Implementation of a Novel Online Condition Monitoring Thermal Prognostic Indicator System

University of Southampton

HubNet – The Supergen Energy Networks Hub

Introduction:

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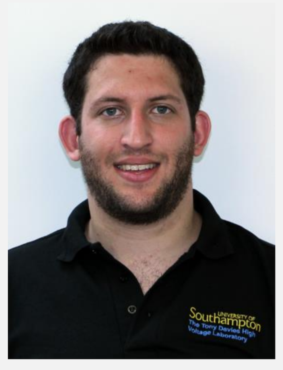
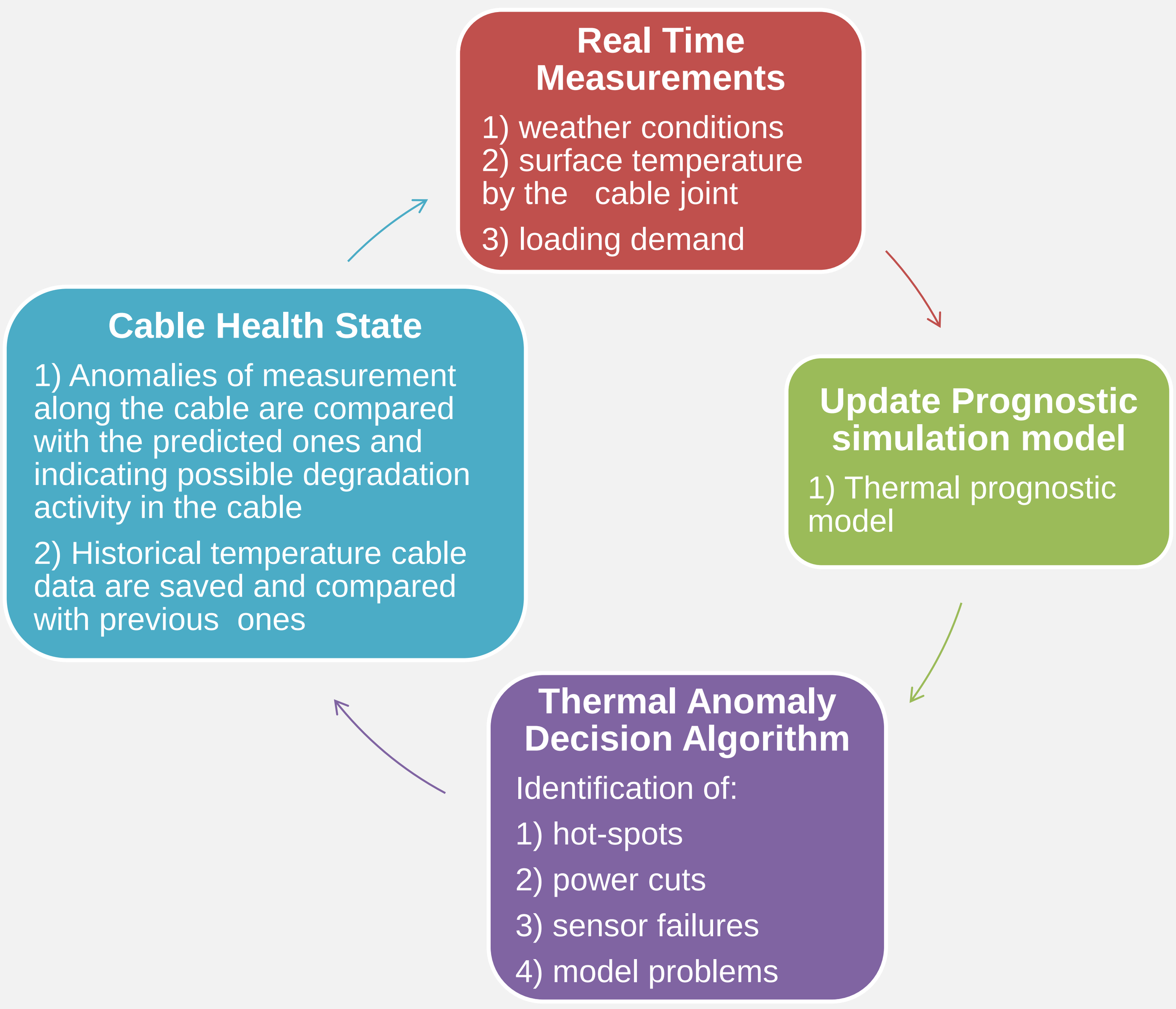


Current and future activities:

Introduction

This research aims to develop a reliable and robust online condition monitoring thermal prognostic indicator system which will reduce the risk of failures in a Power System Network. Real-time measurements (weather conditions, temperature of the cable joints or terminations, loading demand) taken close to underground cable will update the prognostic simulation model. Anomalies of the measurements along the cable will be compared with the predicted ones hence indicating a possible degradation activity in the cable. The use of such systems within a power networks will provide a smarter way of prognostic condition monitoring in which you measure less and model more. The use of suggested thermal models will enable the power network operators to maximize asset utilization and minimize constraint costs in the system.

The implementation of the Online Condition Monitoring Thermal System is summarised below:



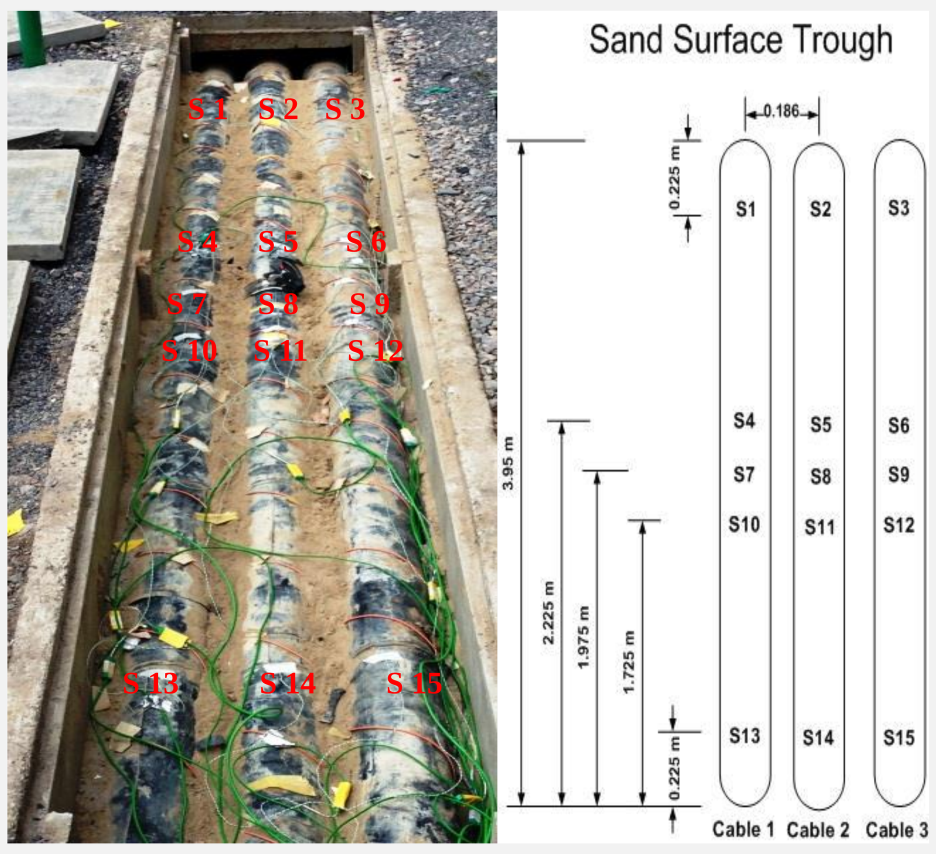


Fig. 1 Layout of T/Cs in the Sand Surface Trough.

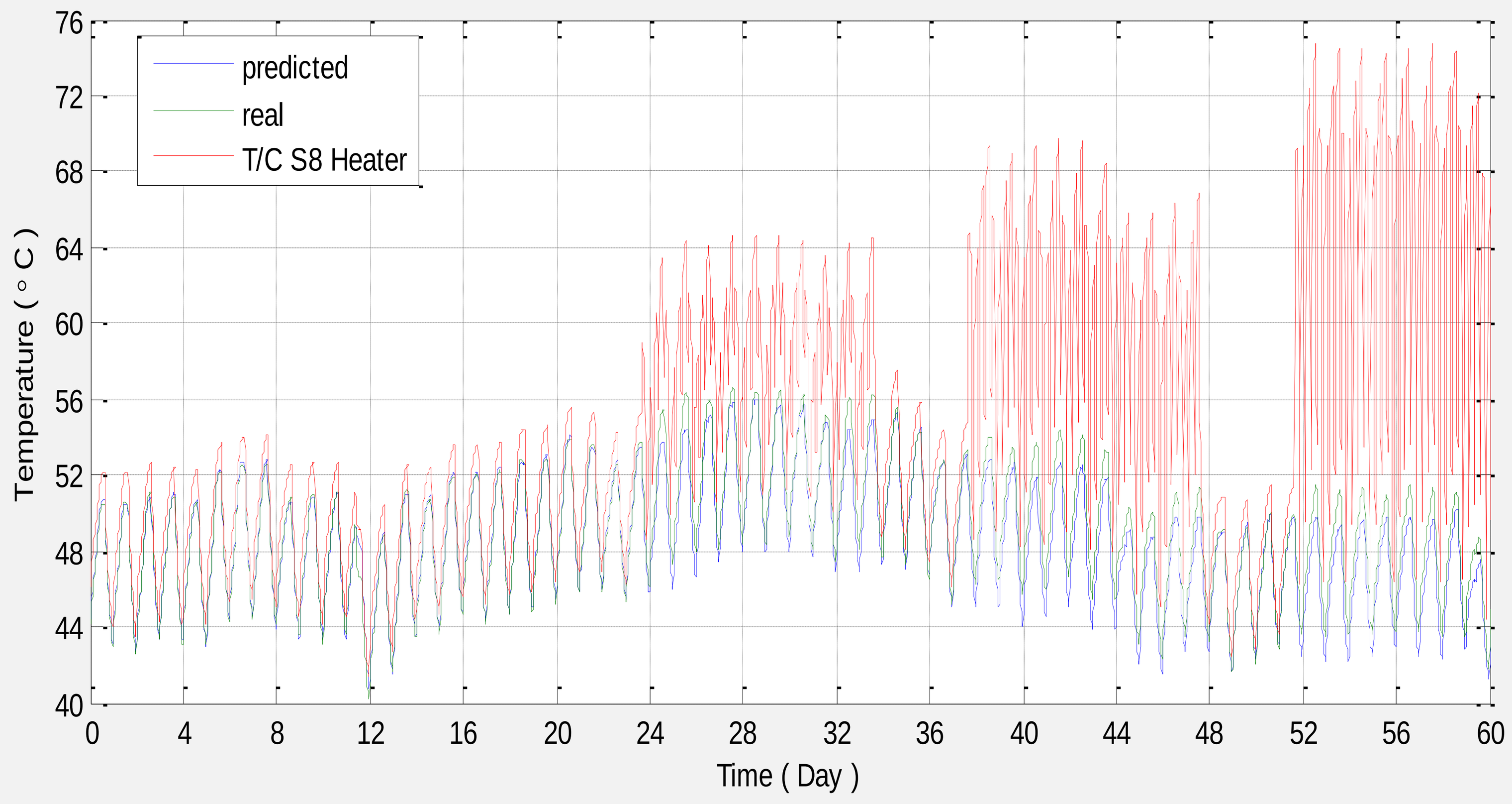


Fig. 2 Predicted temperature and real temperature for T/C S11 under the influence of Hot-Spots, MAPE=4.76 % .

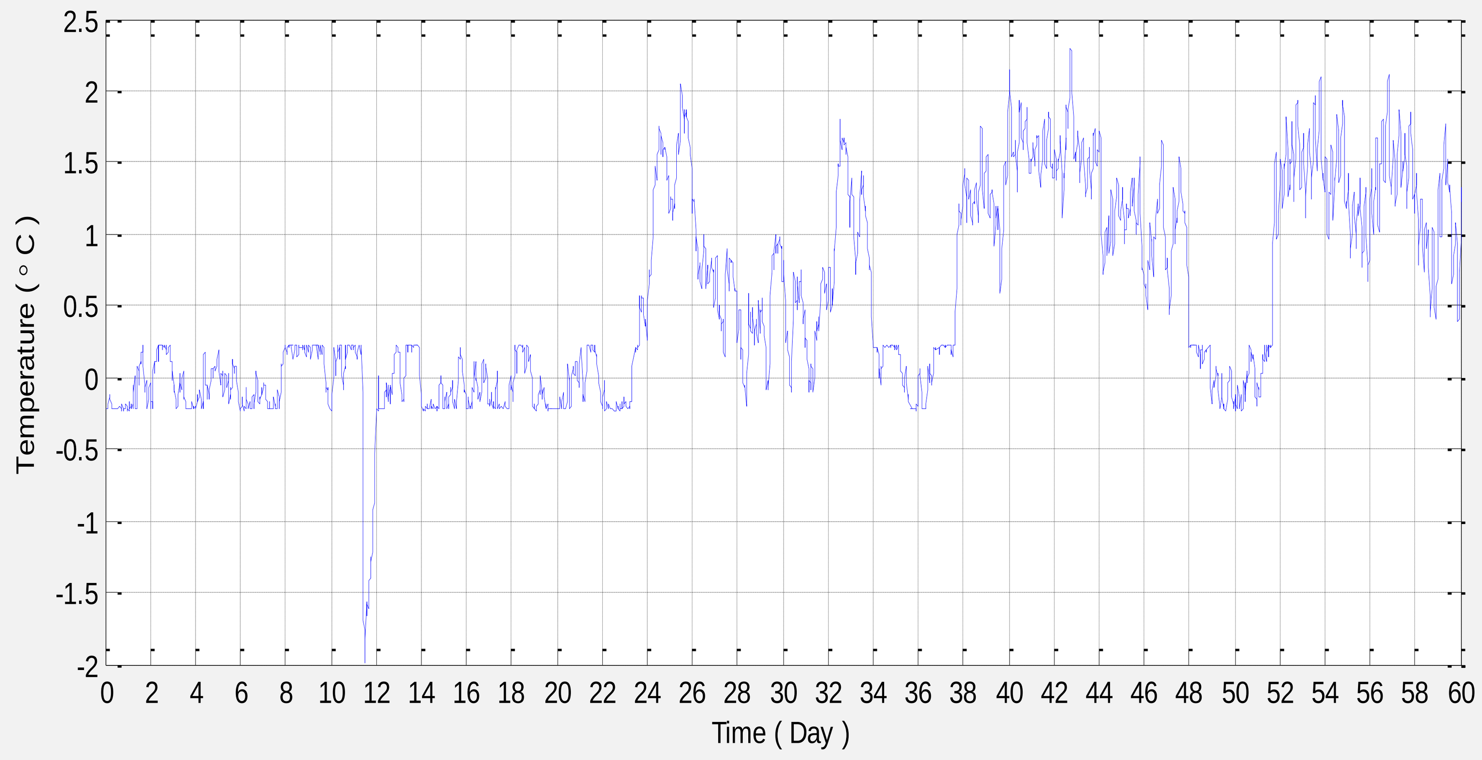


Fig.3 Temperature prediction error for T/C S11 under the influence of Hot-Spots.

Current Research

- During this experiment a constant cyclic power demand profile of 100W (6 hours) and 200 W (18 hours) was loaded in the simulated cables. During the loading condition artificial hot-spots are introduced to the cable, by an external heat source, in order to investigate if the thermal prognostic simulation model is sensitive enough to detect the existence of the temperature anomalies along the cable, produced by the Hot-Spots. Three different hot-spot power profiles of 5, 10,15W were performed.
- The external heat source is monitored by T/C S8 which is positioned in the middle of the Cable 2 as is shown in Fig. 1. T/C S2 is used as an input variable for SVR training as well as the Solar Radiation, the Air Ambient Temperature and the load profile demand of the experiment.

Results

Based on the SVR algorithm the thermal prognostic model was developed which predicts the cable temperature 30 minutes ahead.

Future Work

Further work includes:

- Evaluation of new predictive methods such as ANN, ARIMA, ARMA.
- Undertake field measurements in four MV substations.
- Test and implement the thermal prognostic model on real data taken from different MV substations.

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