[P2023-08] Boosting China's Electric Vehicle Quality and Capacity

Requirements

The University has been approached by Company-A, a well-known *electric vehicle* (EV) manufacturer based in China. Company-A is a leader in many areas of EV technology, including autonomous and assisted driving. Company-A has invited the University to provide a *software engineering* (SE) team to complete a challenging project related to the *quality assurance* (QA) of their EV embedded systems.

This project relates to EV technology, specifically the QA of their current and future EV *electronic control units* (ECUs). The selected project team will need to get a good understanding of current and expected future technology surrounding EVs and ECUs. They will need to master many aspects of QA, especially software testing. Although EV ECU technology will be the main focus of the project, knowledge of other related technology will be necessary. An identified problem is the oracle problem [R-1], which will need to be considered, and potentially addressed and alleviated: In a nutshell, how can we ensure that EV ECUs are tested well?

Based on preliminary discussions with Company-A, the SE team will need to be motivated, capable of working independently, and willing to explore and innovate. The team will learn and work with new technologies, including elements not (yet) taught through the University's Computer Science programmes.

A final potential requirement for this project may be for the SE team to create some form of *open educational resource* (OER) [R-2] that will gather their knowledge, understanding, and developed tools together in one place. This resource could then be used by future Company-A employees or SE teams to help understand many of the challenges associated with this project and technology. For example: It may eventually form part of an on-boarding training/induction for future Company-A SE people.

Background

China's rise as a global player in EV technology has been very fast, and a large number of EV-related companies and stakeholders have appeared in China over recent years. As with many new technologies, there are concerns over the QA for EVs. Some of the best EV stakeholders, like Company-A, devote a lot of attention and resources to doing the best possible QA.

As part of a plan to implement an embedded EV system that provides services to other ECUs, Company-A wants to examine the feasibility, and then implement a top-notch testing plan, framework, and tool. They have also spoken of the need for these things to be automated, and the results to be reproducible. Company-A has asked about the potential to develop bespoke software, or to use existing open-source software. They have mentioned a large number of ideas, but will be interested to hear the feedback and recommendations of the SE team.

Company-A have also said that the eventual system will probably be run on a FreeRTOS-like environment. Further details can be found at [R-3].

Outline

The selected students will form an SE team, and work together to complete a full cycle (maybe several full cycles) of the SE process. Relevant stakeholders (from the University, Company-A, and potentially elsewhere) will be identified, and *requirements engineering* processes used to identify the exact SE project requirements. A final project proposal will be prepared, and the project implemented over the course of the GRP time period.

Because the SE team will need to go through *requirements engineering*, part of this project will involve applying an appropriate requirements elicitation methodology. The requirements engineering, feasibility analysis, and project scoping will all need to be completed early in the GRP time frame.

The team will need to make informed decisions about which SE process approaches or methodologies to apply to this project. (Experiences from previous SE teams may prove useful.)

Over the course of the project, the SE team will need to produce several deliverables, which may include (but are not limited to):

- a report on the current situation
- a proposed system to implement
- a system requirements specification
- design documentation
- team management and planning documentation
- prototypes
- progress reports
- verification and validation plans
- code and code documentation
- tests and test reports
- instructions/user manual(s)
- OER

The target goal of the SE project will be to deliver, on time, a system (or several systems) that meet the requirements of the various stakeholders (both at Company-A and at the University).

Tasks & Deliverables

This unique project may have several groups of stakeholders, and will require significant project management skills to complete. In addition to the deliverables listed above, the team may also need to produce other resources, including recommended protocols or format specifications, or other advice for future evolution.

References

[R-1] https://en.wikipedia.org/wiki/Test_oracle

[R-2] https://en.wikipedia.org/wiki/Open_educational_resources

[R-3] https://www.freertos.org/install-and-start-qemu-emulator/