

Research and development of measurement methodology for outdoor digital screens' effects assessment

Summary

In light of fast technological changes and growing usage of LED and other outdoor digital screens (ODS) to spread information in form of commercials or announcements, the light pollution and comfort of people are more and more important to consumers of information and regulatory bodies. At the same time, in order to assure people about the safety and comfort of those technologies, the traceable and repeatable measurement method for ODS needs to be advised. Considering state of art studies and experimental approaches used for assessment of effects ODS to road safety, the novel lighting parameters assessment and measurement methodology should be developed.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Argo Rosin Dr. Toivo Varjas
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich)

Description

The **main goal** of the project is to develop outdoor digital screens (ODS) measurement methodology for lighting parameters which will consider technological, psychological and road safety aspects to improve traffic safety.

The project addresses the following **research questions**:

- What are regulations and restrictions for ODS installations described in standards/guidelines by different countries and municipalities to reduce light pollution and to ensure traffic safety?
- Which areas are most dangerous in urban traffic and what psychologically affects the attention of road users most?
- What are important lighting parameters and measurement methods to assess the impact of ODS on road traffic safety, and how these parameters affect the attention of road users?
- How to measure luminance of ODS considering environment and ODS parameters affecting the luminance measurement methodology?
- How to design ODS measurement methodology for lighting parameters which will consider technological, psychological and road safety aspects to improve traffic safety

The **sub-goal** of this PhD project is to present the needed parameters to determine the traceable luminance value and to model the illuminance conditions of urban areas. Specifically, the project should examine the relation of information carrier luminance to illuminance of urban areas.

Responsibilities and (foreseen) tasks

- Investigation and analysis of international regulations, standards and guidelines for ODSs in urban areas.
- Investigation and analysis of psychological and road safety aspects, that may be affected by ODS.
- Investigation and analysis of lighting parameters (e.g. luminance and illuminance) and measurement methods to assess the impact of ODSs on road traffic safety, and how these parameters affect the attention of road users.
- Selection of most important parameters and development of novel method for measurement of lighting parameters of ODSs. Develop model for illuminance dependence of parameters of ODS
- Investigate measurement uncertainties affecting light parameter measurements and illuminance model.
- Validation of developed method in real conditions.
- Formulation the regulative recommendations for municipalities

Data collection for investigations and analyses should be based on literature study, questionnaires, tests and measurements. Also, scientific results should be published at least on two ETIS category 3.1 conferences and at least on one ETIS category 1.1 journal paper (at least quartile Q2).

Applicants should fulfil the following requirements:

- a master's degree in electrical or mechanical engineering
- a clear interest in the topic of the position
- excellent command of English and Estonian
- strong and demonstrable writing and analytical skills in both languages. It is required to communicate and cooperate with Estonian municipalities
- capacity to work both as an independent researcher and as part of an international team

The following experience is beneficial:

- Experimental and/or theoretical metrology
- Programming in python
- Working knowledge of statistics

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in an international research group “Microgrids and Metrology”
- Opportunities for conference visits, research stays and networking with leading universities in the fields of lighting engineering

About the department

Department of Electrical Power Engineering and Mechatronics was established on 1 January 2017 within the framework of the structural reform of Tallinn University of Technology (TalTech) based on the departments of Electrical Power Engineering, Fundamentals of Electrical Engineering and Mechatronics. We are an academic structural unit that belongs to the TalTech School of Engineering. The department conducts teaching at the bachelor, master, and PhD levels, as well as research in the field. Department of Electrical Power Engineering and Mechatronics published in TalTech the highest number of research articles (1.1, 1.2, 3.1) in 2018– 2020. Department has strong international cooperation with well-known universities abroad, and with national public sector institutions and private sector companies.

Additional information

For further information, please contact Prof Argo Rosin argo.rosin@taltech.ee and Toivo Varjas toivo.varjas@taltech.ee



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