

## Introduction

Underground transportation systems have significant impacts on energy consumption at a regional scale. While the transportation systems, i.e. trains, has observed regarding energy efficiency, the subsystems of metro stations and surroundings, such as ventilation, escalator and lightning are mostly unexplored.

Although a nominally small percentage of energy can be saved with an efficient management of these subsystems, a large energy saving in absolute terms can be obtained. In other words, a 5% energy saving in non-traction electricity consumption in one year, is equivalent to the electricity consumed in more than 700 households.

To investigate on energy efficient subsystems (ventilation, escalator, lightning), the EU funded in the Seventh Framework Programme the project "Sustainable Energy mAnageMent for Underground Stations" (SEAM4US). The SEAM4US project develop a predictive control architecture, which controls proactively the metro station subsystems, taking current and predicted count of persons within the station into account. The count of persons is provided by an enhanced CCTV system. On the same time the count of persons is the bases for the prediction.

The remainder of this paper is organized as follows. First an overview of SEAM4US project is given. Followed by a description of the pilot station. Subsequently the count of persons extraction is described, followed by a detailed view on the passenger density data. Last, our conclusions are drawn.

## SEAM4US project

The aim of SEAM4US "is to develop advanced technologies for optimal and scalable control of metro stations [...]" [1].

For optimal control, a predictive control architecture was developed. The control architecture proactively perform energy management tasks and controls the metro station subsystems, taking different passenger densities into account [2]. Also situations taking place in the future are considered by utilizing, beside others, the passengers prediction model. The passenger prediction model predicts the count of persons in a certain section, on a certain time in the future.

The SEAM4US consortium consists of nine partners from six different EU countries, namely Cofely, UniVPM, UPC, Fraunhofer FIT, VTT, Almende, UniKassel, CNET, and TMB. Each partner supports the consortium with its expertise:

**Cofely** Cofely Italia Spa (Italy):

Energy-efficient system management.

**UniVPM** Universita Politecnica Delle Marche (Italy):

Building and environmental physics and construction.

**UPC** Universitat Politecnica De Catalunya (Spain):

Building and environmental physics and construction.

**Fraunhofer FIT** Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung E.V (Germany):

R+D experts in middleware.

**VTT** Teknologian Tutkimuskeskus VTT (Finland):

R+D experts in middleware.

**UniKassel** University of Kassel (Germany):

User and agent-based scheduling modeling.

**Almende** Almende B.V. (Netherlands):

User and agent-based scheduling modeling.

**CNet** CNet Svenska AB (Sweden):

System integrator.