

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

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

Action number: CA15127 "Resilient communication services protecting end-user applications from disaster-based failures" (RECODIS).

STSM title: Design of quality-based WSN resilient to adverse weather conditions

STSM start and end date: 2020-02-23 to 2020-02-29

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PURPOSE OF THE STSM:

The STSM explores the problems associated with design of quality-based WSN resilient to adverse weather conditions, with special focus on the weather conditions impact on the quality of the signal transmission in WSN.

The STSM aimed to summarize results of continuous research, regarding wireless sensor networks operating in outdoors under changing weather conditions as well the analysis of testing results. The sustainability issues of WSN testbed - autonomous beekeeping have been considered. In the research the emphasis on the development of a reliable monitoring system, which should be survivable in changing outdoor weather conditions: significant deviations of the temperature, humidity, rain, froze, snow, frosting impact, etc. was considered. Therefore, the data, which have been transmitted in different weather conditions, have been summarised in order to evaluate resilience of autonomous beekeeping system against variable weather conditions. The main motivation of STSM was to analyse the system monitoring data, and draw conclusions for different weather conditions, in addition the video monitoring file of bee colonies was analysed.

The research is directly related with topic of Quality In Wireless Communications Under Weather-Based Disruptions. Current topic of STSM: " Design of quality-based WSN resilient to adverse weather conditions " fits the WG2 - Weather-based disruptions. The STSM aimed to work on common journal publication targeted to Baltic region audience, related with COST RECODIS WG2.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSM

First of all, during the STSM, the analysis of weather dependence of RSSI parameters was used as input to design of resilient WSN, based on data from 2018 till now. The test beds available allowing to analyze changes in bee hive mass and test temperature at the level of the bee colony. The most expensive equipment, in addition to beekeeping, offers retrieval of meteorological data in the apiary. The data of Autonomous beekeeping system was analysed as row data, the pressure, temperature and humidity will be also available from the testing area in Riga Botanical Garden and second test located in Osi, Annuzi, Talsu novads. During STSM the data was rearranged, taking in account selected period and weather impact. The Velleman WS1018 metering station transducer module is attached to a pillar, transmitting data to the data receiver. The weather station Velleman WS1018 data receiver with embedded external sensors (located on a mast 2.5 m high): wind speed sensor (top left), wind direction sensor (top right), rainfall sensor (bottom left), temperatures, atmospheric pressure sensors and data transmitter (down right). The receiver has built-in air pressure and temperature sensors, the internal temperature sensor data is used only for analysis of the operating conditions of the unit. For meteorological data collection, changes were made to cloud-based software that provides data collection and storage for long-term future analysis. The receiver is housed in an airtight plastic box for protection from the outside. The application of autonomous wireless sensor network nodes in outdoor monitoring was used to control crucial systems, taking in account of reliability issue for stability of the data transmission solutions. Design of next iteration of the prototype, based on quality-based WSN resilient to adverse weather conditions, like technologies for construction of measuring instruments was drawn. The reconfiguration issues was modeled in cooperation with KTU.

Based on the results, RTU and KTU teams agreed to develop common publication and are cooperating together in joint chapter preparation, related with COST RECODIS WG2 (Weather-based disruptions focusing on the end-to-end transmission continuity solutions) tasks.

The KTU team proposed algorithm for the analysis of the data transmitted over WSN. The re-routing technique of data over WSN network, due to the weather impact on battery and degradation of signal and non-acceptable of Quality of Service (QoS) parameters, were modelled as well during this STSM.

Based on the obtained results, the drafting of article in Quality of service for distributed Quality monitoring solutions in distributed networks were discussed, and now are in the preparation process in cooperation with KTU team.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The STSM mission was dedicated to the progressing of the joint publication of RTU and KTU teams, the article is prepared in the first draft version.

FUTURE COLLABORATIONS (if applicable)

We plan to finish article and submit common journal publication target to Baltic region audience.

In addition, we have idea for working together in order to submit common project for Interreg V-A Latvia – Lithuania programme, or similar, if that programme will be not open after 2020, as well as to continue collaboration in academia and research challenges.