Innopolis University | Software Architecture | Spring 2016

Using Avatars for Reducing Electrical Consumption

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Problem Description

The main goal of this second project deliverable is to design the architecture of a visualization technology for home energy consumption that has positive effects on the attitudes and the way people use energy at home. This is not a programming deliverable, so full emphasis will be put on architectural issues. Programming and implementation issues will be tackled during the coming third project deliverable. The business context of the described application is intentionally moderately small so as (*i.*) to keep the scope of the project manageable, (*ii.*) to limit the use of third party technologies, (*iii.*) to limit the complexity of the project and adapt it to the time constraints of a course project, and (*iv.*) to encourage architectural thinking.

This project deliverable has two parts. Part one will be done as a team. In part one your team will design the architecture of a system in the light of a given business context. You will describe your architectural drivers and discuss how they provide support to the business goals of the system.

While you may discuss part two as a group, the write-up of part two must be done individually. In part two you will (individually) suggest one architectural alternative to the solution found as a team in part one. You (individually) may enclose an additional document or figure that supports your individual suggestions.

Business Context

You are the new IT manager for Madeira Sustainable Environments (MSE), which specializes in embedded software for cars, telephones, security systems, televisions, and home appliances, in general. MSE's business started out through personal customer relationships, but has now grown considerably because of MSE's reputation of delivering high quality products in the area of embedded systems, and because sustainability has become an important issue today due to the constant global climate changes that the entire world has experimented over the past 20 years.

MSE' CEO has recently being contacted by a customer, Green Homes Ltda (GH), who is interested in contracting for the design of the architecture of an embedded system to monitor and assess the energy consumption habitats of people at home. Your goal as MSE's IT manager is to respond as a team to GH's architectural needs in the form of a written software architecture document that clearly justifies your architectural decisions.

GH Ltda is interested in the use of interactive technologies for sensing energy consumption at home. The technology is to be visualized as an Avatar persona that persuades householders to modify their energy consumption habitats. GH is open to different ways this interactive technology and the Avatar persona would interact with householders. The Avatar persona can, for instance, adopt a grumpy red face if home energy consumption surpasses a certain pre-established threshold. It

can also suggest householders to modify certain energy consumption behaviors, or it can make householders aware of high energy consumption variations over a certain period of time.

GH Ltda wants the interactive technology to respond in real-time (fast) to high or sudden variations of home electrical consumption. It is required that the implemented interactive technology makes the householder immediately aware of an undesirable energy consumption behaviour, and hence she can fix the problem rapidly.

GH Ltda requires that the developed interactive technology interfaces with the existing company's hardware for home energy measurement. GH's hardware is powered with AC (Alternating Current) energy supplies that can sense current energy consumption via various power modes. GH's hardware devices can supply current to a home continuously. Energy supply efficiency is increased via extended mechanisms that operate using primary and secondary batteries. It's expected that the future software implemented by MSE interfaces with GH's existing hardware for sensing electrical consumption at home.

Your architecture must provide support to certain analytics, for instance, one the analytics might involve storing energy measurement results into a persistent mechanism (e.g. database, XML file, external server, text file, the cloud, etc.), or it might consist in making some calculations over the stored result values, etc.

The envisioned software architecture must provide support to off-house runtime monitoring. Therefore, the software system will enable householders to access, interact, and monitor home electrical consumption while they're away from home.

Part One: Architectural Analysis (Team Work)

1. (**20 marks**) According to the business context, what are the key architectural drivers of your system? Please describe those factors that determined your choice of the architectural drivers. There are 3 types of architectural drivers that you may consider, namely, technical constraints, business rules, and quality attributes. Quality attributes and technical constraints should be written following the templates in Sections 4.5 and 4.6 of `SA-Req-template.doc`. Business rules are to be written following slides 38 and 39 of `02-SA-Req.pdf`.

2. (**50 marks**) Provide **4+1** architectural views of your system: 1. Use Cases View (**10 marks**), 2. Logical View (**10 marks**), 3. Process View (**10 marks**), 4. Implementation View (**10 marks**), and 5. Deployment View (**10 marks**). For the Use Cases view you can use UML Use Cases diagrams. For the Logical view you can use UML class diagrams. For the Process View you can use Activity Diagrams. For the Deployment View you can use UML Deployment Diagrams.

3. (**20 marks**) Justify why and how the architectural views of your system support each one of the architectural drivers that you identified above.

Part Two: Alternatives (Individual Write-Up)

Even though the system architectural design in Part One was made as a team, you are free to disagree in Part Two with your team's decisions. In Part Two (**10 marks**) you will propose an alternative of improvement to the architectural design described in Part 1. In Part Two you may include any additional figure or diagram that can help to support your ideas. As its name implies, the proposed *alternative* must be *different* to the options considered in Part One. Notice that Part

Two is an individual assignment, hence, while you can discuss different options for an architectural design, the writing of Part 2 is an individual exercise.

What to Turn In?

- As a team you must turn in a Word file corresponding to Part One of this second project delivery. The Word file must include all your diagrams as pictures, and it **must** stick to the following naming convention: **project-02-<Group-Number><Team-Number>.docx**. If you don't follow this naming convention, then your team will be penalized with **5** marks. Your Word file must include the names of all the members of your team.
- Individually you must turn in a Word file corresponding to Part Two of this second project delivery. The Word file **must** stick the following naming convention: **project-02-<Group-Number><Student-Number>.docx**. If you don't follow this naming convention, then you will be penalized with **5** marks.