SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: TD1409
STSM title: Short Term Scientific Mission (STSM) Scientific Report
STSM start and end date: 22/10/2017 to 29/10/2017
Grantee name: Dr. Nikolaos Ploskas

PURPOSE OF THE STSM:

My colleagues and members of the MI-NET MC committee, Vasileios Kostoglou and Efstathios Antoniou, attended the 125th European Study Group with Industry (ESGI125 - 1st Study Group with Industry in Cyprus) and informed me about the interesting industrial challenges that they worked on. More specifically, I became interested in the problem "Optimizing bus routes in urban Nicosia", one of the four industrial challenges of the ESGI125. Since I have worked on similar projects, I contacted Dr. Katerina Kaouri, the organizer of ESGI125 and member of the MI-NET MC committee, asking for more details about the project. After a couple of interesting and fruitful discussions, we agreed that an STSM would be the starting point of our collaboration on working on industrial challenges using mathematical modelling. Moreover, I also wanted to discuss future collaboration with other researchers in Cyprus University of Technology - Dr. Fragkiskos Papadopoulos, Dr. Michael Sirivianos, and Dr. Ioannis Lestas who work on solving similar optimization problems.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

During my stay all aims of the STSM were fulfilled. I worked on the industrial challenge of optimizing bus routes in urban Nicosia together with members of the team that worked on the challenge during ESGI125 and in close collaboration with the General Manager of OSEL – Transportation Organization of Nicosia District, Mr Andreas Athanasiades. Moreover, I had the opportunity to meet with other researchers in the Cyprus University of Technology, like Dr. Michael Sirivianos, and Dr Savvas Loizou (Mechanical Engineering and Materials Science, CUT) and discuss future collaborations. Finally, on the 27th of October I gave a 5-minute presentation on a research project with Mitsubishi where we improved the performance of heat exchangers using mathematical modelling, in the Industry-Academia Workshop "Solving pressing industrial challenges with mathematical modelling". During the workshop I had the opportunity to network with several other company representatives and explore other possible collaboration.
The researchers that worked on the problem "Optimizing bus routes in urban Nicosia", one of the four industrial challenges of the ESGI125, proposed a simple model for optimizing only one bus route and concluded that the collection of data should be a priority for the company, OSEL – Transportation Organization of Nicosia District. During my visit, I had several meetings with the core members of the team that worked on this problem during ESGI125:

- Dr. Katerina Kaouri, Cyprus University of Technology
- Dr. Ioannis Kyriakides, University of Nicosia
- Marcos Charalambides, Sharpnote
- Andreas Athanasiades, General Manager, OSEL

DESCRIPTION OF THE MAIN RESULTS OBTAINED

Andreas Athanasiades, the GM of OSEL, informed us that a new ticketing system has been installed recently on the buses in order to collect data (number of passengers boarding in each bus station and time of travel between bus stations). We set up a framework about the data we need to propose a new methodology for tackling the problem. The data is being collected and it will be ready and relayed to us in a few weeks.
I have also updated the literature review performed during the ESGI125 by the other team members and concluded that the following variables are the most important ones:

- Passenger walking time
- Passenger waiting time
- Travel time
- Traffic time
- Transfer time

Using the above variables, we formulated a constrained optimization problem aiming to minimize the above times and maximize the number of passengers served by a bus route.
I also performed a literature review on methodologies used to solve similar bus routing problems and found out three existing genetic algorithms that we could adapt to our framework. This is another direction we will pursue.
Finally, we decided to prepare a journal publication (projected submission date: February 2018) and eventually also apply for local or EU funding in order to further study the bus route optimization problem and also other related challenges OSEL is facing.

FUTURE COLLABORATIONS (if applicable)

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