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**CA & Complex Systems
from theory to practice**

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Outdoor lighting optimization and other research projects at the ISI Center

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Projekt współfinansowany ze środków Unii Europejskiej w ramach Europejskiego Funduszu Społecznego

- Look around (after dark).
- How much does it cost?
- Could it cost less?
- Is it safe?

- LED lights are not being sufficiently exploited
- Overlit areas, light pollution
- Design of lighting infrastructure is not fit for dynamic control
- Control systems are too simplistic
- Additional value: aesthetic side



A need



- Multi-variant design for various, dynamically switched lighting profiles
- Control hardware with efficient network stack
- Dynamic application of lighting profiles based on multiple sensors

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- PhoCa Design performs precise, multi-variant photometric calculations based on formal requirements, infrastructure constraints (posts, geometry, etc.) and fixture parameter definitions
- Designs can be evaluated according to various criteria, i.e. energy efficiency, exploitation cost, etc., as well as their combinations
- PhoCa Control implements the decision-making logic to switch between configurations obtained from PhoCa Design

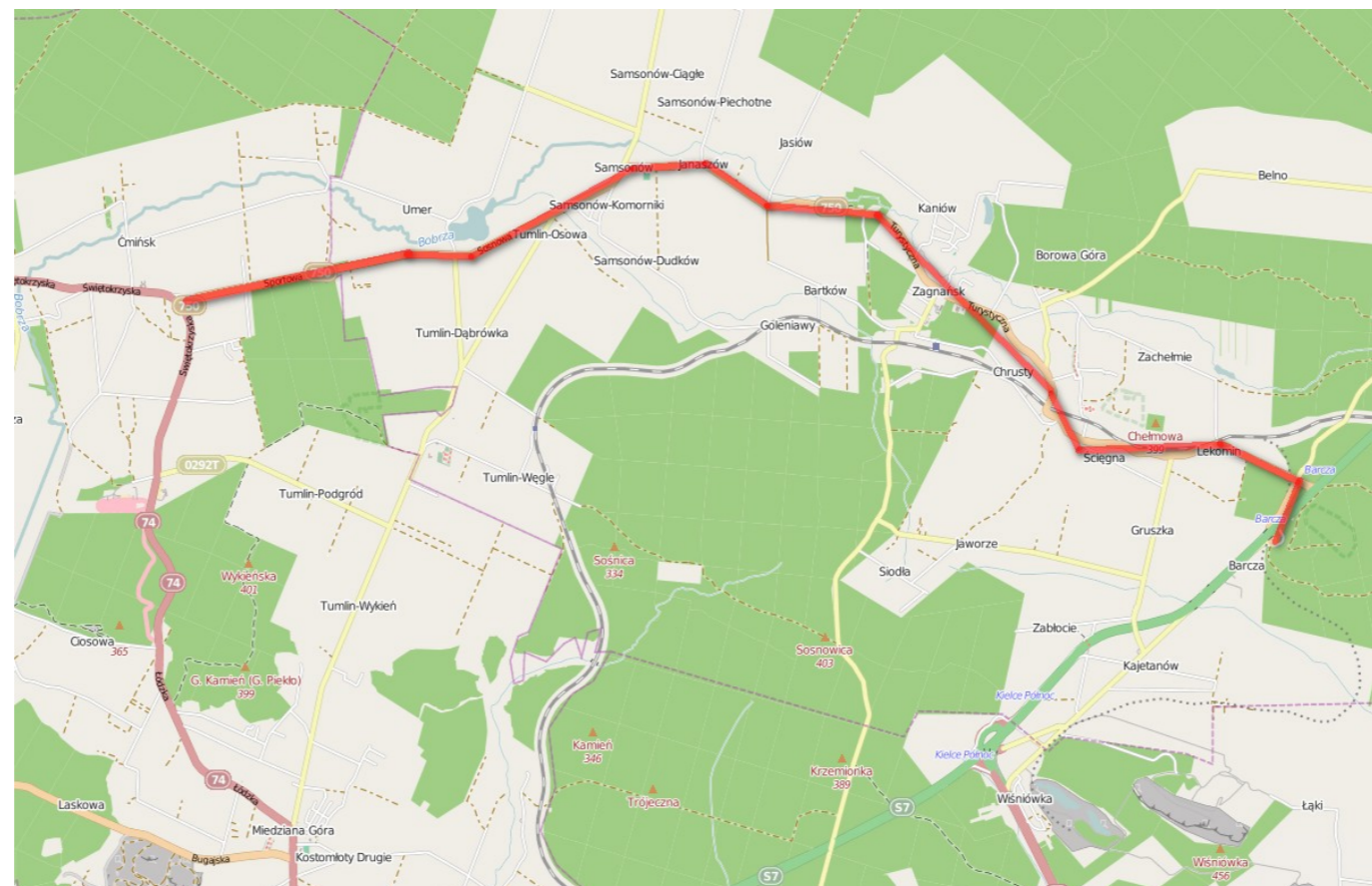
- Design phase is time consuming (costs!)
- Weak or no support for optimization
- Too many factors to develop a good project using the "traditional" approach to design
- Usually, overestimated lamp parameters in traditional design process produce
- Over-illumination
- A well tailored design is the winning factor in selling lighting systems

- 4 types of design parameters - 10 steps each (e.g. pole height can change from 8m to 10m, with 0.2m increments) - 10 000 combinations
- We get 100 variants of lighting configuration based on external factors: ambient light, traffic, emergencies, presence...
- We get only 10 road sections (lighting situations)
- Designing each section takes 10 minutes (optimistic)
- Total time: **190 years** of one man's work
- In Pho-Ca, it takes less than **one day**

- Lighting profiles specify scenarios with the required lighting levels for various segments (lanes, pavements, etc.)
- Multi-variant design assures all foreseen situations are covered: any profile can be applied
- Visual effect is improved by including predicted intensity changes in the control algorithms, reducing flicker and resulting in smooth transitions

- Formal graph-based representation
- Agent-based, distributed graph processing
- Heuristics
- Cellular automata traffic flow analysis
- Rule-based runtime

- A road section of about 23 km
- Design based on only two profiles
- LED lamps



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- Only one road (23 km)
- 80% energy savings
- More than 200 MWh annual saving
- More than 100 000 PLN annual savings

- Heterogeneous, distributed architectures for Smart Grid. (CA)
- Enabling participation in energy market.
- Energy efficiency: buildings and microgrids. (CA)
- Early detection of faults in electric machines.
- Optimizing architectural design and building management with crowd dynamics. (CA)
- Smart parking lot. (CA)
- 3D visualization of dynamically created scenes.
- Optimizing flood emergency response.
- Situational awareness based on video processing.