UNIVERSITY OF STIRLING
COMPUTING SCIENCE AND MATHEMATICS
CSCU9E5 GROUP PROJECT
Autumn 2024

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For the purpose of this group project assignment, you are required to operate as a member of a team, part of a company that is bidding for a software development contract – and so you are advised not to share ideas with members of other teams.

This assignment will consist of two parts:

1. The development of a **design** for a system as specified by a Project Requirements document (**group work**).
2. A **reflection on individual and team performance**, which reflects on the teamwork experience **(individual work).**

DESIGN

The task of the team is to produce a design for a system satisfying the requirements described by the Project Requirements, later in this document – see page 5. The team is *competing* to undertake the complete job of building such a system, so the final document that is submitted by the team should be regarded as a 'proposal' or 'tender'. The system design should be broken down in enough detail to allow you to understand how much work would need to be done for your design to be implemented (although you are *not* asked to make workload estimations).

Your final document must be structured according to the following sections/subsections including all the requested elements. Figures in brackets indicate the strongly suggested ***upper*** page limits for each item (please don't treat them as targets – go for quality, not quantity).

1. Requirements Specification: Understanding the problem **[7 pages]**
   (a) Assumptions: Where additional assumptions were made during the requirements analysis because of missing, unclear or ambiguous information – describe the assumptions made, justify (where relevant) the choices made, and discuss the possible alternatives considered (where relevant).
   (b) Use case diagram, with brief explanations, including textual descriptions of ***four*** significant use cases.

2. System design description: Modelling design of solution **[13 pages]**
   (a) Static Design Model
      - Class diagram.
      - Textual description of the purpose and functionality *offered by the **four** most important classes* – role, attributes and operations.
      - Boundary, entity and control classes must be clearly identified.

   (b) Dynamic Design Model
      - ***Four*** significant sequence diagrams, with brief explanations sketching how the diagrams elaborate the dynamic behaviour of the use cases.

The tender document should be a ***single document*** with diagrams prepared using the team's chosen UML diagram tool.
Pay attention to professional presentation: good English, clear layout, numbered pages. In addition to the technical content, your document must also feature a cover page that clearly identifies it as the **CSCU9E5 Group Project** submission, states the ***name* of the group** and the **student numbers of the group members**, but **not** the names of the members. Please include a **table of contents** listing the sections/subsections and their page numbers. Finally, your document must include an appendix that lists the **responsibilities of each team member** and the tools that were used to produce the diagrams.

ORGANIZATION & GROUP MEETINGS

Each group must create their own team on Microsoft Teams. Name the team ***CSCU9E5 (<name>)*** where <name> is the name of your group on Canvas and invite the group monitor (see below) as a member. The team can be used for meetings and presentations, file sharing and collaborative working. Microsoft Teams provides convenient tools for collaboratively writing the tender document.

Each group is strongly advised to agree a consensus on which UML diagram tool to use. All members of the group should also regularly back up the work that has been done, e.g. by copying the files to their own hard drives. While the cloud-based file stores that underlie Microsoft Teams (or Visual Paradigm Online) are very unlikely to lose your data, they do occasionally have problems with availability. An up-to-date backup can help you cope with such outages.

The *organization* and coordination of the work is up to the team. Some tasks naturally lend themselves to being done by the entire team, whereas other tasks are more suited to be delegated to individuals. Groups should aim for a *fair* distribution of the workload and make sure that ***every team member takes responsibility for a significant technical part*** of the tender document. But bear in mind that a perfectly balanced distribution is impossible.

Each group is strongly advised to agree a regular schedule of meetings, to keep notes of meetings, and to log who attended and what decisions were taken. Groups must resolve conflicts on their own – conflict resolution is part of the teamwork experience. ***If your group suffers from persistent team management problems (e.g. an over-dominant member, or a member not engaging/contributing), then you, either as a group or individually, may contact your monitor as a last resort.***

GROUP PRESENTATION & MONITOR

Each group will have one lecturer as a group monitor; monitors will be allocated in week 8.

On **Monday, 4th November**, each group will meet their monitor to present an initial design and a workplan. The meetings will take place face-to-face and last about 25 minutes. Slots for these meetings were allocated in week 6; see announcement from 18th October. The group presentation is **mandatory - all group members must attend the meeting.**

At the meeting, the monitor will act as the client who is commissioning this software development project. The group should present their **initial class diagram** and their **plan** for developing the full design; this presentation should take no more than 10 minutes. After the presentation, the client will ask questions to understand how the design will realise the required functionality, and how the workplan will ensure quality and timeliness. The client will also be available to answer questions from the group, e.g. to clarify the Project Requirements.

REFLECTION ON INDIVIDUAL AND TEAM PERFORMANCE

Team working is a core learning outcome of the module, and reflecting on your recent experience will reinforce that learning. Therefore, at the end of the project, every team member must individually complete and submit the **reflection on individual and team performance form** (available on Canvas). Part of the reflection is an **assessment of individual contributions**, where everyone rates the contributions of their team members relative to each other.

The reflection is not marked. However, it is a **mandatory** component of the group project. **Non-submission of the reflection will be treated as non-participation in the group project, and result in a zero mark for the assignment.**

ASSESSMENT

This assignment is worth **50%** of the overall mark for the CSCU9E5 module. Although this is a group project, you will be given an **overall individual mark** for this assignment based on the group mark for the tender document adjusted by an individual weighting factor.

The **group mark** for the assignment is solely based on the assessment of the tender document. A total of **100** marks are allocated as follows:

1. Requirements specification: **25**
2. System design:
   (a) Static design: **25**
   (b) Dynamic design: **25**
3. Structure/clarity/coherence/presentation of the report: **25**

The **individual weighting factor** is derived from the assessments of individual contributions of the entire group. The declaration of responsibilities, the reflections, and the observations of the monitor are also taken into account.

SUBMISSION ARRANGEMENTS

Each group must submit ***one copy of the tender document*** (in PDF or Word format) to the *Group project* assignment on Canvas before **17:00 on Wednesday 13th November 2024**.

Additionally, each group member must submit their ***reflection of individual and team performance*** (in PDF or Word format) to the *Reflection* assignment on Canvas, also before **17:00 on Wednesday 13th November 2024**.

More detailed instructions can be found in the assignment folders on Canvas.

LATE SUBMISSION

The standard University policies dealing with non-submission and late submission apply. Coursework will be accepted up to seven calendar days after the submission deadline, but the mark will be lowered by three percent per day or part thereof. After seven calendar days, the piece of work will be deemed a non-submission, which will result in No Grade being awarded.

Late submission of the tender document will result in penalties for all members of the group. Late submission of a group member's reflections will result in penalties for that member only.

NOTE ON AVOIDING ACADEMIC MISCONDUCT

Work which is submitted for assessment must be your own work. All students should note that the University has a formal policy on Academic Integrity and Academic Misconduct (including plagiarism) which can be found at https://www.stir.ac.uk/media/stirling/services/academic-registry/documents/academic-integrity-policy.pdf.

Plagiarism: We are aware that assignment solutions by previous students can sometimes be found posted on GitHub or other public repositories. Do not be tempted to include any parts of such work in your submission. Using work that is not your own will be treated as “poor academic practice” or “plagiarism” and will be penalized. To avoid the risk of your own work being plagiarised by others, do not share copies of your solution, and keep your work secure both during and after the assignment period.

Collusion: The reflection form is an individual part of this group project assignment: every student must write their reflections on their own. If students submit the same, or very similar reflections, this will be treated as "collusion" and all students involved will be penalized.

Contract cheating: Asking or paying someone else to do assignment work for you (contract cheating) is considered gross academic misconduct and will result in termination of your studies with no award.

NOTE ON THE USE OF GENERATIVE AI

The use of generative AI for producing the **tender document** is allowed up to **level 2 of the AIAS** (AI in Assessments Scale). That means that the group can use AI to brainstorm and explore ideas, but AI-produced content (text and/or diagrams) must not be included in your submitted document.

The use of **generative AI is not allowed for completing the reflection** of individual and team performance, as the use of AI would defeat the purpose of reflecting on the group project experience and expressing your thoughts in your own words.

Your team has been approached by the *Bike Buddies* – an association of independent bicycle service and repair shops in southern Scotland. To support their businesses, the Bike Buddies have decided to offer a *cross-country cycling callout scheme (C4S)* for assisting cyclists who get into difficulties while out in the countryside. Members of the association commit to providing vehicles and bike mechanics who can respond to callouts and aid cyclists with problems such as fixing punctures, adjusting gears, or repairing broken lights. Where a problem cannot be fixed, the mechanics will offer to take the bike and the rider to a nearby town instead. The Bike Buddies have a strong presence in rural areas across southern Scotland, so they are confident that they can meet the demand of C4S even during the busy summer months.

The Bike Buddies require IT infrastructure and a suite of software to operate C4S. This consists of a mobile app for cyclists to sign up to the scheme and call for assistance, a mobile app for bike technicians to manage callouts, and a backend for both apps. The backend must assign technicians to callouts, invoice cyclists for assistance provided, and store all data that is required for operating C4S.

C4S offers year-long subscriptions with two levels of service:

- Basic service for a flat subscription fee of £10. In return, cyclists can get assistance 24/7 anywhere in southern Scotland. However, they will be charged the full cost of each callout, including for parts required to fix the bike and for the time the technician was working on the callout. In addition, a night-time surcharge of £20 will be added for callouts between 5pm and 7am, and a remote surcharge of £1/mile will be added if the technician has to travel more than 10 miles to the callout.
- Peace-of-mind service is available for a higher subscription fee; the fee starts at £120 for the first year but may increase or decrease in future years, depending on the number of callouts in previous years. The higher fee includes the cost of labour during callouts and any night-time or remote surcharges. That is, cyclists opting for peace-of-mind service will only pay the cost of parts for individual callouts.

App for cyclists

The app for cyclists provides functionality to sign up to C4S, update personal details, and call for assistance. The app does not store any data; all data is stored and managed by the backend.

To sign up to the scheme, cyclists provide their personal data, such as name, address, email and credit card details. They also have to provide the details of at least one bike (type of bike, wheel size, age) and select the level of service. They are then immediately sent an invoice for their annual subscription fee, which must be paid before they can call for assistance.

Cyclists can update their details at any time, including registering more bikes, or upgrading their service. When upgrading their service from basic to peace-of-mind, cyclists will receive another invoice, which must be paid for the upgrade to take effect.

Cyclists can call for assistance using the app, provided there are no unpaid invoices. When calling for assistance, the cyclist selects which of their registered bikes has broken down and enters a reason for the breakdown (e.g. a puncture). The cyclist must also provide their location. (The app will try to access location data from the cyclist's phone, but not everyone permits this.) The app will respond with an estimated arrival time for a technician and alert the cyclist to any surcharges for the callout, which the cyclist must confirm for the callout to go ahead. While waiting for the technician, the cyclist can check back on the app, which will update the arrival time regularly, depending on how far away the technician is and how many other callouts they need to attend to before.

The app for technicians

The app allows technicians to manage their callouts, and to log the work being done on each one. The app also tracks the technicians' location. The app does not store any data, all data is stored and managed by the backend, to which the app maintains a continuous connection over the Internet.

While on duty, a technician is either waiting for a callout (while possibly working on other jobs at their bike shop), driving to a callout, or working on a callout. While waiting for a callout, the app will notify the technician if the backend has assigned them a new callout (the location of which will be displayed on a map). Technicians will not receive notifications while they are driving to or working on callouts.

When arriving at a callout, the technician logs their arrival time on the app. While working on the callout, the technician will log the actions that they perform to fix the bike, including any parts they used. Examples of actions include fixing a puncture, fixing lights, adjusting gears, adjusting brakes, or giving the rider and bike a lift (if the problem can't be fixed on site, or the rider is exhausted).

Once the technician is done with the callout, they will log their completion time on the app. This marks the technician as waiting for a callout, so they can again receive notifications on the app.

The backend

The backend keeps track of all information relating to cyclists, technicians and callouts. It also dispatches technicians and sends invoices, both for subscription fees as well as for the cost of callouts.

When a cyclist calls for assistance, the backend estimates how long a technician will take to arrive at the callout. The estimate is based on the location and availability of all technicians, that is, on the number and locations of other callouts they need to attend before (assuming each callout requires 15 minutes work, on average).

When a technician logs a callout as completed, the backend will send an invoice to the cyclist. The backend will also notify the technician of new callouts and update the estimated arrival times of pending callouts (if there are any). Otherwise, the technician will be marked as waiting.

For invoicing callouts, the backend assumes fixed costs for parts (e.g. tires, tubes) depending on the actions that were logged by the technician. The system calculates the cost of the technician's labour based on arrival and completion times. Surcharges may be added depending on the time and location of the callout, and on the customer's level of service. For calculating peace-of-mind

subscription fees, the system uses an algorithm (that is, a machine-learning model) to determine an individual price based on the number and costs of callouts in previous years.

Scope

The tender document must consider the software needed for the backend. The design of the apps for cyclists and technicians are out of scope of this tender – these apps are frontends that will be designed by other software developers. However, your design of the backend must provide all services that these apps need to function as described.

Handling payments is out of the scope of this tender. You may assume that the Bide Buddies association are using a payment system provided by their banking partner. However, the backend must be able to track the payment status of invoices to distinguish paid from unpaid.

END OF PROJECT REQUIREMENTS