Intermediate Report

team_we_got_this

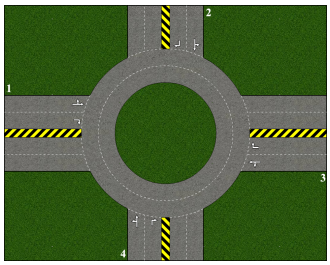
1 Introduction

In this report we will discuss the initial progress of our group project. We will describe the design and progress of the simulation in the first section and in the latter section we will discuss how the group is organised.

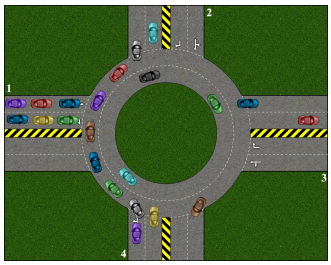
2 Project Description

2.1 Overview of our Simulation

Our group proposes to build a four junction roundabout with multiple lanes (see figure 1a) and to introduce policies and road layouts loosely based around existing roundabouts in London. Originally our design included traffic lights but within two weeks we had working traffic lights on our test simulation. Hence, it was decided that it would more challenging to build a roundabout without traffic lights, as our cars would then need to be intelligent enough to know when to give way to other cars already on the roundabout. We aim to also allow users to change the probability of cars coming from each junction, entering the roundabout, to allow users to accurately measure real life scenarios. For example, if there was a heavy flow



(a) Our roundabout design



(b) Image of our blocked roundabout

of cars from one junction, this will stop cars from the junction to the left of it entering the roundabout as they will have to give way (see figure 1b).

If we could succeed in implementing the give way policy we would then create our own scenario, introducing traffic lights to analyse network flow and policies to improve this flow. We will then analyse how many cars enter the roundabout from each junction per minute. Our system would give users control of the time duration of the lights so that we could allow lights to be green for a longer duration at the junction where the traffic flow is heaviest. As an optional attribute to our system we would like to implement traffic lights which are dynamic and will change colour based on the number of cars passing through instead of time elapsed.

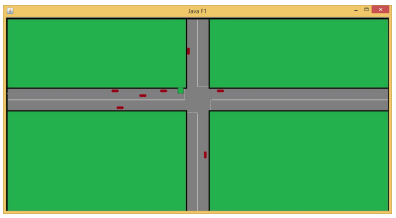
Project Timetable		
Date	**Description of Implementation**	**Status**
22/01/15	Basic model with moving cars	Achieved
29/01/15	Collision detection and avoidance	Achieved
16/02/15	Working Basic Cellular Automation model	Pending
04/03/15	Roundabout	Pending
21/03/15	Multi-lane roundabout	Pending

As a group there were several different approaches that we thought were viable. We decided to explore each option and an overview of each is discussed in sections 2.2 and 2.3

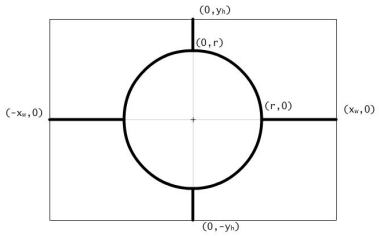
2.2 Design Approach 1: Using a Matrix

The first option we trialled was building our system in ActionScript 3.0 using a hexagon matrix. In this model we used coordinates to track the position of cars on the matrix as this would allow us to prevent collisions. We used a hexagon matrix as we thought it would better suit the shape of the roundabout, however in the trial of the model we decided a hexagon grid was an unnecessary complication.

The second option is based on a cell automation model [1]. In this model each cell of a matrix is given attributes and properties. The attributes will include the width, height and type of cell whilst the properties will give information on whether the cell is occupied by a vehicle. The most important feature we will include in each cell is information on its neighbouring cells so that cars can make dynamic decisions about where they will go in the next tick on the simulation.



(a) Screenshot of our model



(b) Sample graph for Our Continuous Model

2.3 Design Approach 2: Using Equations

The third model was the first working simulation the group created (see figure 2a). It is built by recolouring pixels every 30 milliseconds to show movement of the cars across the map. We had this working model running quickly, but we questioned whether it would be dynamic enough to adapt to our growing plans. In particular, we were concerned that this naive approach would hold us back as we tried to develop a multi-lane roundabout where cars would need to change lanes. Originally this model had issue with collisions but it now has a level of intelligence - cars can respond to other cars in front of them by changing lanes. They also know not to overtake on the left.

The final approach we considered was a continuous model in which our map was represented by several parametric equations (see figure 2b). Although this approach would allow us to accurately calculate where each car is at any given time, we decided this implementation would be unnecessarily time-consuming.

2.4 Final Implementation Choice

The model the group has decided to implement is a cell based approach where the speed of vehicles is based on movement of cells and not pixels. We hope to implement a two lane roundabout with four junctions where cars will need to change lanes and adjust there speed accordingly.

3 Project Organisation

At the start of our project our group decided to meet for two hour meetings twice a week. The weekly meeting slots are at a set time but this caused some issues, hence we are now aiming to be more flexible with the meeting times. Now that we have decided on the final approach of our system, we

are having separate meetings to discuss individual areas of the project, i.e meetings for the software engineers. Whilst we all have an active say in all areas of the project, we all have different focuses. Rochelle is project coordinator and administrator; Zaki, Anton, and Nur are software developers; and Kim is graphics coordinator and assistant software developer. In the peer assessment we plan to give everyone equal marks as we all have pre-defined and necessary roles in the project. We are trying to compromise on smaller issues while voting on any large issues.

One of our difficulties thus far has been using GitHub. It has been very challenging for all of us to learn how to use this new platform. Much of our project so far has been diagrams or pictorial representations of what we plan to do. As we are unsure what file types GitHub allows, we have been using a shared Dropbox folder for our group. We have now set a deadline(16/02) for each member of the group to learn how to use GitHub. It was agreed that each week by Sunday at 6pm, we will all push what we have been working on that week to the repository, creating new branches where necessary.

The biggest challenge we have faced as a group is communication. We could not agree as a group what we to use to communicate with each other and as a result there were messages which were not received by every member of the group. We have now agreed to all use the application 'Slack' as our primary means of communicating.

The project coordinator keeps detailed logs of all of our meetings, which include an agenda, action points and any task which must be completed by the next meeting. This is so everyone is clear what we have achieved and what still needs to be done. We are following a waterfall structure for our group as it is a simple and clear approach which all members can follow. We are using UML diagrams to set out clear specifications for our software developers. This will allows us to work on separate areas of the program and then merge the components.

References

[1] M Namekawa, F Ueda, Y Hioki, Y Ueda, and A Satoh. General purpose road traffic simulation system with a cell automaton model. In *International Congress on Modelling and Simulation (MODSIM05), Melbourne, Australia*, 2005.