpenStreetMaps



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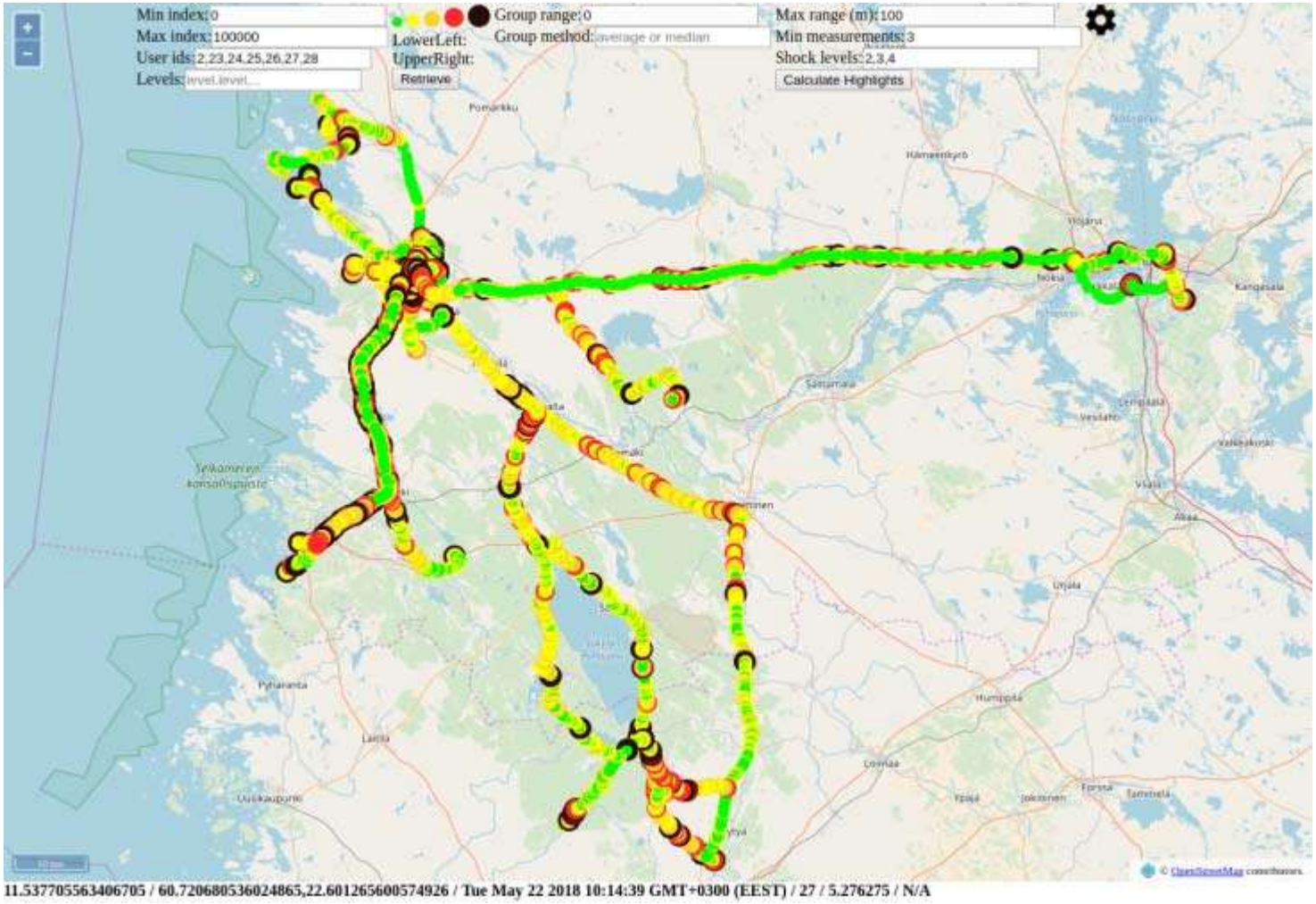

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TABLE I. BREAKDOWN OF SHOCK DATA POINTS

Shock Level	$v \geq 0$ m/s		$v \geq 1$ m/s	
	n	%	*n*	%
$L_{N/A}$	334730	69.3	312334	68.3
L_0	98367	20.4	98320	21.5
L_1	45083	9.34	42101	9.20
L_2	3419	0.71	3413	0.75
L_3	904	0.19	904	0.20
L_4	368	0.08	368	0.08
Total Count	482871	100	457440	100
Total Count with Level	148141	30.7	145106	31.7

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Discussion

- Technical difficulties
- Hardware differences
- Solution: Required the calculation of a “normal” for each device.
- Interpretation of the data
- Known places of data variance (e.g roadworks, speed bumps)
- Random events made by user
- Challenge: Visualization of large datasets
- Future research
- Open up the collected data for further analysis.
- Several possible variables (car, speed, wheather and so on)

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Thank you

Questions?

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