Identifying the Major Software Safety Concerns in SmartGrid Technologies (Level 4)

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1 Introduction

A smart grid is an electrical system of systems, which includes a variety of innovative operational concepts and energy efficiency measures including smart meters, smart appliances, renewable energy resources etc. The aim in this work is to develop a technique that can be used specifically to identify the risks within one component or across an entire SmartGrid network.

2 Tool Development

The aim is to provide a tool that will help senior or middle management to assess and mitigate software-safety risks in these networks. Stakeholders in this context include, but are not limited to, existing network operators, energy producers, energy consumers (customers), device manufacturers, Smart Grid service providers. The design of the technique is entirely open. You may choose to use one of the risk assessment techniques that are introduced during this course, such as Fault Trees or Failure Modes, Effects and Criticality Analysis. If you do this then in your report you need to explain why this particular approach is appropriate for the SmartGrid technology that you focus on. Alternatively, you may choose to develop an entirely new approach. In both cases, you must show how the technique can be used with a detailed AND specific case study based on significant research into existing plans by manufacturers/governments that have approved these networks for trial use.

The key aim is to help organizations assess the likelihood and consequence of hazards that can arise from the deployment of SmartGrid systems. These include issues associated with testing and debugging, especially from the risk exposure associated with mass-market products. They also include the problems of network stability and the risks that arise from the potential loss of a distribution network if a grid collapsed. The specific focus must be on helping managers mitigate those risks by appropriate planning before a system goes live.

You may choose to develop electronic tools that support the application of your technique using any programming methodology. The implementation of the tool could rely on simple web pages generated using HTML, PHP or any other associated technology. Your design may be realized using conventional programming languages or you could simply rely on paper-based support. However, the marking scheme will take into account both the strengths of the design for the risk assessment technique and the effectiveness of an implementation in terms of the support that they offer to the potential end users.

3 Evaluation

It is important that you evaluate your technique/tool for assessing the risks associated with SmartGrid deployment (hint: some systems have already been deployed so you can identify case studies from these to determine if your technique can model known risks). Other means of evaluation would be to ask a number of different users to try it out, exploiting an appropriate evaluation methodology. For example, you could ask one group to use your technique and another to use an alternate approach developed by someone else in the course. If you do this you MUST consider the relevant plagiarism guidance on the School Learning and Teaching Committee web site and state the name of the person you worked with on your submission. You must develop your reports independent of each other.

You also need to consider the level of existing expertise that the people you test will have in the development of SmartGrid technologies.

If you evaluate with a friend and split your users into two groups, one for each tool, then this raises important methodological concerns. Firstly, how would you insure that both groups have the same level of expertise and background knowledge so that any comparisons are fair? Secondly, how would you go about assessing the accuracy of any risk assessments that are produced? Please consult with me before conducting your evaluation so that I can provide advice in answering some of these questions. You should also consult the course handbook and associated web pages that cover the ethical guidelines for user testing.

4 Transferable Skills

This exercise will provide a first-hand introduction to the challenges that face many large organizations as they try to innovate and at the same time ensure the safety of their products. There is little common agreement on the best approaches to adopt and hence you will be working in an area of active research, which is also a focus for public, government and commercial interest. The exercise will underline the uncertainty that often characterizes risk assessment in safety-critical engineering – for example, credible attempts to use quantitative techniques will attract high marks especially if you can validate assessments of the probability and consequence of particular hazards. You should consider the role of regulators in the development process; this is covered in the early part of the course including the use of process based software standards. Recall also that regulators must protect safety but also, where possible, enable companies to develop new markets.

5 Assessment Criteria and Submission Details

This exercise is degree assessed. It contributes 20% to the total marks associated with this course. The body of the report should not exceed fifteen A4 pages. The report must be printed out and must be submitted in a secure binder (something that keeps the pages together and does not have sharp edges). It must include: A title page containing your contact details (metric, email etc); a table of contents and appropriate page numbers; a section on the tool that you developed; a section on the evaluation method that you used; a results sections and some conclusions.

In addition to the fifteen pages in the body of the report, you may also include appendices. These should contain the listing of any code used during the study together (this can be included on a CD) with suitable acknowledgements for the source of code that has been borrowed from other programmers. The report should be handed in by 16:30 on 11th March 2016 using the submission box outside the teaching office in Lilybank Gardens. Please make sure that you keep back-up copies of all of your work and submit a plagiarism statement using the standard on-line form. The following marking scheme will be applied: 30 for the method; 20 for the results; 30 for the conclusion; 20 for the technical documentation. All solutions must be the work of the individual submitting the exercise and the usual lateness penalties will apply unless I am given good reason in advance of the deadline. You must state your name and the title of the exercise on the front of your submission so I know this is level 4 and a level M open exercise.

6 Hints

You will need to do considerable reading first into the background of SmartGrid technology so please do not delay starting this assessment.