Fontys

University of Applied Sciences

Trafic Control System

Process Report

Agnes Wadee
Coen Stange
Wen Li
Yongshi Liang

Contents

Introduction

As part of the requirements of ProCP, which is the final project of the core phase. We as a group (4 Cube) consisting of Coen Stange, Wen Li, Yongshi Liang and Agnes Wadee, had a project to make a Traffic Simulation Application. Not only did we have to do the software development aspect of the project, but also make documentations such as a User Requirements Specification (URS) Document, Design Document and finally a Process Report. This document being the process report, will elaborate on success and challenges faced during our participation in this project.

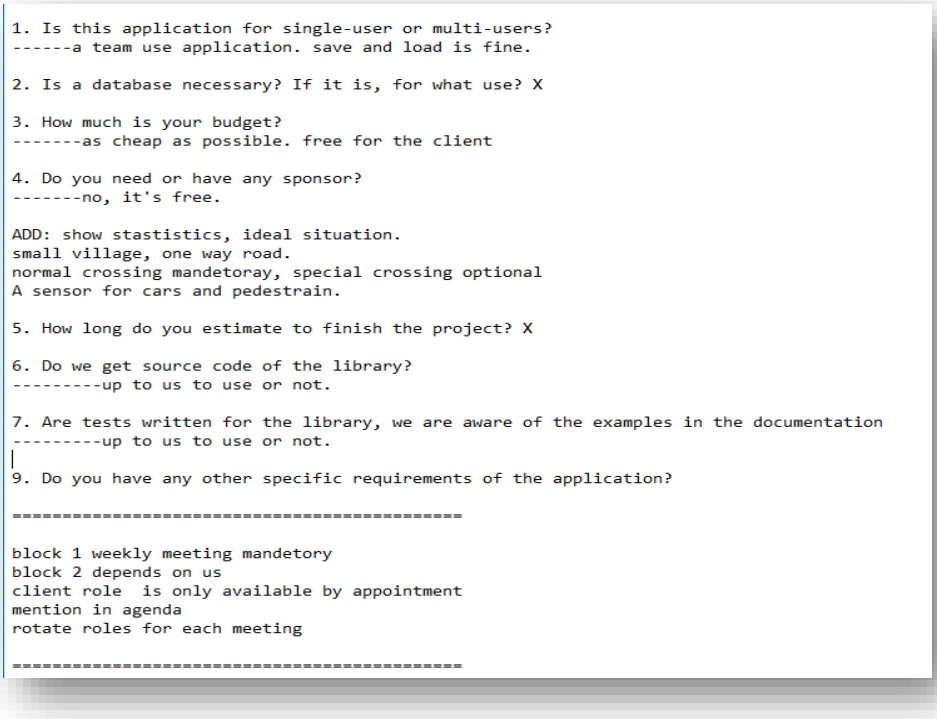
This document will give a brief overview of decisions made concerning the project with ourselves as a group and also our formal client/lecturer. We will also outline the division of task among ourselves in parallel with the time spent on the tasks. The document will also give an overview of choices we made and also problems we encountered and how we were able to solve them.

Understandings made with group members and the teacher/client

The project was scheduled into two blocks, the first block was for documentation and the second was for implementation.
During the first block of the project, we had a meeting once a week with the teacher. Below are the minutes recorded from the meeting which elaborates the feedback from the teacher and some decisions we made a group.

WEEK 1:

This was a short meeting, the forming stage of the group. Where the group members interacted with each other to get to know each other more and also know where each of our areas of expertise lies. We had our first deadline to hand in the first version of the Project Plan, so we then began to work on the version 1 of the Project Plan and submitted it before the given deadline. We also prepared for our first meeting with the teacher/client the next week.



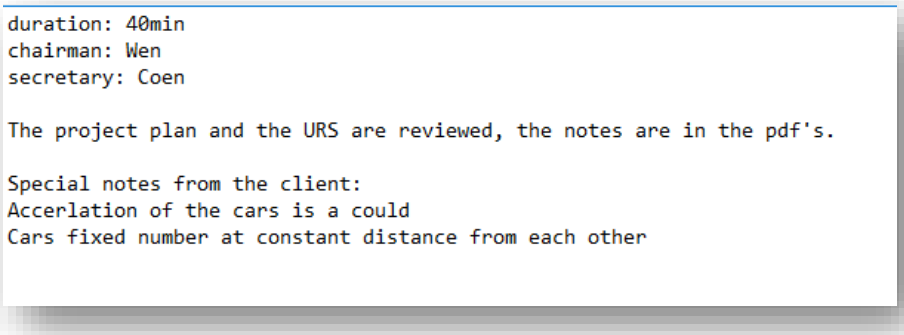
```
1. Is this application for single-user or multi-users?
------a team use application. save and load is fine.

2. Is a database necessary? If it is, for what use? X

3. How much is your budget?
-------as cheap as possible. free for the client

4. Do you need or have any sponsor?
-------no, it's free.

ADD: show stastistics, ideal situation.
small village, one way road.
normal crossing mandetoray, special crossing optional
A sensor for cars and pedestrain.

5. How long do you estimate to finish the project? X

6. Do we get source code of the library?
---------up to us to use or not.

7. Are tests written for the library, we are aware of the examples in the documentation
---------up to us to use or not.

9. Do you have any other specific requirements of the application?

================================================

block 1 weekly meeting mandetory
block 2 depends on us
client role  is only available by appointment
mention in agenda
rotate roles for each meeting

================================================
```

WEEK 2:

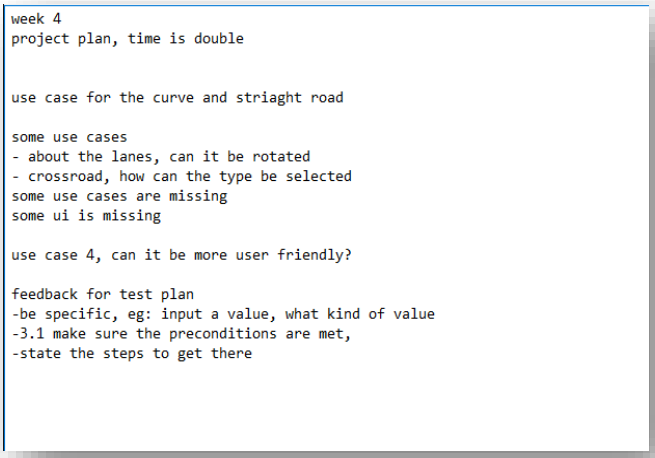
As we scheduled with the

teacher, we had a meeting to receive feedback on the first version of the project plan. There was some feedback received which is shown in the image. We also improved our document according to the feedback and worked on the first version of the requirements.
In addition to this, we also got some feedback on the project plan which includes fixing the risk section, not necessary on the money part, etc.

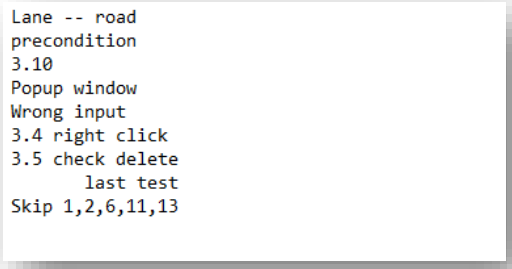
WEEK 3:
This week was to discuss the project plan and URS document in order to identify changes in order to modify the final version. Most of the feedback was used to improve the document. The client also requested for a report showing some statistics of the simulation. But we as a group decided that due to time constraint, this will be a should when implementing the project.



WEEK 4:
The meeting this week was to get a review on our documents and information about the grade of the project plan and requirements document. We also worked on the first version of the test document, to be handed in by the end of the week.

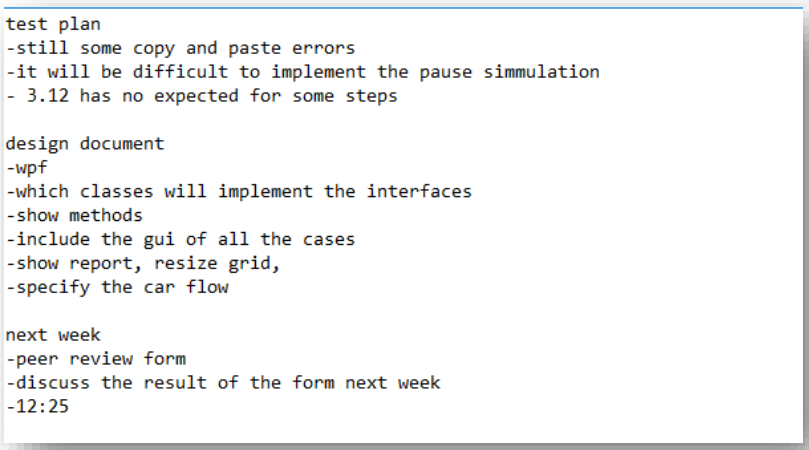


WEEK 5:
The meeting this week was to get a review and feedback on the test plan by the teacher. We also worked on the second version of the test plan based on the feedback and other decisions we made as a group, to be handed in by the end of the week. The image just shows a few minutes on the feedback received.



WEEK 6:

The meeting this week was to get a final assessment of the test plan. And also we started working on the design document, in which the first version was due by the end of the week.



```
test plan
-still some copy and paste errors
-it will be difficult to implement the pause simmulation
- 3.12 has no expected for some steps

design document
-wpf
-which classes will implement the interfaces
-show methods
-include the gui of all the cases
-show report, resize grid,
-specify the car flow

next week
-peer review form
-discuss the result of the form next week
-12:25
```

We decided to use WPF instead of Windows Form to implement the UI of the application, to learn something new and learn about dependency injection, MVC, etc.

We decided to use SOLID principles instead of the other way we learnt were all the data objects, logic, view, etc. of say a component is in one class, here they are separated from each other, to encourage reusability and ensure one layer knows less about the other layer.

Task Delegation

Work Type	Deliverable Area	ID	Description	Owner
Programming	Common layer	1	Common layer coding	Agnes
Review	Common layer	1	Common layer review	Coen
Review	Common layer	1	Common layer review	Agnes
Programming	Data layer	2	Data layer coding	Wen
Programming	Data layer	2	Data layer unit test	Wen
Review	Data layer	2	Data layer review	Coen
Review	Data layer	2	Data layer review	Wen
Programming	Launcher layer	3	Launcher layer coding	Yongshi
Review	Launcher layer	3	Launcher layer review	Coen
Review	Launcher layer	3	Launcher layer review	Yongshi
Programming	Bussiness layer	4	Gridmodel coding	Wen
Programming	Bussiness layer	4	Gridmodel coding	Yongshi
Testing	Bussiness layer	4	Gridmodel unit test	Wen
Testing	Bussiness layer	4	Gridmodel unit test	Yongshi
Review	Bussiness layer	4	Gridmodel review	Coen
Review	Bussiness layer	4	Gridmodel review	Wen
Review	Bussiness layer	4	Gridmodel review	Yongshi
Programming	Bussiness layer	5	Simulator timer	Agnes
Programming	Bussiness layer	6	Simulator traffic light	Agnes
Programming	Bussiness layer	6	Simulator traffic light	Wen
Testing	Bussiness layer	6	Simulator traffic light unit test	Agnes
Testing	Bussiness layer	6	Simulator traffic light unit test	Wen
Review	Bussiness layer	6	Simulator traffic light review	Coen
Review	Bussiness layer	6	Simulator traffic light review	Agnes
Review	Bussiness layer	6	Simulator traffic light review	Wen
Programming	Bussiness layer	7	Simulator car	Yongshi
Testing	Bussiness layer	7	Simulator car unit test	Yongshi
Review	Bussiness layer	7	Simulator car review	Coen
Review	Bussiness layer	7	Simulator car review	Yongshi
Programming	Bussiness layer	8	Simulation pedestrian	Unassigned

Testing	Bussiness layer	8	Simulation pedestrian unit test	Unassigned
Review	Bussiness layer	8	Simulation pedestrian review	Coen
Review	Bussiness layer	8	Simulation pedestrian review	Unassigned
Prestudy	Presentation layer	9	Prestudy WPF + MVVM	Wen
Prestudy	Presentation layer	9	Prestudy WPF + MVVM	Yongshi
Prestudy	Presentation layer	9	Prestudy WPF + MVVM	Agnes
Programming	Presentation layer	10	Designing UI	Yongshi
Programming	Presentation layer	11	ViewModels in C#	Wen
Programming	Presentation layer	12	ViewModels in View	Wen
Review	Presentation layer	13	ViewModels in View review	Coen
Review	Presentation layer	13	ViewModels in View review	Wen
Programming	Presentation layer	14	UserControls for Components, cars, pedestrians	Agnes
Programming	Presentation layer	14	UserControls for Components, cars, pedestrians	Wen
Programming	Presentation layer	14	UserControls for Components, cars, pedestrians	Yongshi
Review	Presentation layer	14	UserControls for Components, cars, pedestrians review	Agnes
Review	Presentation layer	14	UserControls for Components, cars, pedestrians review	Coen
Review	Presentation layer	14	UserControls for Components, cars, pedestrians review	Wen
Review	Presentation layer	14	UserControls for Components, cars, pedestrians review	Yongshi
Programming	Presentation layer	15	General MainWindow	Yongshi
Programming	Presentation layer	16	Resize grid window	Agnes
Programming	Presentation layer	17	Traffic light window	Wen
Programming	Presentation layer	17	Traffic light window	Agnes
Review	Presentation layer	18	Review Presentation layer	Agnes
Review	Presentation layer	18	Review Presentation layer	Coen
Review	Presentation layer	18	Review Presentation layer	Wen
Review	Presentation layer	18	Review Presentation layer	Yongshi

Explanation of choices as solutions to problems encountered

Use of a Library:

We came to a realisation that implementing the property changed event for updating data fields when a change has occurred, needed more effort and time to implement.
We came up with an alternate solution to use a library which automatically fills the getters and setters for the property change.

Preventing the possible occurrence of a deadlock:

There was a problem we encountered, the cars were standing in a deadlock position on the crossroad sometimes. After analysing various possible solutions to this problem, we came to a decision to allow the light to stay orange until all the cars have left the centre of the crossroad and this solution when implemented, solved the deadlock problem of cars in the simulation.

Check when the car should enter the crossroad:

We observed that the orange light stays for a long time until all the cars have left the centre of the crossroad.

In order to solve this problem, we made sure cars will only enter the centre of the crossroad when the outgoing lane is free.

Collision Detection:
By testing and observing, we realised that collision detection between cars is slow. And that was because collision detection was done for the whole grid, and this will obviously need a lot of time to process.
We decided to use multithreading, each component has its own thread. And then we ensure collision detection takes place in each component separately.

Simulation waits for the UI:
Our observation was that the simulation does not wait for the UI to add/remove cars, the cars that have to be added are filled into a queue. And by the use of FirstInFistOut(FIFO), the members of the queue are added to the UI when the thread runs.

Simulation runs too slow:
The problem with the simulation not being time effective was encountered, we decided to implement a solution to this problem by use multithreading, which makes use of Read/Write locks on the list of cars as illustrated earlier in collision detection. The Read locks are use to Add/Remove a car from the list of cars in the simulation. The write lock is responsible for showing the items in the thread to the User Interface.

Maximum speed of the simulation:
Being aware of the need to run the simulation in maximum speed depending on the user. We decided to implement that functionality with a while loop instead of a timer for efficiency.

Personal Evaluations

Name of Group Member : Yongshi Liang
During this project, I learn a lot of new skills than in the previous projects. The main reason is, this time, I am having a good team. Each group member has their strength point. Agnes is good at documentation, that is teaching me how to write document in a good format in the future. Coen is good at programming skills, he taught us some nice patterns which we have not learned yet from the previous courses. That we can use it later when we are having an internship. Wen is good at Explanation. When I was messing up or have something does not understand, she would use examples to make me much easier to catch that point. I think the project itself does not difficult, but we are making it more challenging cause we using lots new patterns that we did not know before. We are working hard to understand how to implement it. Discussing it together, spending more time on learning new stuff. After that, I really learned a lot, improved and refreshed my skills. The success of it is thanks to the great teamwork we have.

Name of Group Member : Wen Li
We did something pretty different than what we did in ProP. This course is supposed to let us utilize what we learnt from the two years to a reality related project. However, for me it

does not feel like a project but somehow some kind of teaching and learning course. This is because we chose to use a method that most of us were not familiar with. It took extra time and effort. The process was challenging and we after all learnt a lot of new skills and knowledge. The team cooperates well and the teacher is helpful.

Name of Group Member: Coen Stange

For me PROCP was tougher than I expected, I guess made it more difficult than it supposed to be myself. I wanted to teach my teammates some sick programming skillz, stuff that they can learn know and use later when they have internship/job. Teaching some patterns was more difficult than I expected, but I hope it will be worth it. In this process I guess I got myself more teaching experience, and learn how to be more patient.

Name of Group Member: Agnes Wadee

This project in my opinion was difficult and time consuming, but however, we worked very well as a team to embrace the challenge and ended up with a successful project. I had no knowledge of WPF, but through this project I learnt a lot, and also Coen was really patient in teaching us and reviewing our code in the project. As most projects, not only did I gain experience in software development, but I also learn to improve my team working skills. I had a really good group to work with, everyone is hardworking and strives for the best.
If there was something that needs to be changed about this project, I will suggest to adapt Agile SCRUM methodology instead of Waterfall, even though waterfall could be helpful for large projects, I highly doubt that you will able to plan exactly how your software will work upfront. I think it is good to have a good draft at the start and then work with it and constantly improve it.