

UniCAT: Data Analytics Module

By

CHEW WEI LOONG

A REPORT

SUBMITTED TO

UNIVERSITI TUNKU ABDUL RAHMAN

In partial fulfilment of requirements

For the degree of

BACHELOR OF COMPUTER SCIENCE (HONS)

Faculty of Information and Communication Technology

(Perak Campus)

JAN 2017

University Tunku Abdul Rahman

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DECLARATION OF ORIGINALITY

I declare that this report entitled “**UniCAT – DATA ANALYTIC MODULE**” is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

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I would like to express my sincere thanks and appreciation to my supervisors, Dr. Cheng Wai Khuen who has given me this bright opportunity to engage in the Data Analytic Module. It is my first step to establish a career in data analytic module field. A million thanks to you. Besides that, I would like to take this opportunity to thank my moderator, Dr. Ooi Boon Yaik for the suggestions at the FYP1.

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ABSTRACT

University Cyber Agent (UniCAT) is a graphical social networking system. The objective of this system is to study the behavior of the local population in University Tunku Abdul Rahman (Perak Campus). The UniCAT system contain event sharing module, trading module, bus schedule checking module and so on. The main idea of the system is to implement the concept of smart campus which benefits the student and the staff in this campus.

The project will focus on enhance the UniCAT system by solving the parking problem inside the campus. However, the project will mainly focus on develop a model and simulate it to solve the parking problem. In the simulation, it able to imitate the operation of a real-world process or system over time.

After studying the existing documentation of the software that used, it has been found that the software able to provide the feature of simulation. The power of simulation is able to imitate all kinds of parking scenario and hence it could run the numbers of simulation tests. The higher the number of simulation, the higher the accuracy of the results that produce. Thus, it could solve parking problem in more advance by producing the accurate data.

In conclusion, this project will enable the university authorities to implement a smart parking module according to the results and the data that obtain from the model.

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1.1 Motivation and Problem Statement

Motivation and Problem Statement

As a driver inside the UTAR campus will encounter few problems such as:

1. There is not enough parking spaces,
2. The carpark is far from the class,
3. Searching for empty parking space will consume lots of time,
4. Need to walk a long distance if the carpark is too far from the destination.

The aim of this project is to solve the problems above. It brings the motivation to solve those problem because the drivers will gain plenty of benefits, such as save their time by searching around to find parking slots, save energy by parking their car near to their destination. Besides that, the university authorities will also get the benefit by applying the model to understand better the traffic condition inside the campus and can make improvement from it.

1.2 Project Scope

The scope of this project is to develop a model which allow the imitating of the parking condition inside the campus. The model will be utilized to run a simulation in order to allow university level decision maker in performing campus planning. We have design sufficient modelling components to develop all the carpark in the university. However, during the illustration we only cover the carpark at Zone D, Zone E and Zone F.

1.3 Project Objectives

The objectives of the projects is **to develop a model which is able to analyze and simulate the parking problems** encountered by the drivers inside the campus.

1.4 Proposed Approach

The project will help to develop a model in the metamodeling toolkit called, ADOxx. First of all, the software able to represent real carpark module into a data model. By using the model, it is easier to know which one is Block, Zone, Carpark and so on. Besides, the software able to assign the specific relationship between those attributes. For example, there is the relationship between Zone and Carpark. The purpose of this is to provide a convenience way for the system and people who use the software to recognize the relationship between the attributes.

Next, the model allow to perform some analyze and simulation process. In the simulation process, the model able to imitate the real parking scenario such as how the traffic follow inside this campus, where the drive can search the carpark, how the driver can search the carpark and so on. By go through numbers of simulation cycle, the simulated results will go through further analyze. At the end the threshold value will be produced. The purpose of the threshold value is to let the university authorities know that when is the period that the carpark is full, where the carparks are always occupied, when need to alert the driver if the carpark is above the threshold. Whereby the drivers have lower chance to get an empty parking space.

Besides that, this model will help in improving the traffic condition inside campus by go through the simulation process, the users able to set the condition which relate to real life by initializing the parameter. After that, the model will go through simulation process and produce the results for the further analyze use.

1.5 Background information

University Cyber Agent (UniCAT) is a graphical social networking system. The objective of this system is to study the behavior of the local population in University Tunku Abdul Rahman (Perak Campus). The UniCAT system is represented by a visualized map. The visualized map contains POI such as cafeteria, school buildings and experimental laboratory.

In addition, an avatar which represents the user will appear in the system when the user is performing tasks using the system. The system also contains some features, such as social networking features, which enable the processes of file sharing, sending messages, and friend management to take place. The user can also share information among him or her and his or her friends in the UniCAT system. The information that can be shared among them included events, food, studies, and so on.

The concept of the UniCAT system is to build a smart campus and to provide useful facilities to the students and staffs. Thus, the user who ever uses the system can easily share and retrieve information from it. However, in order to implement the “smart concept” in the UniCAT system, it is necessary to solve the problems which encounter by the students and the staffs in this campus. One of the problem that are going to solve in this project is parking problems.

As a driver in the campus, it causes inconvenience and wasting of time when searching for an empty parking slots. Thus, to solve the parking problems this project will introduce a data modelling platform. This platform able to help the users to analyze the parking condition with relevant data. The analyze results will be very important because it will be use as a parameter for the developer to develop a smart parking module.

Nowadays, data analytic is getting more and more general because it can help to study the behavior, pattern, and performance between the user and his or her environment. Data analytic has contributed in a variety of fields as well. For instance, it helps the company to make business decision by analyzing the past trading data of the company. Once the data analytic concept is implemented into the UniCAT system, it will help the user to analyze and generate useful results. Hence, the data collected can be reused to perform useful functions for them.

1.6 Report Organization

This report consists of 6 chapters in total. The first chapter is introducing about the project, such as the motivation, objective, project scopes and etc.

In the second chapter, there are five existing softwares that had been reviewed and compared. Besides that, the carpark applying the data modelling platform and carpark without data modelling platform also compared in this chapter.

In the third chapter, there is the introduction of ADOxx and the system design. There is the project methodology and tools to use introduce in the fourth chapter. In the fifth chapter, there is the system implementation and also model results. The last chapter is about the conclusion and future work of the whole project.

2.1 Review Description

The literature reviews in this project will break into two parts. The first part is to compare the data analyze platform. The second part is the comparison between the carpark with and without the implementation the data modelling method.

There are plenty types of the data analytic platforms that found in this world. Some of the data analytic platform will represent the end results with graphical model, some of them will represent the end results with modelling method. Thus, this project will review different types of data analytic platform and compared them based on the need of this project.

2.2 Review of Existing System

2.2.1 ER/Studio Enterprise Team Edition

ER/Studio Enterprise Team edition is a sets of new standard for data management that empowers the users to easily share, document and publish models and metadata across the whole organizations.

Features of ER/Studio Enterprise Team Edition

1. Provide the capabilities in analyse, document, and share essential models and metadata across the organization.
2. Provide the metadata foundation to quick respond to business process demands for the data management professionals which will able to lower down the risk of non-compliance, and deliver more actionable insight.
3. Gives support of strategic enterprise system including Teradata, Netezza, Azzure and so on.
4. Provides fastest, easiest, and most collaborative way for data management professionals to build and maintain enterprise-scale data models and metadata repositories.

Chapter 2 Literature Review

There are some feature and the description about ER Studio represent in Table 2.1.

| Feature | Description |
|-------------------|--|
| Extensibility | Flexible attachments and dictionary |
| Compare / Merge | Easiest and most automated |
| Macro Language | Standard language; more capabilities and options |
| Mapping & Linking | Flexible mapping and linking for traceability |
| Ease of Use | Consistent behaviour across product |

Table 2.1 Features and Description about ER Studio

Besides the features there are some benefits represent in Table 2.2. and Table 2.3.

| Logical and Physical Data Modeling | | Model Repository | |
|------------------------------------|---|---|---|
| UNIVERSAL MAPPINGS | Map between and within conceptual, logical and physical model objects to view upstream or downstream. | COMBINED DEPLOYMENT WITH TEAM SERVER | Team Server and Repository have a shared database to simplify deployment and model storage and to eliminate synchronization while allowing for selective publication. |
| "WHERE USED" ANALYSIS | Display mapping between conceptual and logical models and their implementations across physical designs. | CONCURRENT MODEL AND OBJECT ACCESS | Allows real-time collaboration between modelers working on data models down to the model object level. |
| VISUAL DATA LINEAGE | Visually document source/target mapping and sourcing rules for data movement across systems. | REVIEWING CHANGES AND RESOLVING USER CONFLICT | Conflict resolution through simple and intelligent interfaces to walk users through the discovery of differences. |
| ROUND-TRIP DATABASE SUPPORT | Native forward and reverse engineering for multiple RDBMS and big data platforms. | VERSION MANAGEMENT | Manages the individual histories of models and model objects to ensure incremental comparison between, and rollback to, desired diagrams. |
| BUSINESS DATA OBJECTS | Represent master data and transactional concepts with multiple entities and relationships, such as products, customers, and vendors. | COMPONENT SHARING AND REUSE | Predefined Enterprise Data Dictionary eliminates data redundancy and enforces data element standards. |
| ADVANCED COMPARE AND MERGE | Enable advanced, bidirectional comparisons and merges of model and database structures. | SECURITY CENTER GROUPS | Streamline security administration with local or LDAP groups improving productivity and reducing errors. |
| NAMING STANDARDS | Automatically apply a naming standards template across logical and physical models by binding it to models, submodels, entities and attributes. | AGILE CHANGE MANAGEMENT | Assign and track tasks associated with data models to align changes to user stories and development workflows. |

Table 2.2 Benefits of ER Studio

| Metadata Collaboration | | Business Process and Conceptual Modeling | |
|-----------------------------------|---|--|---|
| TEAM COLLABORATION | Apply enterprise collaboration features such as activity and discussion streams, to capture and share corporate knowledge and reduce time identifying and correcting expensive data quality issues. | CONCEPTUAL MODEL CREATION | Supports high-level conceptual modeling using elements such as subject areas, business entities, interactions, and relationships. |
| MODEL AND METADATA ACCESS | Share and collaborate on models and metadata across the organization with unlimited web user access. | PROCESS MODEL CREATION | Support for straightforward process modeling that uses standard elements such as sequences, tasks, swim lanes, start events, and gateways. |
| INTERACTIVE MODEL IMAGE NAVIGATOR | View the data model image interactively within the Team Server web interface, including zoom, search, and repositioning functions. | UML Modeling | |
| INLINE DEFINITIONS | View definitions for registered data elements or business terms in integrated data access tools and internal webpages. | MODEL DRIVEN ARCHITECTURE AND STANDARDS | Supports Unified Modeling Language™, XML Metadata Interchange (XMI®), Query / Views / Transformations (QVT) and Object Constraint Language (OCL). |
| SEMANTIC MAPPING | Relate business terms to critical data elements including tables, columns, entities and attributes. | MODEL PATTERNS | Powerful re-use facilities to jumpstart projects through predefined patterns. |
| ENTERPRISE GLOSSARY | View, classify, relate and centrally store authoritative business definitions in an extensible enterprise glossary of business terms, and track changes with an audit trail. | Access to Multiple Data Sources and Platforms | |
| GLOSSARY HEIRARCHY | Create child glossaries that inherit a subset of terms from one or more glossaries to define a tiered structure that can correlate to organizational configurations. | IMPORT BRIDGES | Import model information from BI, ETL, other modeling tools, and industry-standard metadata interchange formats. |
| DATA SOURCE REGISTRY | Single searchable registry of all available created or imported data sources. | EXPORT BRIDGES | Easily export your models to BI, ETL, other modeling tools, and industry-standard exchange formats such as XMI, XML, and XSD. |
| DATA SOURCE MAPPINGS | Track and analyze the impact of data model changes back to affected data sources. | DATA LINEAGE VISIBILITY | Visualize source-target mapping and sourcing rules designed in an external Extract-Transform-Load (ETL) tool or Data Integration (DI) tool. |
| CENTRALIZED REPORTING | More than 20 out-of-the-box reports and a reporting wizard for ad hoc reports that can be exported to several formats and shared. | ETL/DI TOOL INTEGRATION | Import mapping requirements information to the lineage model from most of the leading ETL and DI tools. |
| ADVANCED SEARCH | Easily search and filter results for data objects, data sources, glossaries, and terms. | | |

Table 2.3 Benefits of ER Studio

2.2.2 PowerDesigner Enterprise Architect

The PowerDesigner Enterprise Architect allows the users to build a blueprint of the current enterprise. Besides that, it allow the user to visualize the impact change before it happens.

Features of the PowerDesigner Enterprise Architect

1. Help to prepare for new technologies and process improvement by mapping and understanding the information architecture
2. Use a drag-and-drop interface to capture all the business requirements and design ideal implementation plans.
3. To avoid potential risks roadblocks by performing IT impact analyses.
4. Streamline data migration which including to SAP HANA, with a built-in migration feature
5. Implement intuitive visualizations and Web-based dashboards to simplify collaboration between business and IT.

Apart from the features in side Figure 2.1 show us the Functional Capabilities and Figure 2.2 show us the Technical capabilities of the PowerDesigner Enterprise Architect.

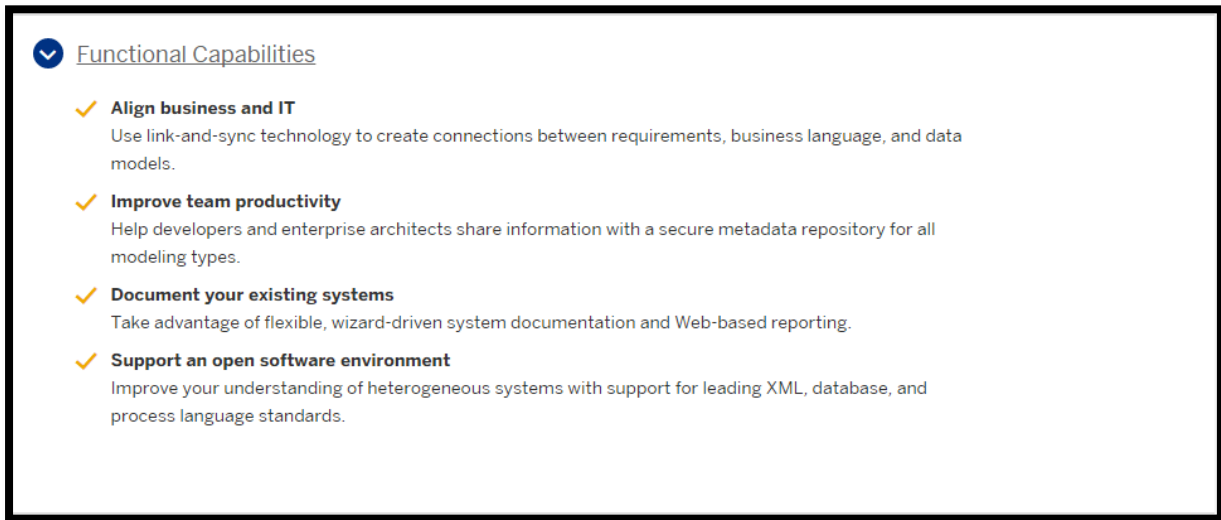


Figure 2.1 Functional Capabilities

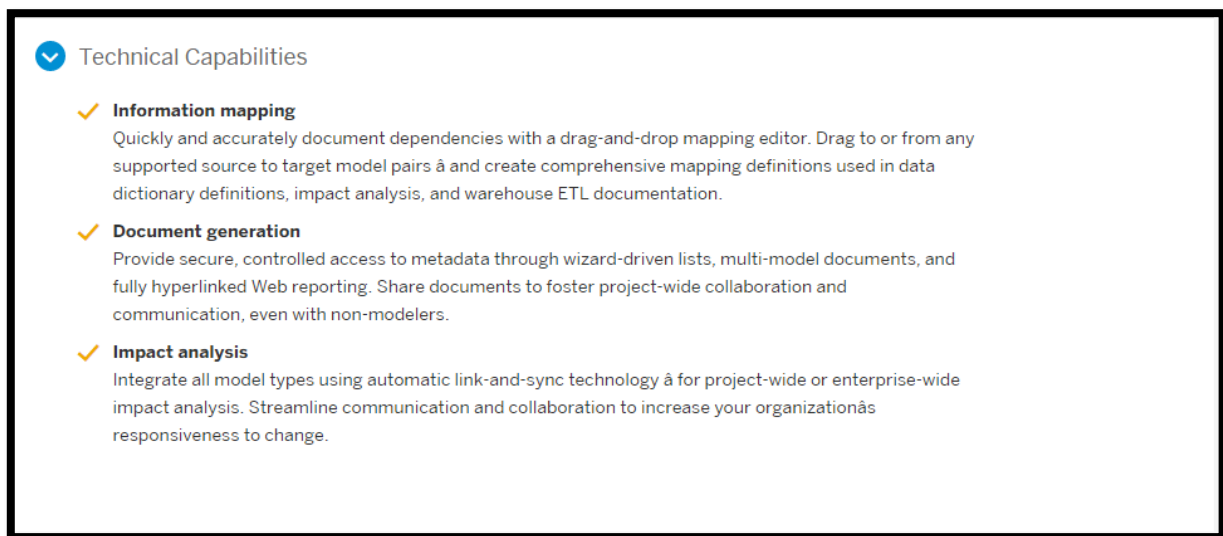


Figure 2.2 Technical Capabilities

Chapter 2 Literature Review

Inside the Table 2.4 present the comparison of the ER Studio and the PowerDesigner Enterprise Architect data modelling tools.

| Capability | ER/Studio Enterprise Team Edition | ERwin DMW + Data Governance Portal | PowerDesigner Enterprise Architect |
|---|-----------------------------------|------------------------------------|------------------------------------|
| Database modeling – logical and physical | ● | ● | ● |
| Process and conceptual modeling (BPMN) | ● | | ● |
| Software modeling (UML) | ● | | ● |
| Model repository – version control | ● | ● | ● |
| Visual data lineage | ● | ● | |
| All major DBMS platforms | ● | ● | ● |
| Big data platforms (e.g. Hadoop) | ● | ● | ● |
| Data source mapping | ● | ● | ● |
| Impact analysis | ● | ● | ● |
| Metadata repository – Business glossaries – Publication & collaboration | ● | ● | |
| Cross-platform SDLC portfolio | ● | | ● |

Table 2.4 Comparison of ER Studio and PowerDesigner Enterprise Architect

2.2.3 R Studio Integrated Development Environment (IDE)

RStudio Integrated Development Environment (IDE) is one of the popular open source software for statistical computing and graphics. This open source software brings a lot of powerful coding tools together into an intuitive, easy-to-learn interface. R is designed around its core scripting language but also allows integration with compiled code written in C, C++, Fortran, Java, etc., for computationally intensive tasks or for leveraging tools provided for other languages (Vezani, 2011). Hence, the design of the Integrated Development Environment (IDE) is used to facilitate the user-written which extended by the R languages

Apart from these, there are some existing IDEs for R as shown inside Table 2.5.

| Name | Platforms | Description |
|-----------|-----------|---|
| ESS | All | ESS (http://ess.r-project.org) is a powerful and commonly used interface for R that integrates the venerable emacs editor with R. There are numerous conveniences, but some find that it is difficult to learn and has an old-school feel, which precludes adoption. |
| Eclipse | All | The open-source StatET plugin (http://www.walware.de/goto/statet) turns Eclipse, a Java-based multipurpose IDE, into a full-featured IDE for R. |
| SciViews | All | An R API and extension for the Komodo code editor. |
| JGR | All | Java-based editor that interfaces with R through the rJava and JRI packages. The Deducer package adds a suite of data analysis tools. |
| Tinn-R | Windows | An extension for the Tinn editor that allows integration with an underlying R process. |
| Notepad++ | Windows | With the NppToR extension allows the Notepad++ editor to interact with an R process. |
| RGui | Windows | The Windows GUI for R has many of the features of an IDE. |

Table 2.5 Others existing IDEs for R

Chapter 2 Literature Review

Moreover, there are few reasons which cause the RStudio IDE to become a popular platform for statistics computing, such as:

- i. Four-panel layout with nicely integrations which includes:
 - a. A console for interactive R sessions
 - b. A tabbed source-code editor to organize a project's files
 - c. Panels with notebooks to organize less central components.
- ii. Source-code editor is rich with all kinds of features and with built-in console
- iii. The tightly linked between console and source-code to R's internal. This helps the system through tab completion and also page viewer component.
- iv. The switching between different projects become easier due to setting up them is a snap.
- v. The friendly use of the administrative tools for managing packages, the workspace, files, and so on.
- vi. Three main operating systems are provided and can be executed through a web browser for remote access.
- vii. Brings more convenience to users:
 - a. Easier to learn compare to Emacs/ESS
 - b. Easier to configure and install compare to Eclipse/StatET
 - c. Better editor than JGR
 - d. Better organized than Sciviews
 - e. Available more platform than just Windows.

Chapter 2 Literature Review

Table 2.6 shows the RStudio on initial startup, the main interface has four panels (one hidden in this screenshot), a toolbar, and in some cases, a menu bar.

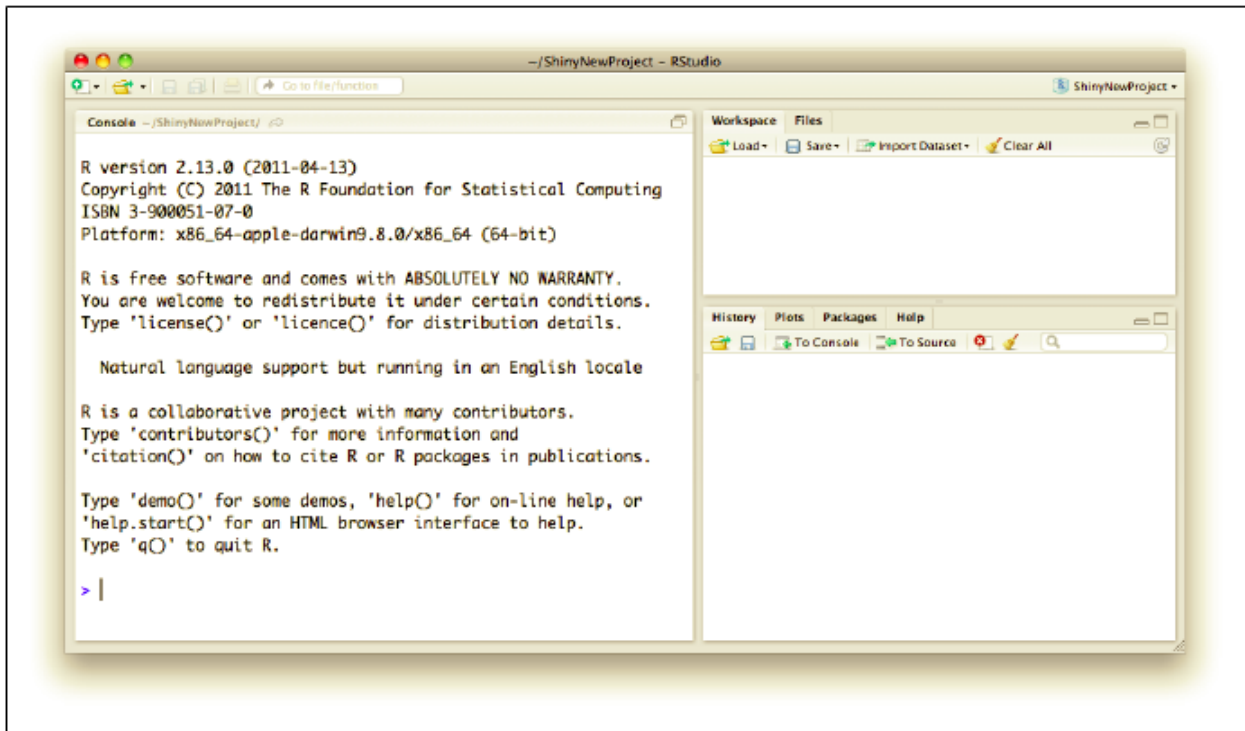


Table 2.6 shows the RStudio on initial startup

2.2.4 Google Cloud Platform

According to Sells, 2016 he said that Google Cloud Platform is known for many things, like big data, machine learning and the global infrastructure that powers Google. Google BigQuery allows businesses and developers gain real-time business insights from massive amounts of data without any up-front hardware or software investments. (Google, 2012). There are lots of benefits for the users when they are using google cloud as their data analysis platform, like the storage is quite large that will able for the user to store whatever they want, if the storage is not enough they still can purchase to upgrade their storage. Besides this the data is protected with high level of security system. **Figure 2.3** below shows the Google Cloud Analytics Platform.

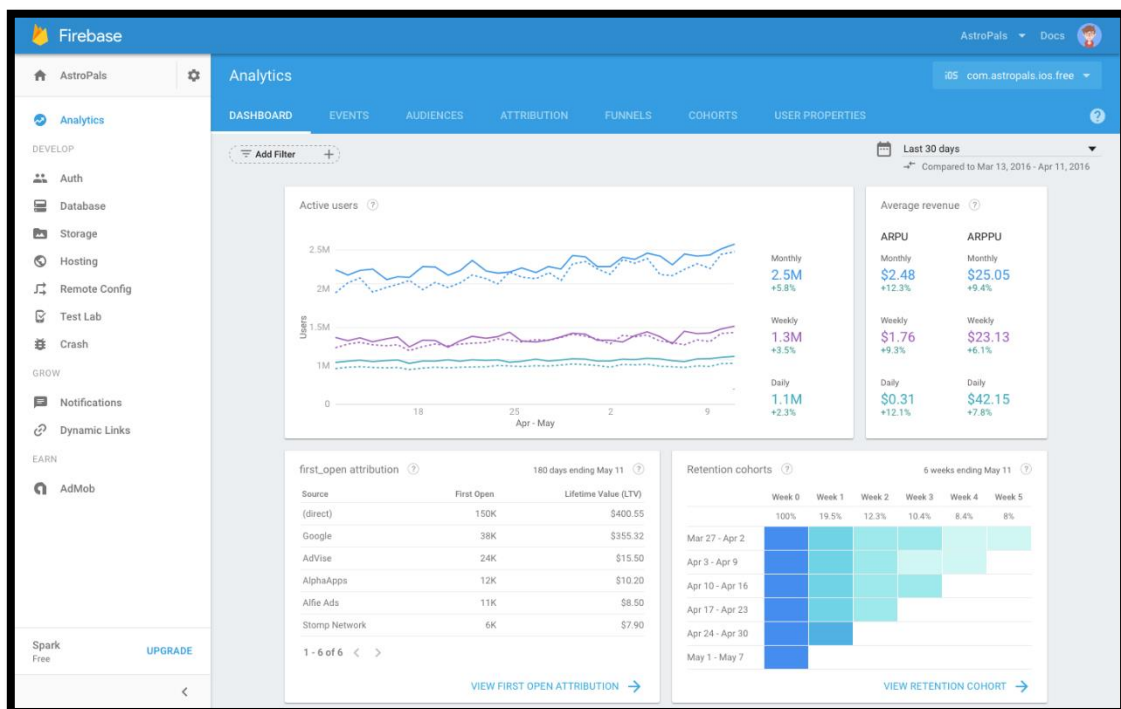


Figure 2.3: shows the Google Cloud Analytics Platform

Chapter 2 Literature Review

According to Google,2012 the features of Google BigQuery:

- i. Scalability
 - a. Data storage is huge enough to store up until hundreds of terabytes which does not require any management.
- ii. Speed and Flexibility
 - a. Using the processing power of Google's infrastructure to run super fast SQL queries against multiple terabytes of data in seconds.
 - b. User friendly syntax like SQL query and intuitive web UI
 - c. Able to JOIN enormous fact tables to most lookup tables
- iii. Integration and accessibility
 - a. Integration with Google spreadsheets by letting data analysts drive massive datasets in BigQuery directly from a spreadsheets interface.
 - b. Interactive dashboards easily build with Google AppEngine, and smooth data export to Google Cloud Storage.
 - c. Easily read and write data in BigQuery via Cloud Dataflow, Spark, and Hadoop.
- iv. Security and reliability
 - a. Multiple layers of security system protect users' important data
 - b. Customer have fully control over who has access to the data stored in it.

2.2.5 ADOxx

ADOxx is the meta-modelling development and configuration platform for implementing modelling methods. The implementation result using ADOxx are modelling toolkits. It can be utilized for the development and configuration of modelling tools by User management, Library management, Meta model specification and Algorithms and Mechanism implementation.

Besides that, the ADOxx Modelling Toolkit can be use to create and modify models according to a selected ADOxx meta model by using the Model management, Modelling, Stimulation, Queries import and export.

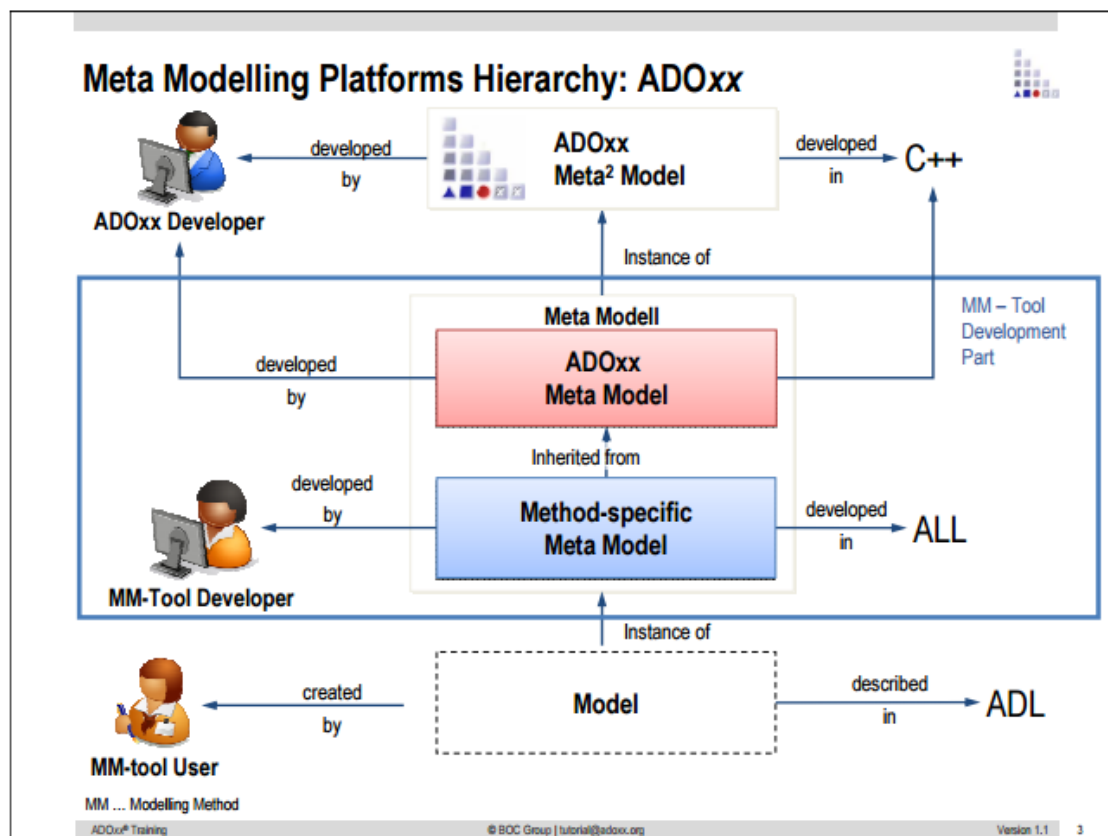


Figure 2.4: Meta Modelling Platform Hierarchy: ADOxx

2.3 Critical Remarks

2.3.1 System Comparison

Table 2.7 System Comparison Table

| Criteria | ER Studio | PowerDesigner Enterprise Architect | R Studio | Google Cloud Platform | ADoxx |
|----------------------------|------------|---------------------------------------|----------------|--------------------------|--------------|
| Analyze data | Yes | Yes | Yes | Yes | Yes |
| Perform simulation | No | No | No | No | Yes |
| Mapping the relationship | Yes | Yes | No | No | Yes |
| Way to present the results | Table form | Table form and diagram | Graphical form | Graphical form | Diagram form |

2.3.2 Criteria Explanation

Table 2.8 Criteria Explanation Table

| Criteria | Elaboration |
|----------------------------|--|
| Analyze data | The platform able to perform data analysis. |
| Perform-simulation | The platform that able to perform simulation when the user provide data. |
| Mapping the relationship | Linking the relationship between the classes in order to perform analysis of the data. |
| Way to present the results | The method that the tools choose to present the result to the user. |

2.4 Comparison between the carpark applying and without applying the data modelling platform

Table 2.9 Comparison between the Carpark Applying and Without Applying the Data Modelling Platform Table

| Condition | Apply Data Modelling Platform | Without Applying Data Modelling Platform |
|----------------------------|--------------------------------------|---|
| Traffic Management Problem | Solve | Unsolved |
| Carpark Management Problem | Solve | Unsolved |
| Parking Problem | Solve | Unsolved |
| Enlarge of Parking Spaces | Effectively | Ineffectively |

2.5 Comparison Elaboration

Traffic Management Problem

By applying the data modelling platform, at first the platform will demonstrate the situation of the traffic scenario for the users. After that, the platform will let the users know when is consider as a peak hour which at that moment the car follow is more than the normal hour. The user can refer to the result and make some arrangement for the car follow. When the driver want to carpark during the peak hour, the platform can shows where the driver should park at. On the other hands, without applying the data modelling platform the traffic inside the campus still maintain as usual. For example, at peak hour the all car will jam at there and some driver also encounters difficulties in finding empty parking slots.

Carpark Management Problem

When applying data modelling platform in carpark management, the platform will manage the carpark very well. This is due to the platform able to estimate when the carpark will be fully occupied and where the carpark not yet occupied. In this case, when the drivers request for empty parking slots, it will refer the driver to the carpark which is available. In other words, if the without applying the data modelling platform, the carpark management still in messy conditions. This is due to the drivers will place their car whenever they see an empty space.

Parking Problem

When applying data modelling platform in carpark management, the platform will let the drivers know where is the carpark which nearest to them. Besides that, the drivers will also save their time in searching for empty parking spaces and need to walk a long distances before reaching their destination. However, the carpark management did not apply the data modelling platform, the drivers inside the campus still face difficult in finding the empty parking slots and need to waste too much time on searching for parking slots. If the driver parks his car too far from the destination, he need to waste his time on walking to his destination.

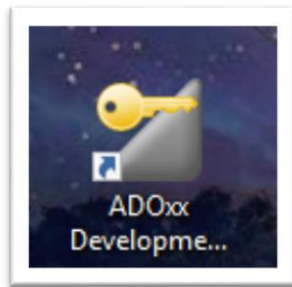
Enlargement of Parking Spaces

When the other developer want to enlarge or increase the number of parking spaces, the data modelling platform can demonstrate and simulate the results for the developers. Thus, the developers can refer to the results that shown to do further enlargement and expansion. The enlargement of the parking spaces will also would not cause any waste of money. This is due to the platform able to estimate how many carpark can allocate the desire numbers of cars that the developers wanted. On the other hands, if without the data modelling platform the developers would not able to estimate well how many carpark is needed or when is the carpark need to build at.

3.1 Introduction of ADOxx

Adoxx is a Metamodelling Platform that able to develop full-fledged Modelling Toolkit. ADOxx offers a wide range of various functionality for implementing the modelling toolkit. This Metamodelling Platform consists of two toolkit which is ADOxx Development Toolkit and ADOxx Modelling Toolkit.

3.1.1 ADOxx Development Toolkit



ADOxx Development Toolkit supports the user in developing model structures, metamodels and functionality. There consists of administration of ADOxx users and user groups, ADOxx libraries, ADOxx models and model groups are also carried out within the ADOxx Development Toolkit. Figure 3.1 shows the platform of ADOxx Development Toolkit.

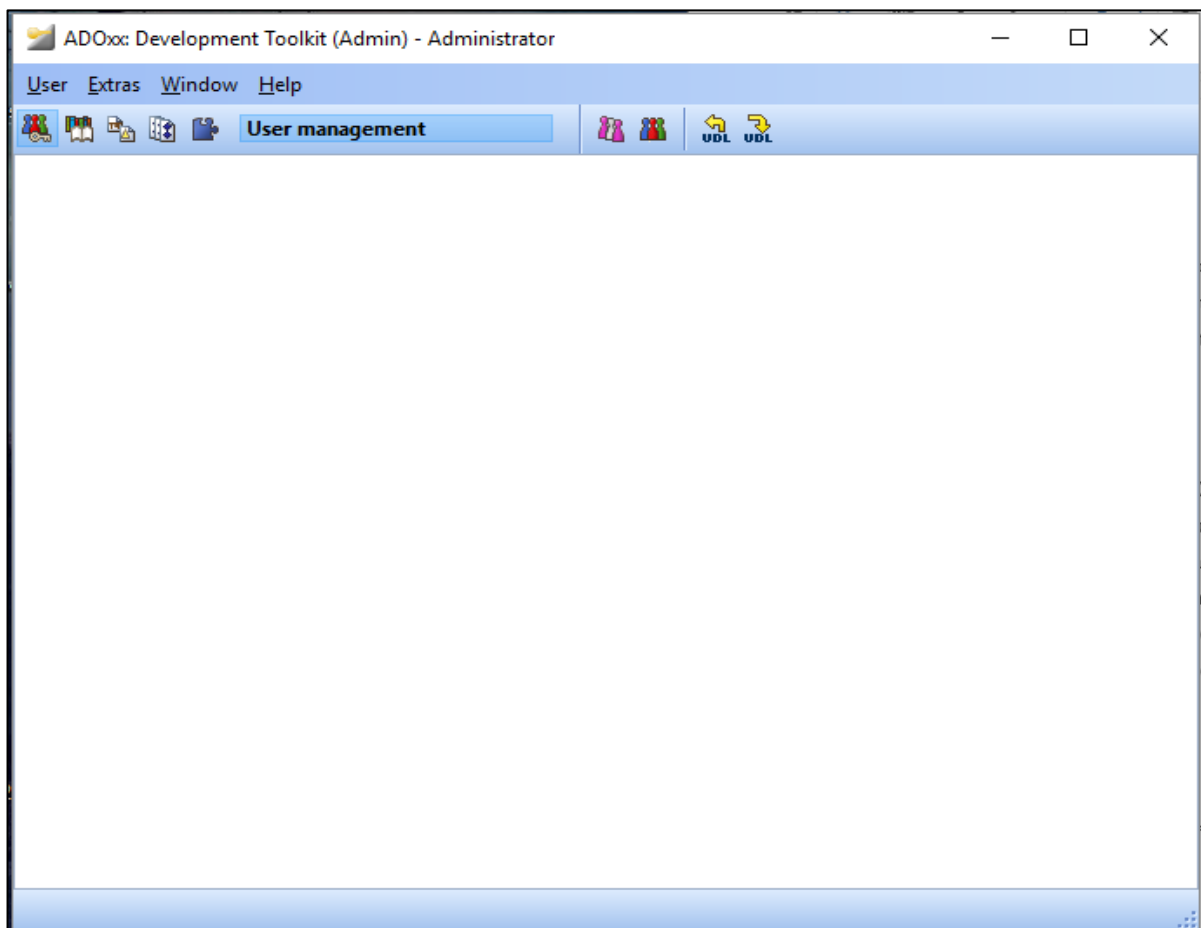


Figure 3.1: ADOxx Development Toolkit

Use Management



The User Management components allows the ADOxx developer to create and authorise ADOxx users. By assigning ADOxx users to ADOxx user groups, the access rights of the users to model groups and models can be defined. The creation, alteration and deletion of users and user groups are also possible within this component. Figure 3.2 shows the user management platform.

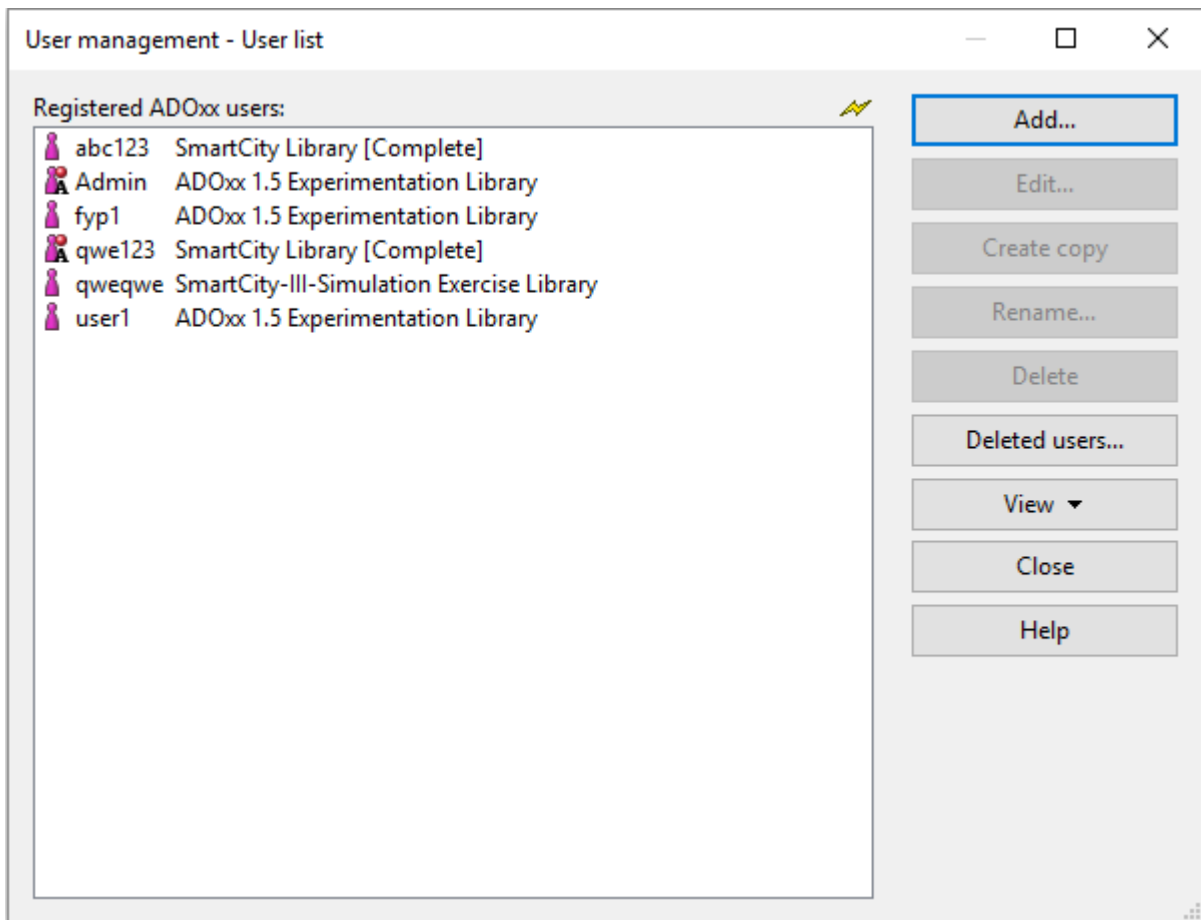


Figure 3.2: ADOxx Development Toolkit – User Management

Library Management



Library Management allows to implement a domain specific library. The library management system allows to create the class attribute, class hierarchy and relations. The library management system also allows to import and export and delete. User also allows to edit and check the library and class attributes of the application libraries takes place within this component. Figure 3.3 shows the library management platform.

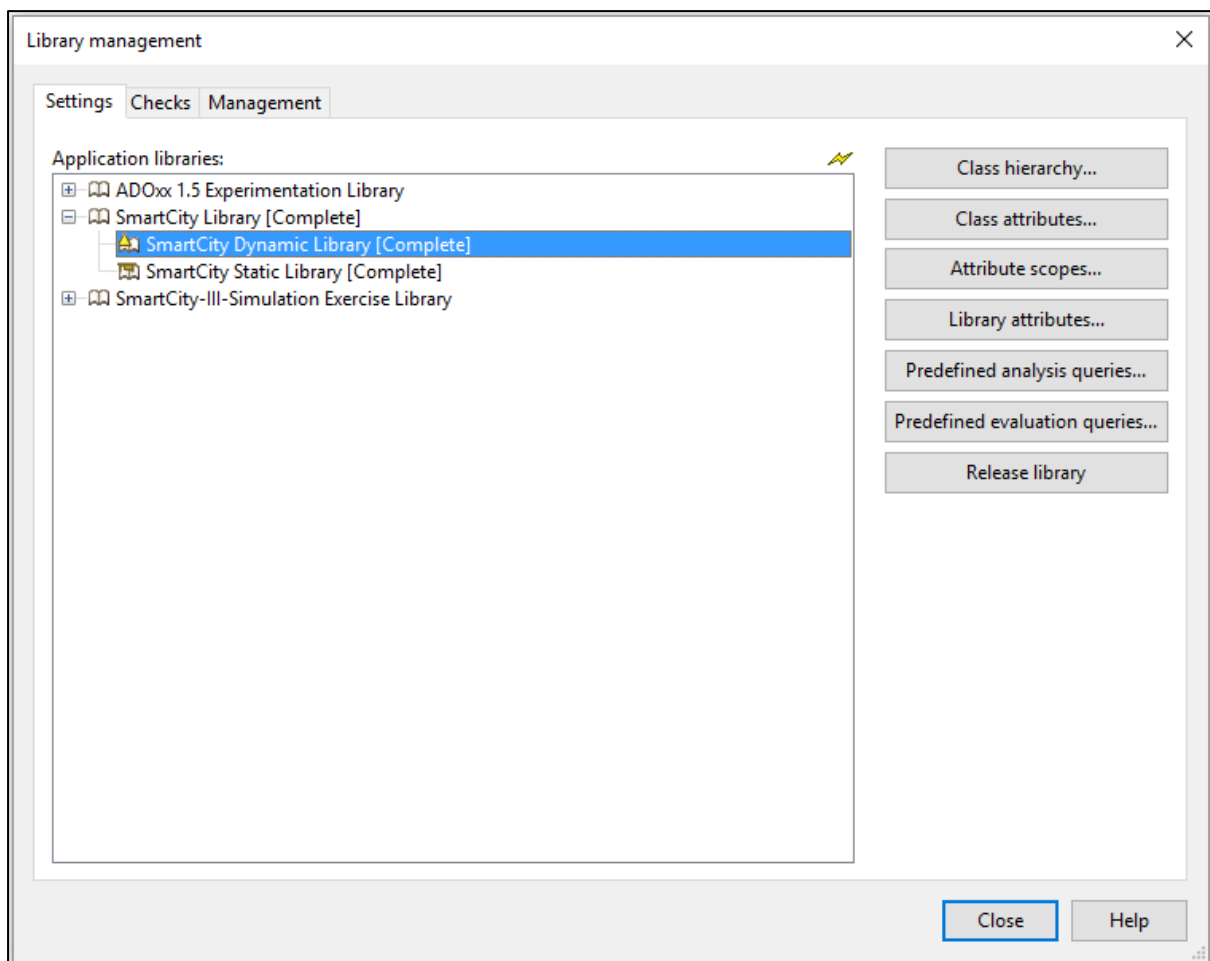


Figure 3.3: ADOxx Development Toolkit – Library Management

Model Management



The ADOxx administrator can import, export and delete ADOxx models, model groups and application models in the model management system. The access rights of user groups are assigned to ADOxx model groups as well. The administrator also can perform model groups creation and alteration. Figure 3.4 shows the model management platform.

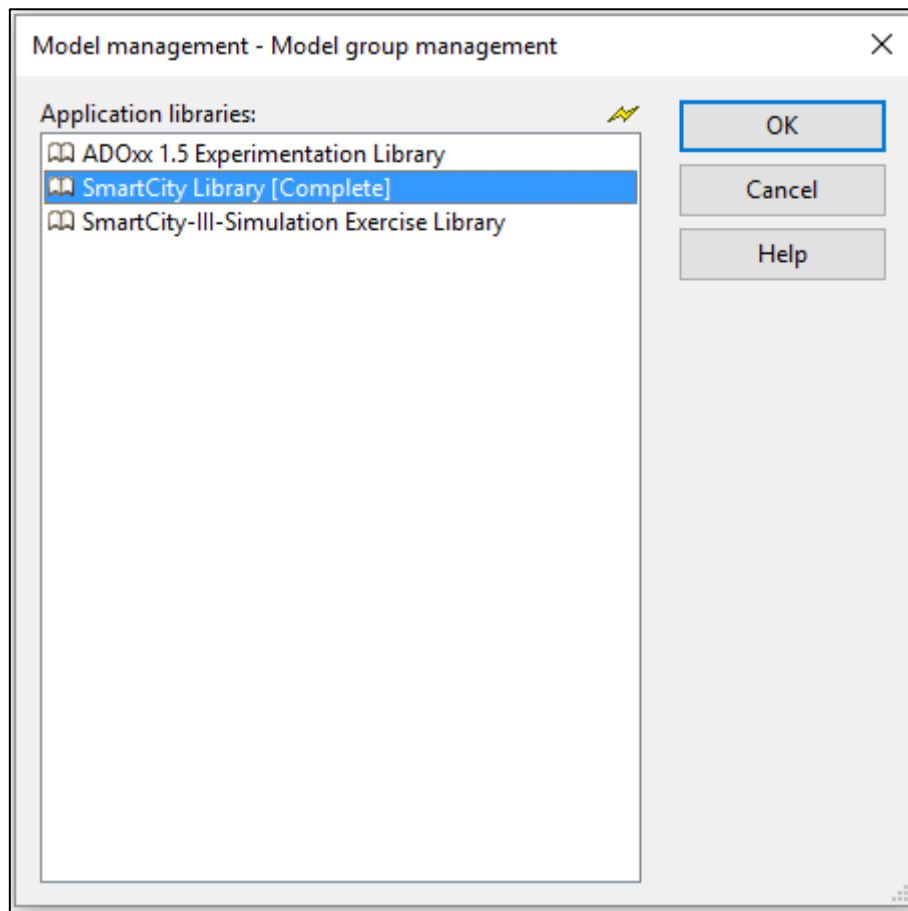


Figure 3.4: ADOxx Development Toolkit – Model Management

Attribute Profile Management



The ADOxx administrator can perform the action of add, delete, edit, export or import the ADOxx attribute profile groups in the attribute profile management. It represent the repository concept in ADOxx. It also represent one or more attributes, may be reused for any object and can be centrally maintained. Attribute profile are embedded in the user rights systems which enable unified and controlled care over attribute profile. Figure 3.5 shows the attribute profile management.

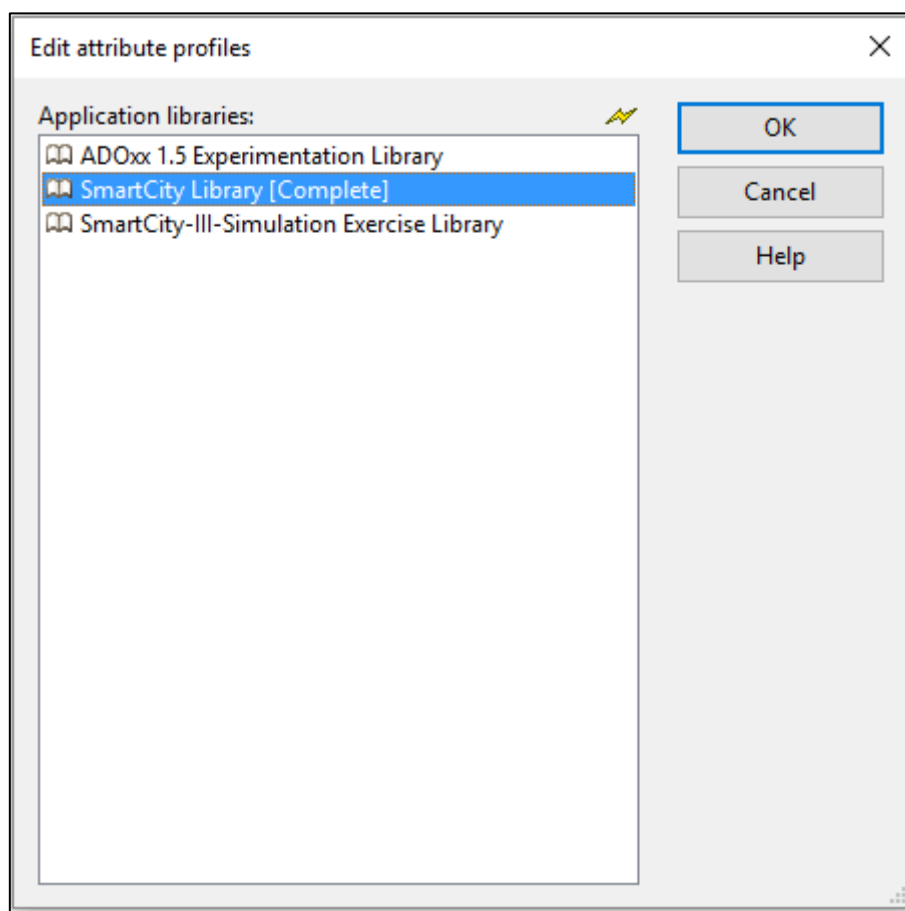


Figure 3.5: ADOxx Development Toolkit – Attribute Profile Management

Component Management



Additional components of ADOxx can be made available to the ADOxx users by using the component management. The current configuration of the Modelling Toolkit can be checked within this component. Figure 3.6 shows the component management.

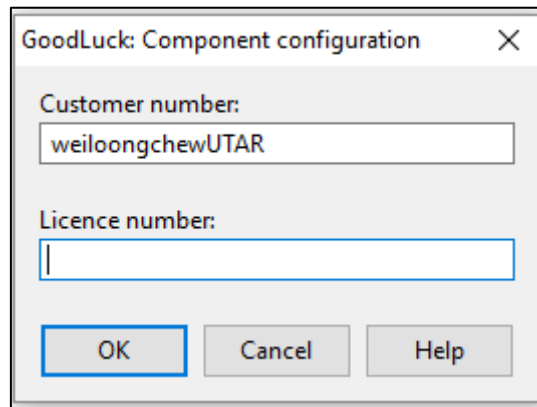
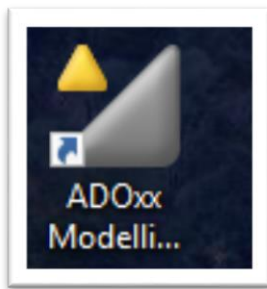


Figure 3.6: ADOxx Development Toolkit – Component Management

3.1.2 ADOxx Modelling Toolkit



ADOxx Modelling Toolkit allows the user to test and debug the implementation after the models are created. Inside the ADOxx Modelling Toolkit, it consists of large number of components and modules, which allows to analyze, simulate and evaluate the models that created. Figure 3.7 shows the platform of ADOxx Modelling Toolkit.

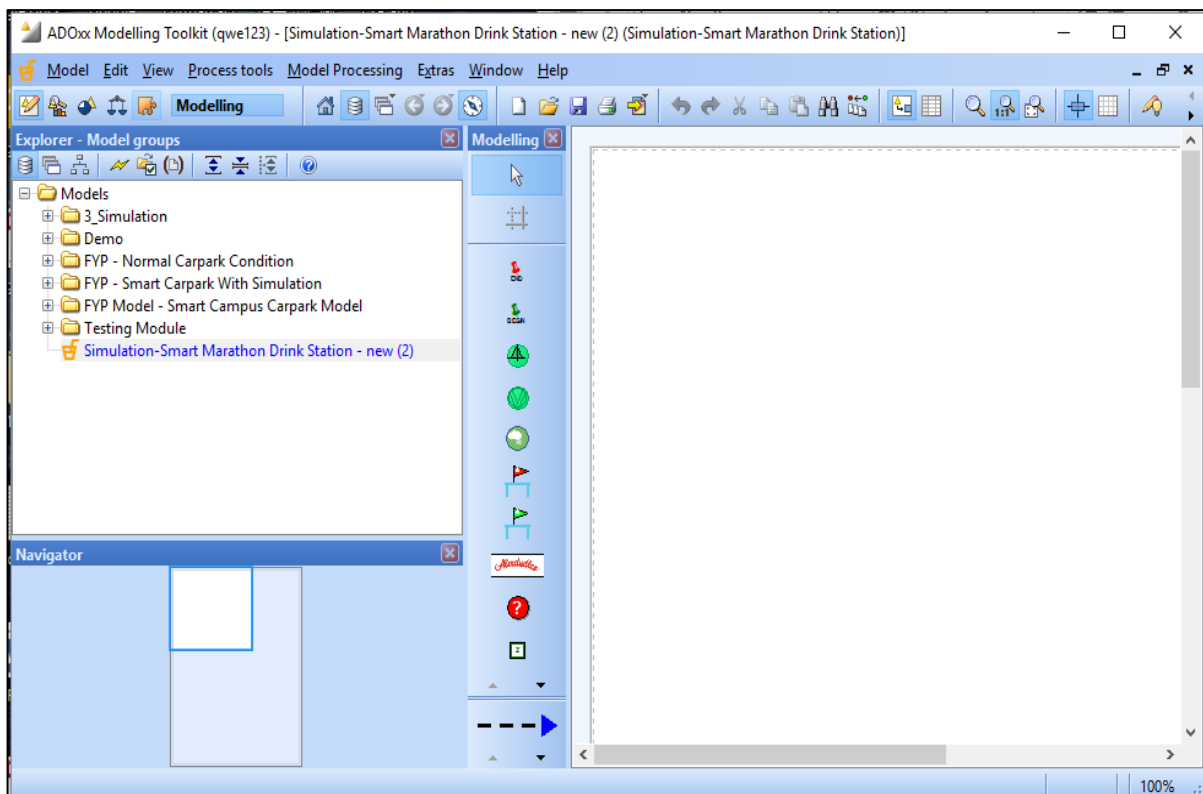


Figure 3.7: ADOxx Modelling Toolkit

Modelling



In the modelling system, the user can build the models that require. The user can create the models by using the graphical editor which provided by the system.

Analysis



In the analysis system, the user can run the queries on the ADOxx models and relation tables and predefined charts can be produced in the system as well. The results of a query can be displayed either as a table or graphically. Besides, the results can also be exported to an ASCII file. It allows the user process the results future in another application, such as, spreadsheet, word processor and so on.

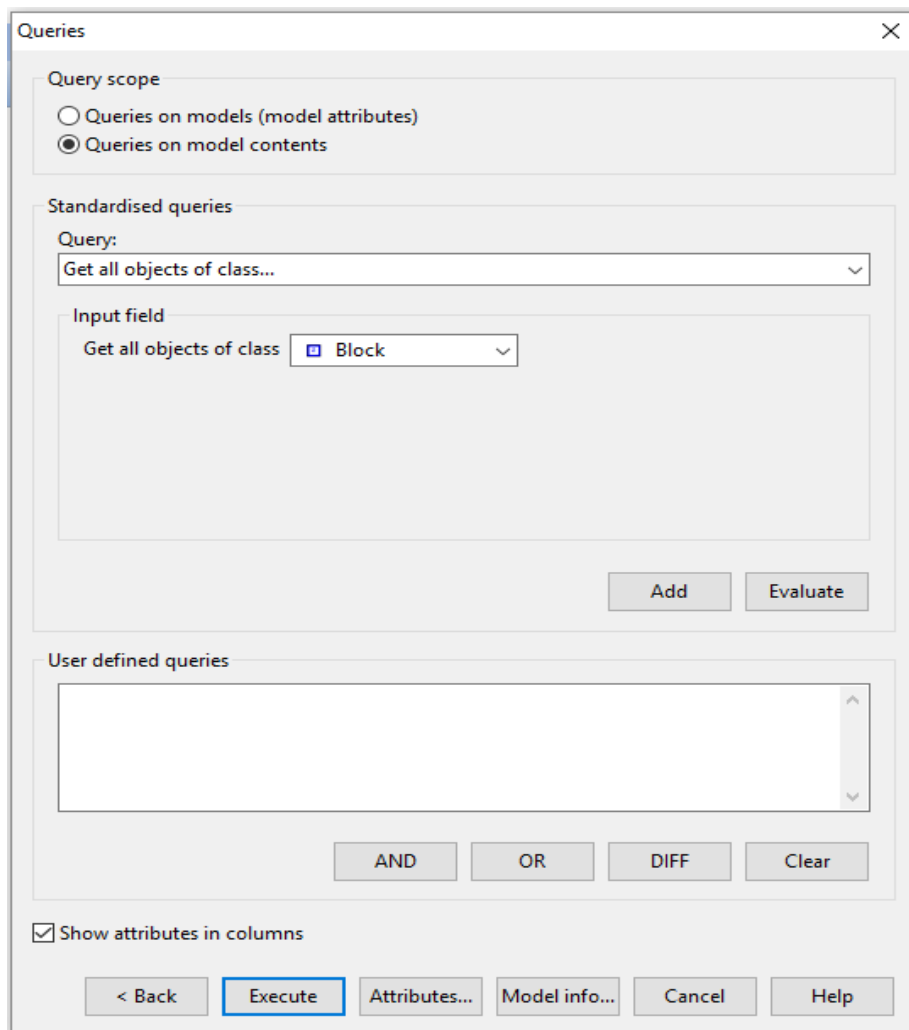


Figure 3.8: ADOxx Modelling Toolkit – Analysis Component

Simulation



The simulation system allows the user to run four simulation algorithms which is Path Analysis which simulates the process-based models, Capacity Analysis, Workload Analysis (steady state), and Workload Analysis (fixed time period) which simulate the process-based models and the corresponding Static models.

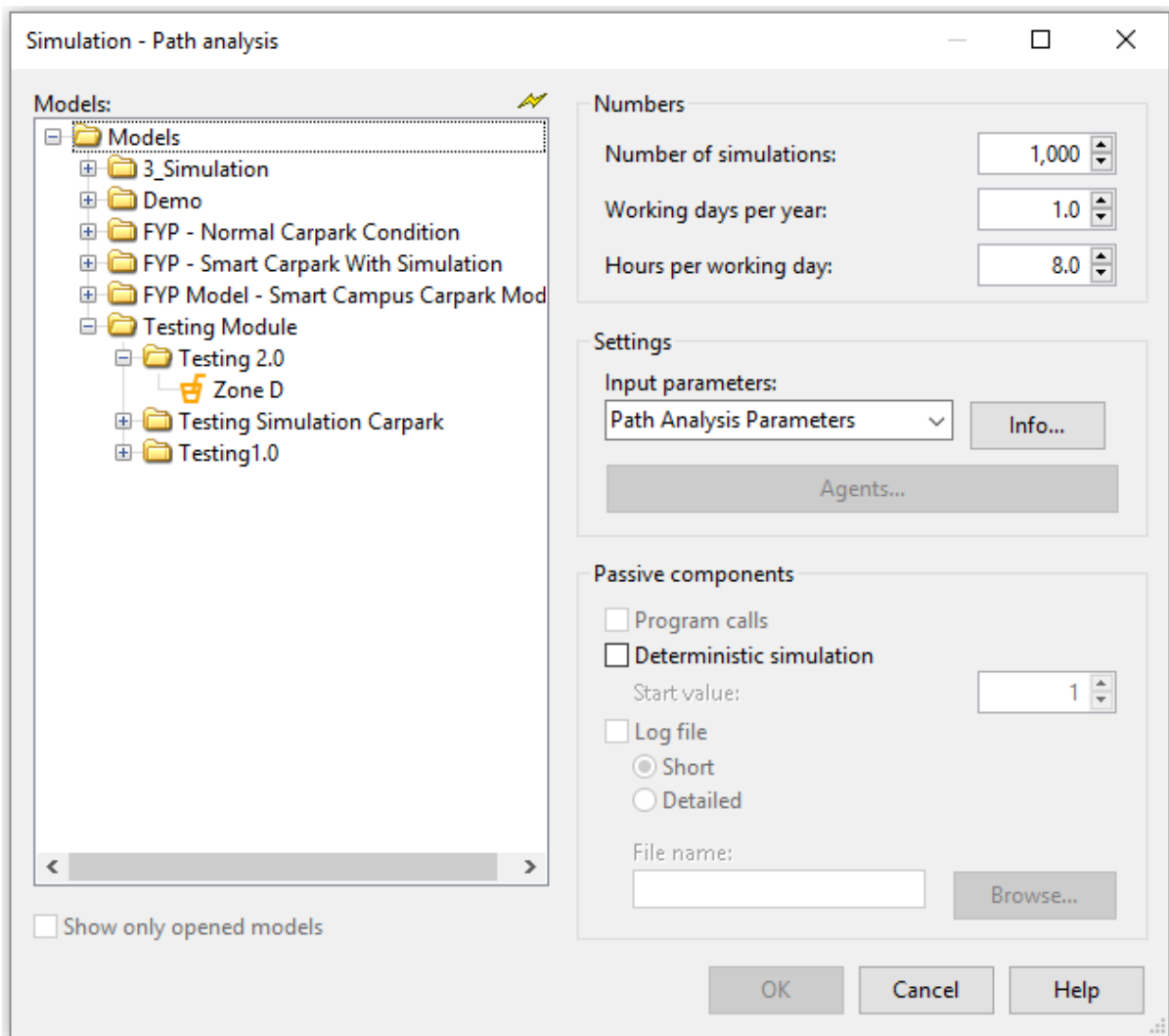


Figure 3.9: ADOxx Modelling Toolkit – Simulation Component

Evaluation



The evaluation system enable the mechanism for the evaluation of “should-be” models as real running process.

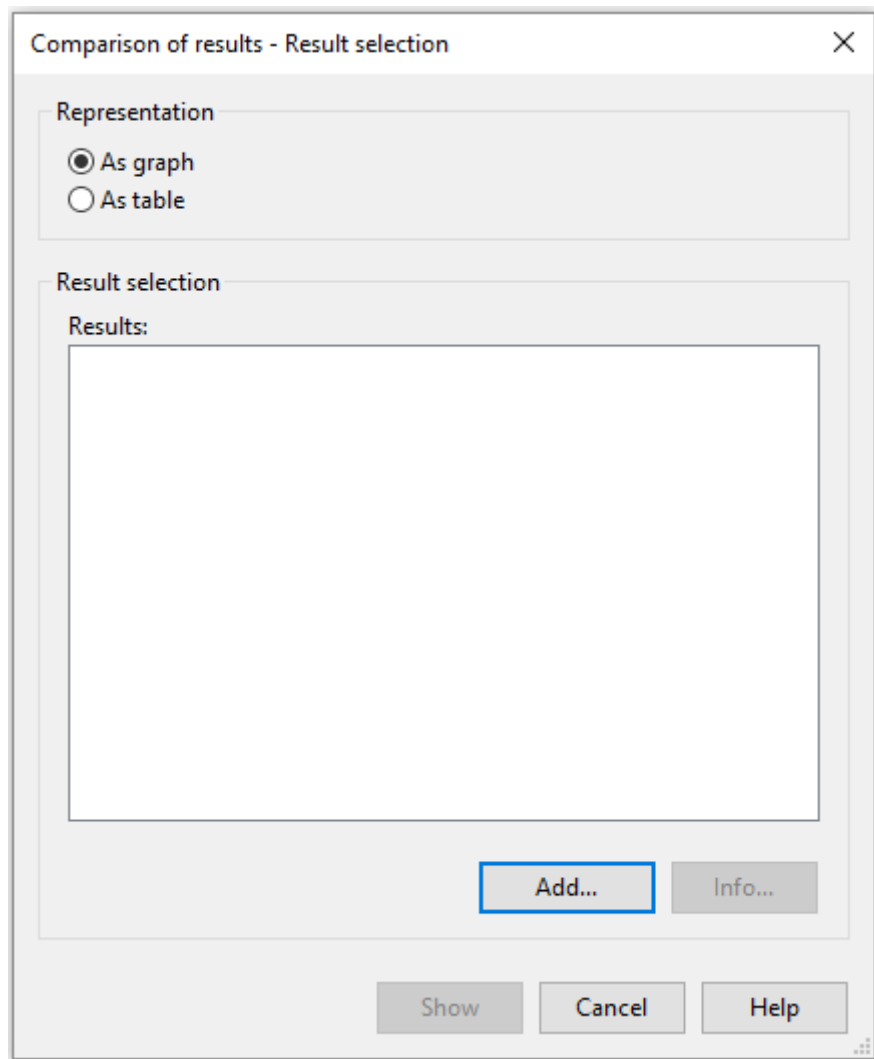


Figure 3.10: ADOxx Modelling Toolkit – Evaluation Component

Import/Export



The import/export system provides the option of exporting ADOxx models, model groups and application models into ADL or XML files as well as importing them into the ADOxx database from such files.

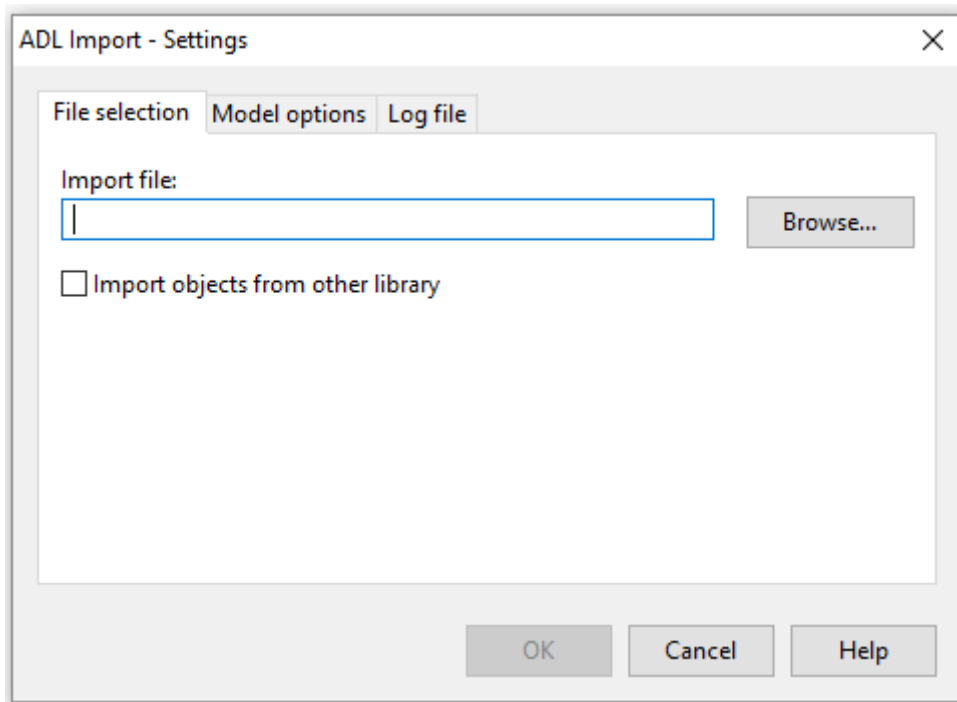


Figure 3.11: ADOxx Modelling Toolkit – Import/Export Component

3.2 Introduction of Model Design

Inside UTAR campus, there is limited parking spaces for the drivers. Thus, the drivers will definitely face the parking problem. Instead building more carpark, the system is going to help the drivers and the campus to manage well the parking condition inside the campus.

First of all the system is going to model the scenario which will encounter by the driver inside the campus. For example, the driver which study at block D. Before he manage to search for the parking space. He will go through Zone D. In Zone D area, there consists of Block D, and 2 Carpark. If the driver unable to get the parking space in Zone D then he will start to search the parking space either in Zone E or Zone F as shown in Figure 5.5: Design the Dynamic Model.

In the system, there is the chance or probability value that assign to each Carpark. Where the rules for the probability is the nearer to the destination which the driver wish to go, the higher the probability of the Carpark he will get. For example, the driver wish to go to Block D, then the probability that he search parking space in Carpark D is higher than other Carpark as shown in Figure 5.7: Assign the Probability Value.

At this point, the probability that assign is according to the Rank Order Centroid which used in modelling human decision logic. Rank Order Centroid Equation:

$$\text{Weigh } t_i = \left(\frac{1}{n}\right) \sum_{i=1}^n \left(\frac{1}{i}\right)$$

Where: Number of criteria (n) – the number of decision components being evaluated.

By using the Rank Order Centroid, we can estimate the chance that the normal human will made. For example, there is three criteria that allow the human choose, through the calculation of Rank Order Centroid the higher probability that he will made is 0.28 (approximate 0.30).

After the modelling is create and all conditions are set. The system are go through the simulation process. During the simulation process there are few data that could analyze from the results. Such as, how many car will park at the particular carpark, how much occupancy (workload) of the particular carpark, how much time the driver need to spend in order to find parking space and so on.

Lastly, the simulated results will go through some analyze and the threshold value will be produced depends on the occupancy (workload) of the particular carpark.

3.2.1 Introduction of Model

3.2.1.1 Dynamic Model

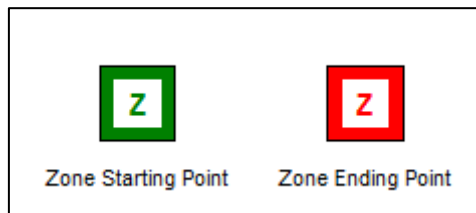


Figure 3.12: Zone Model

Zone – Represent the Zone of particular Block. Classified into two type, Starting Point of Zone and Ending Point of Zone as shown in Figure 3.12.



Figure 3.13: Carpark Model

Carpark – Represent the Carpark of particular Block.



Figure 3.14: Decision Model

Decision Point – Represent the state that the decision start to make.



Figure 3.15: Smart Variable Model

Smart Variable - Variables are used in models in order to define transition conditions.

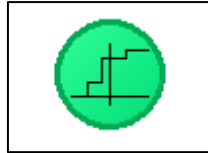


Figure 3.16: Variable Generator Model

Variable Generator - The random generator is used to assign values to variables. The variable may be assigned with a value by a normal, exponential, uniform or discrete distribution function.

3.2.1.2 Static Model

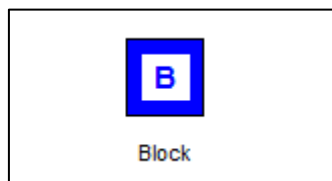


Figure 3.17: Block Model

Block – Represent the particular Block in the campus.

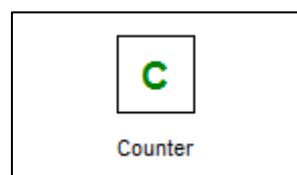


Figure 3.18: Counter Model

Counter - The objects of this class represent the particular performers within the working environment. Each performer may have one or more roles and may belong to one or more organizational units. A performer may also be the manager of one or more organizational units.

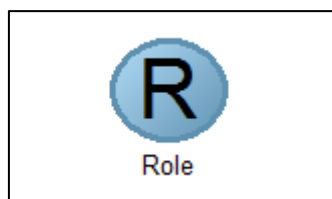


Figure 3.19: Role Model

Role – Represent the role for the particular performer.

3.2.1.3 Specified Relationship between the Attributes

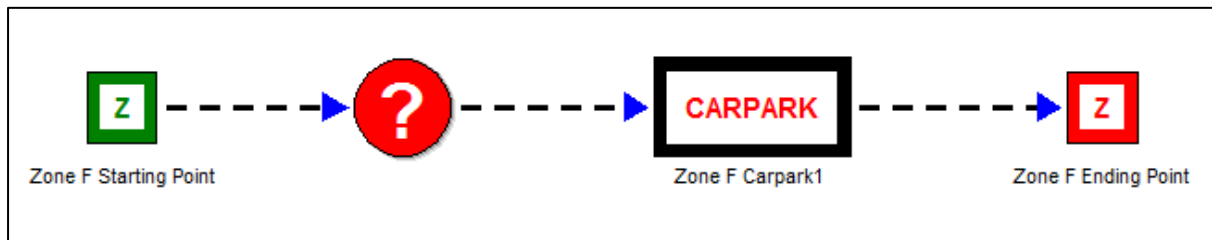


Figure 3.20: Relationship Explanation

In Figure 3.20, it shows that the Zone F starting point is linking with the decision making model then link to carpark and lastly is linking to the Zone F ending point. In this state, when the drivers are enter to the Zone F staring point it will go to decision making model and make some choices before they enter to the Zone F Carpark1. After the decision is make, then the drivers will enter to the particular carpark then lastly will left the carpark and enter Zone F ending point.

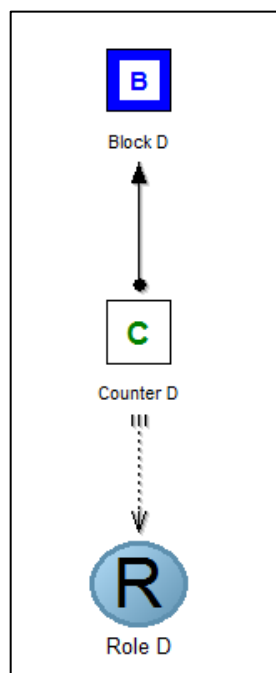


Figure 3.21: Relationship Explanation

In Figure 3.21, it shows that the Counter D belongs to Block D and has a specified role. The role of the Counter D is to count the numbers of car that enter to the specified carpark.

3.2.2 Worst Case

In order to get the better comparison with the smart parking module, the project also create the normal scenario which without the complex and intelligent simulation model named “Normal Carpark Condition”. The parameter that used to compare between the worst case and the best case is through the occupancy (workload) of the carpark.

There have 200 drivers having class at block D. when the 200 drivers wish to go Block D. They will start to search at Zone D Carpark. If failed to get the parking space at Zone D Carpark. They will start to make decision whether want to go to Zone E or Zone F Carpark. The scenario shows in Figure 3.22.

The model must follow some rules and regulations.

1. All the value that assign in the variable generator model will calculate through the Rank Order Centroid.
 - a. The nearer the Carpark near to the destination, the higher probability that assigned to.
2. The time that the drivers park at the parking space at particular Zone (Execution Time).
 - a. Zone D Carpark – 2 minutes
 - b. Zone E Carpark – 1 minutes
 - c. Zone F Carpark – 1 minutes
3. The time that the drivers drive from one carpark to another carpark (Transport Time).
 - a. Zone D Carpark to Zone E Carpark – 5 minutes
 - b. Zone D Carpark to Zone F Carpark – 5 minutes
4. The time that the drivers look around to search for parking space (Resting Time).
 - a. Zone D Carpark – 5 minutes.
 - b. Zone E Carpark – 5 minutes.
 - c. Zone F Carpark – 5 minutes.

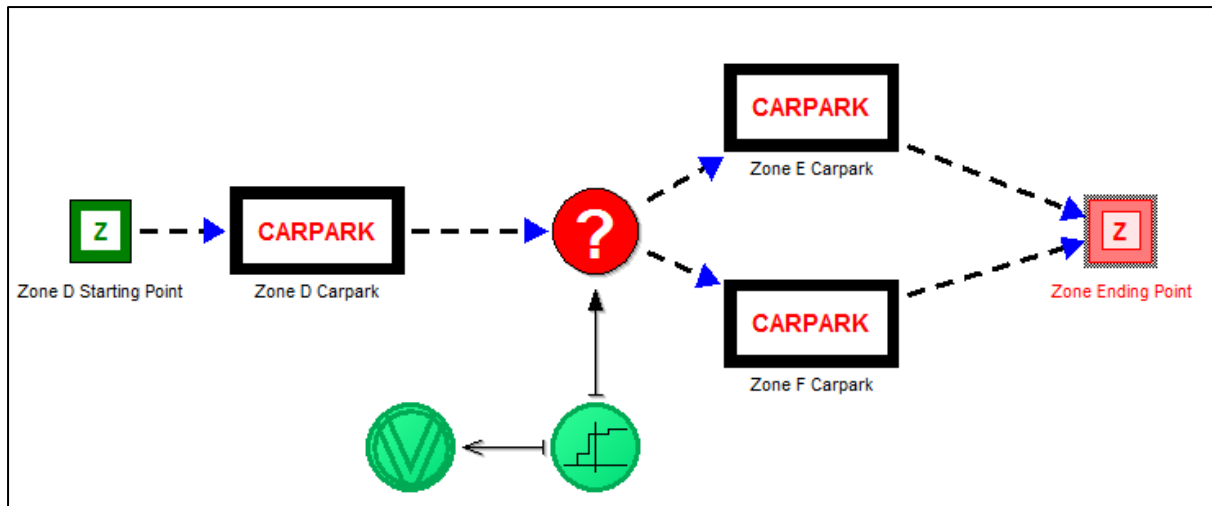


Figure 3.22: Worst Case

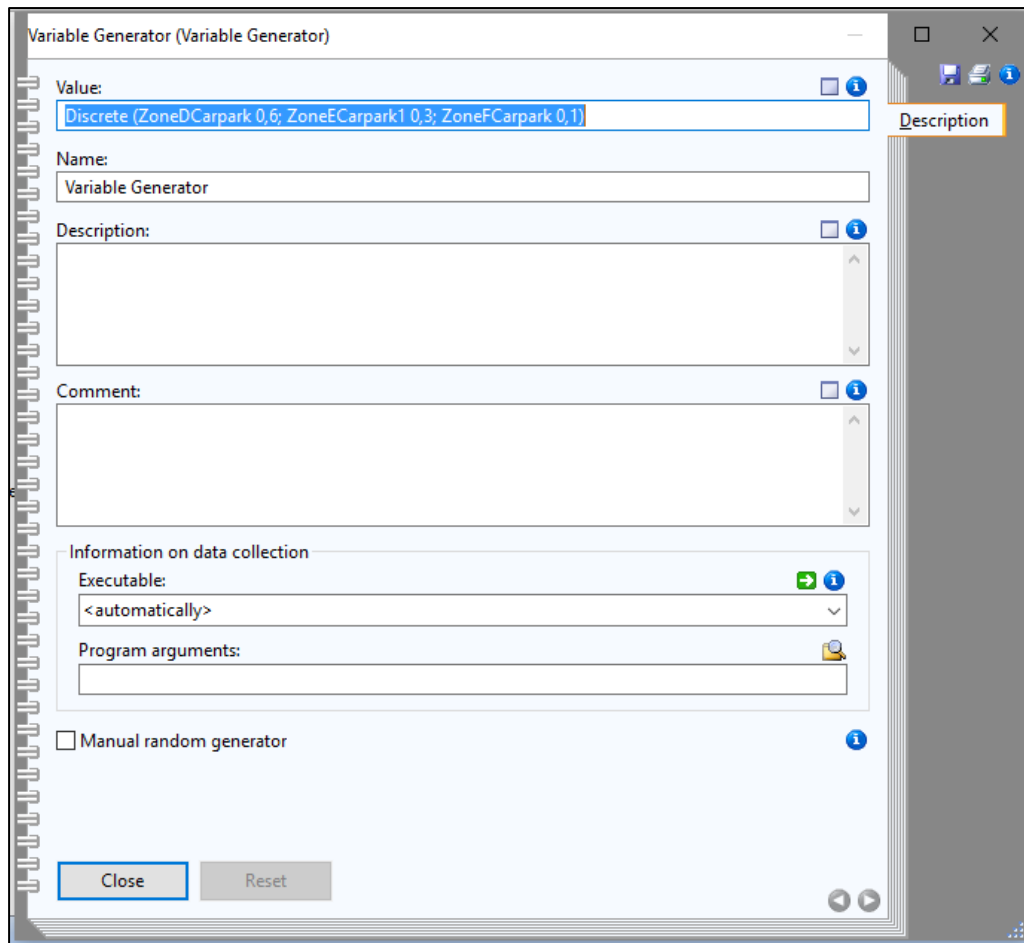


Figure 3.23: Worst Case - Variable Generator

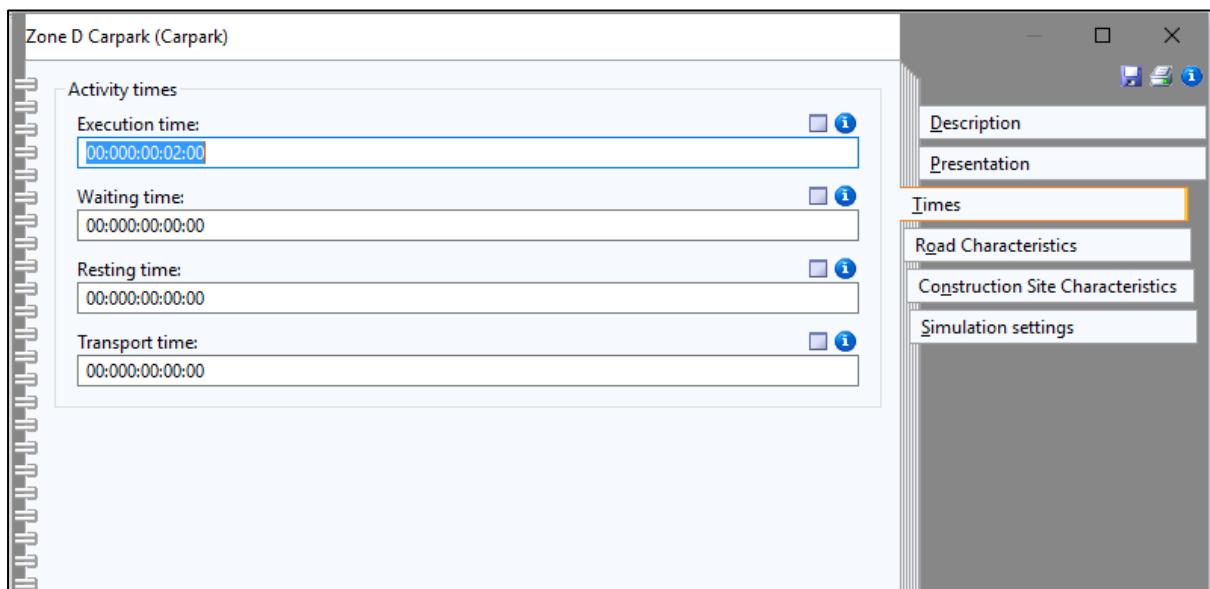


Figure 3.24: Worst Case - Execution Time Setting

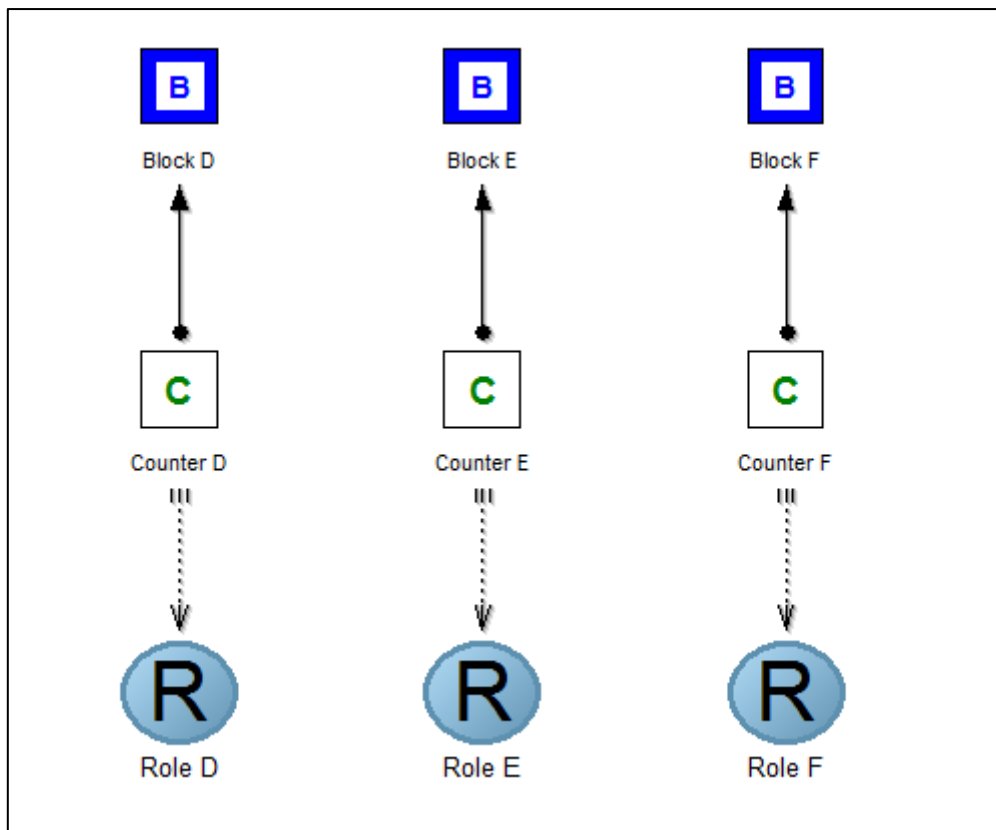


Figure 3.25: Worst Case - Static Model Setting

3.2.3 Best Case

In the best case scenario, the model is create in the intelligent way. Instead of searching from one Zone to another Zone. At the end, the model able to assign the driver go to the certain Carpark. In this scenario, when the driver is reach Zone D, the driver can make a choice whether he want to find the Carpark in Zone D or straight away find the Carpark in Zone E and Zone F. The advantage of this model is to help the driver to save their time instead of keep searching around from one Zone to another Zone.

At the end, the model able to simulate the workload of the certain carpark, the number of car will go to certain carpark and the simulated results will compare with the worst case. Lastly, the simulated results will go through some calculation to obtain the final threshold of the carpark.

The purpose to obtain the threshold is to alert the driver whether the carpark still have enough parking space for them or not. If the carpark is below the threshold, the drivers have higher chance to find the parking space in that carpark. On the other hand, if the carpark is above the threshold, the drivers have lower chance to find the parking space in that carpark. However, how to use the threshold is not a concern in this project. The project is help to get the optimal threshold through modelling and also simulation.

In this best scenario the model must follow some rules and regulations.

1. All the value that assign in the variable generator model will calculate through the Rank Order Centroid.
 - a. The nearer the Carpark near to the destination, the higher probability that assigned to.
2. The time that the driver find the parking space at particular Zone (Execution Time).
 - a. Zone D Carpark – 2 minutes
 - b. Zone E Carpark – 1 minutes
 - c. Zone F Carpark – 1 minutes
3. The time that the drivers drive from one carpark to another carpark (Transport Time).
 - a. Zone D Carpark to Zone E Carpark – 5 minutes
 - b. Zone E Carpark to Zone F Carpark – 5 minutes

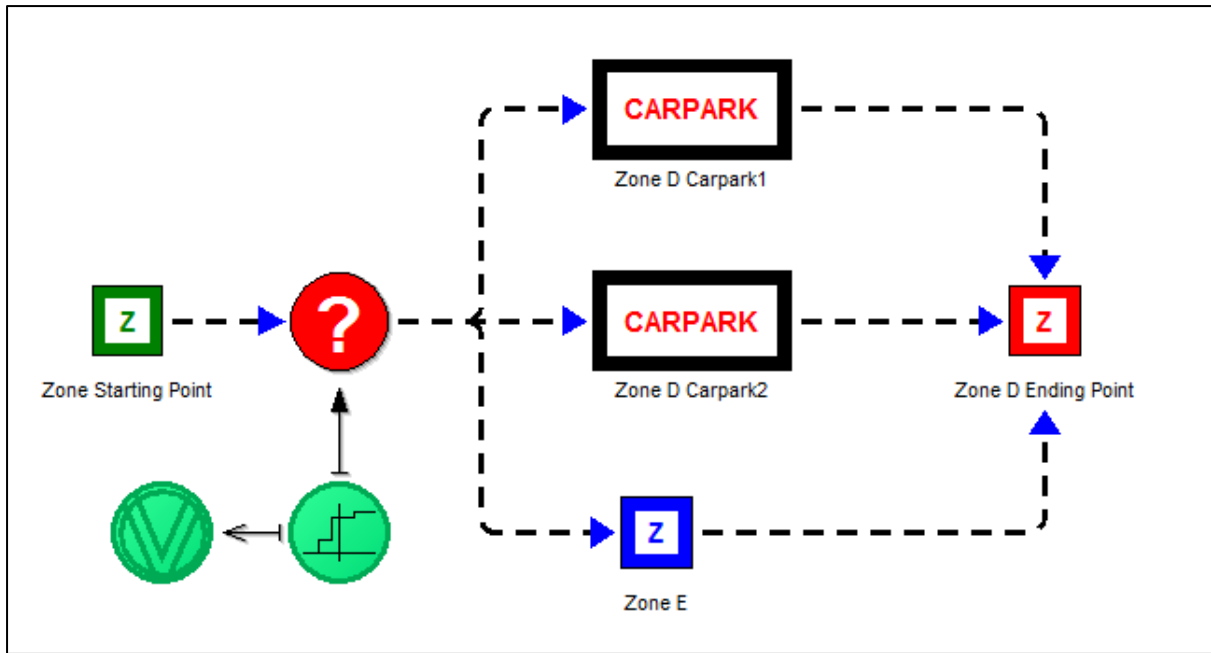


Figure 3.26: Best Case - Zone D

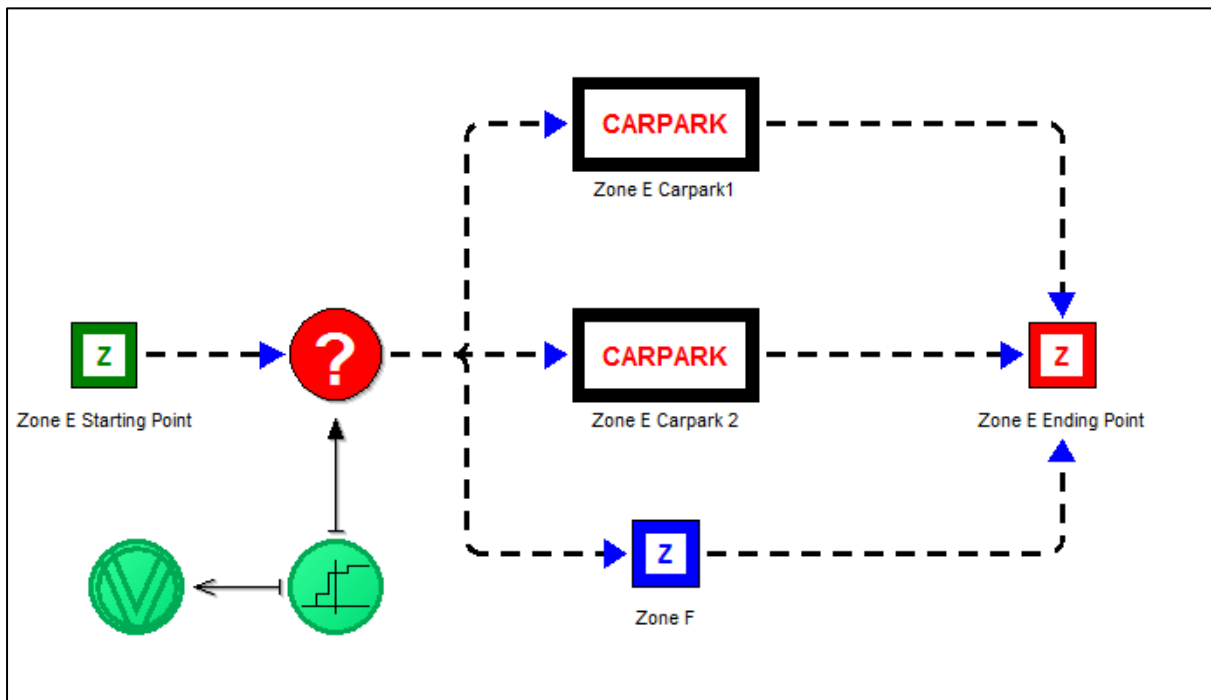


Figure 3.27: Best Case - Zone E

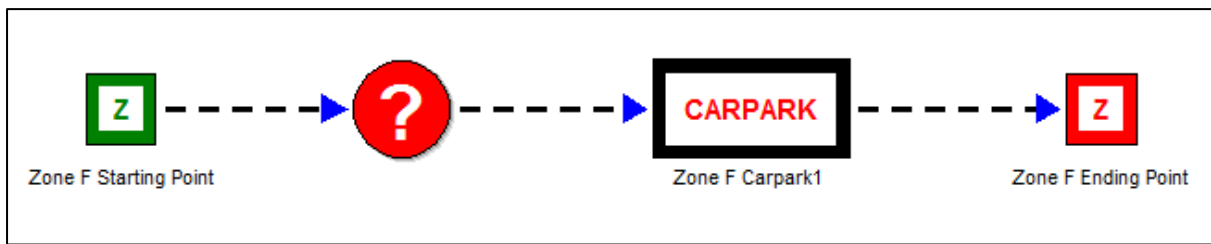


Figure 3.28: Best Case - Zone F

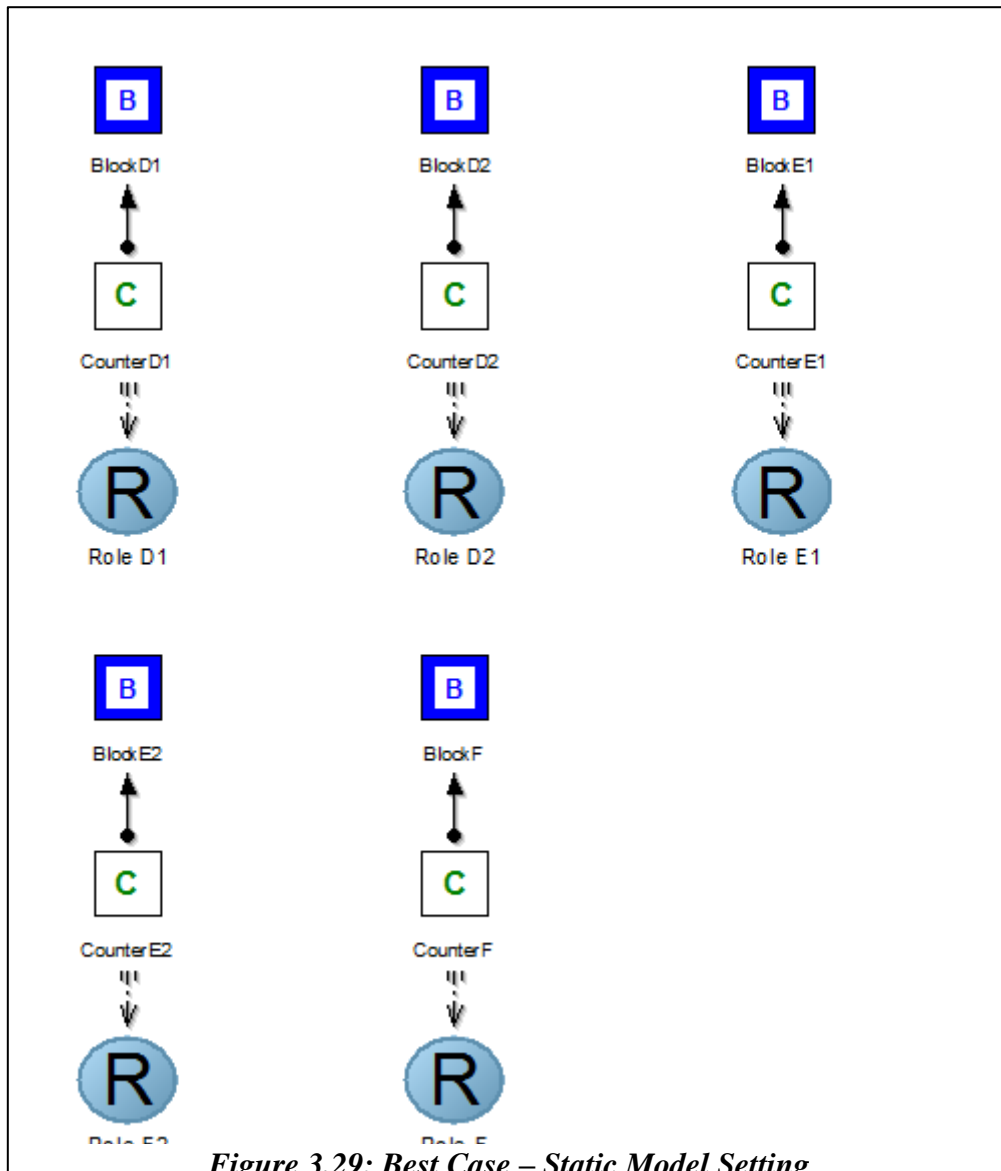
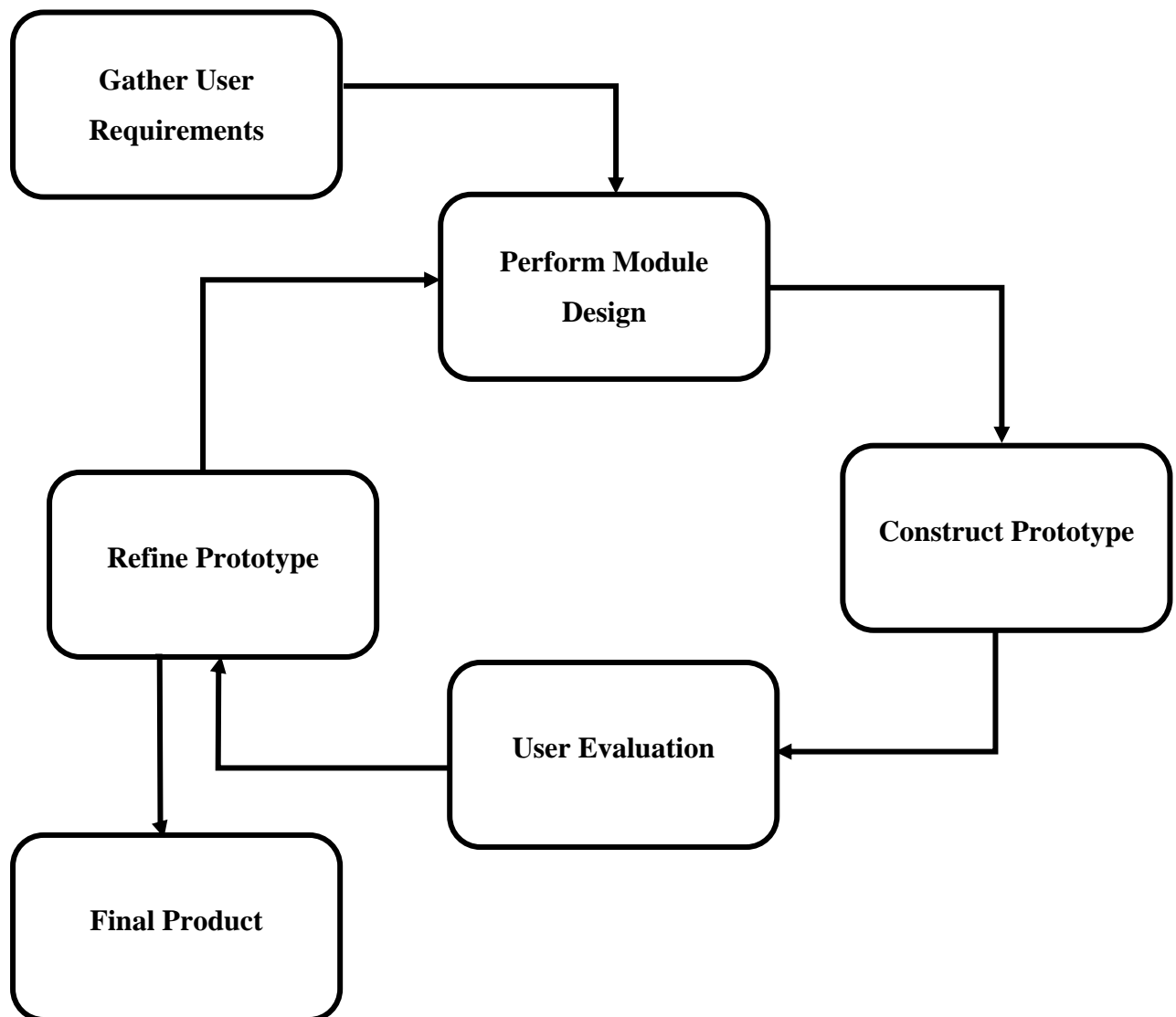


Figure 3.29: Best Case – Static Model Setting

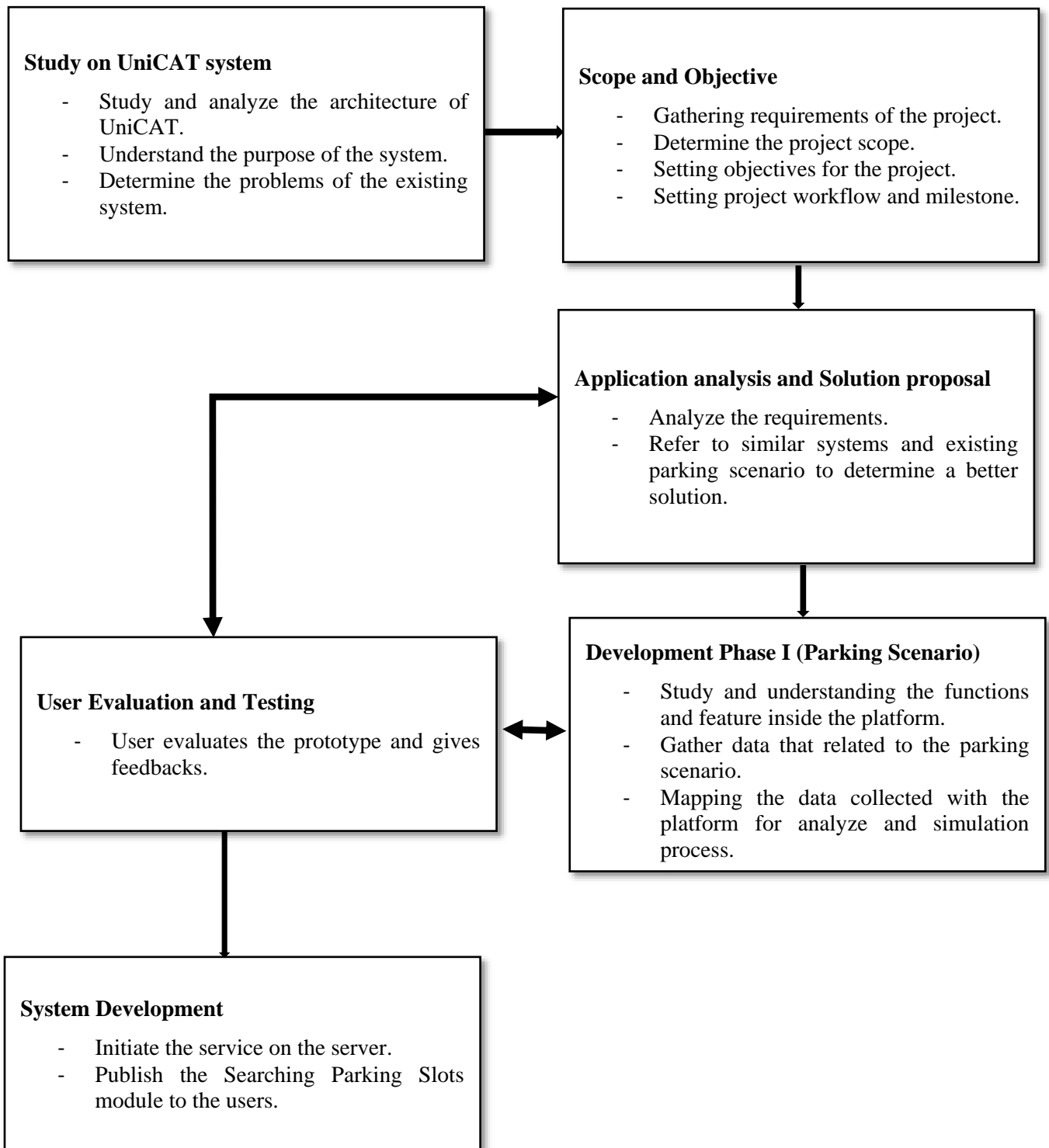
4.1 Project Methodology

In this project, Evolutionary Prototyping methodology will be applied as its software development methodology.

Evolution prototyping is a lifecycle model in which the system is developed in increments. It is based on the idea of developing an initial implementation. Thus, it is ready to be modified in response to end-user and customer feedback. The model will keep refining through many stages until an adequate system is developed.



4.1.1 General Work Procedures



4.1.2 Work Procedure Elaboration

Pre Planning Stage

Conduct some research based on the current UniCAT system. For instance, understanding the project background, functionality and features of each modules, contributions of previous developers. Start to identify the problem in the UniCAT system and the problem statements are constructed.

Planning Stage

After identify the problem of the UniCAT system, allocate the project scope based on the research and findings. The objective and expected contribution of the project are then identified from the project scope. The next step is to decide the methods use and the workflow of the project.

Analysis and Design Stage

Review several existing systems and the parking scenario that are similar to the project scope. In this process, the strengths and limitations of the system and the parking scenario are analyzed for further comparison. The results of comparison are recorded in the table. After comparing the existing system and parking scenario, a new approach is proposed.

Development Phase

Study and understanding the functions and features in the platform that chooses. After that, collect the data that related with the parking scenario. Next, maps the data collected with the platform for the purpose of analyzing and simulation.

Evaluation and Testing Stage

The prototype will be tested by the user and obtain the feedback from them. If the user request for further refinement, then the prototype will be returned to the previous phase and make the changes. This loop will keep running until the fulfil satisfaction of the user. The feedback will collect and record for the future maintenance purpose.

4.2 Tools to use

ADOxx Development Toolkit

A data modelling platform that serve the development part.

ADOxx ModellingToolkit

A data modelling platform that serve the analysis and simulation of the data that the users provide.

4.3 Timeline

Gantt Chart (Project 1 and Project 2)


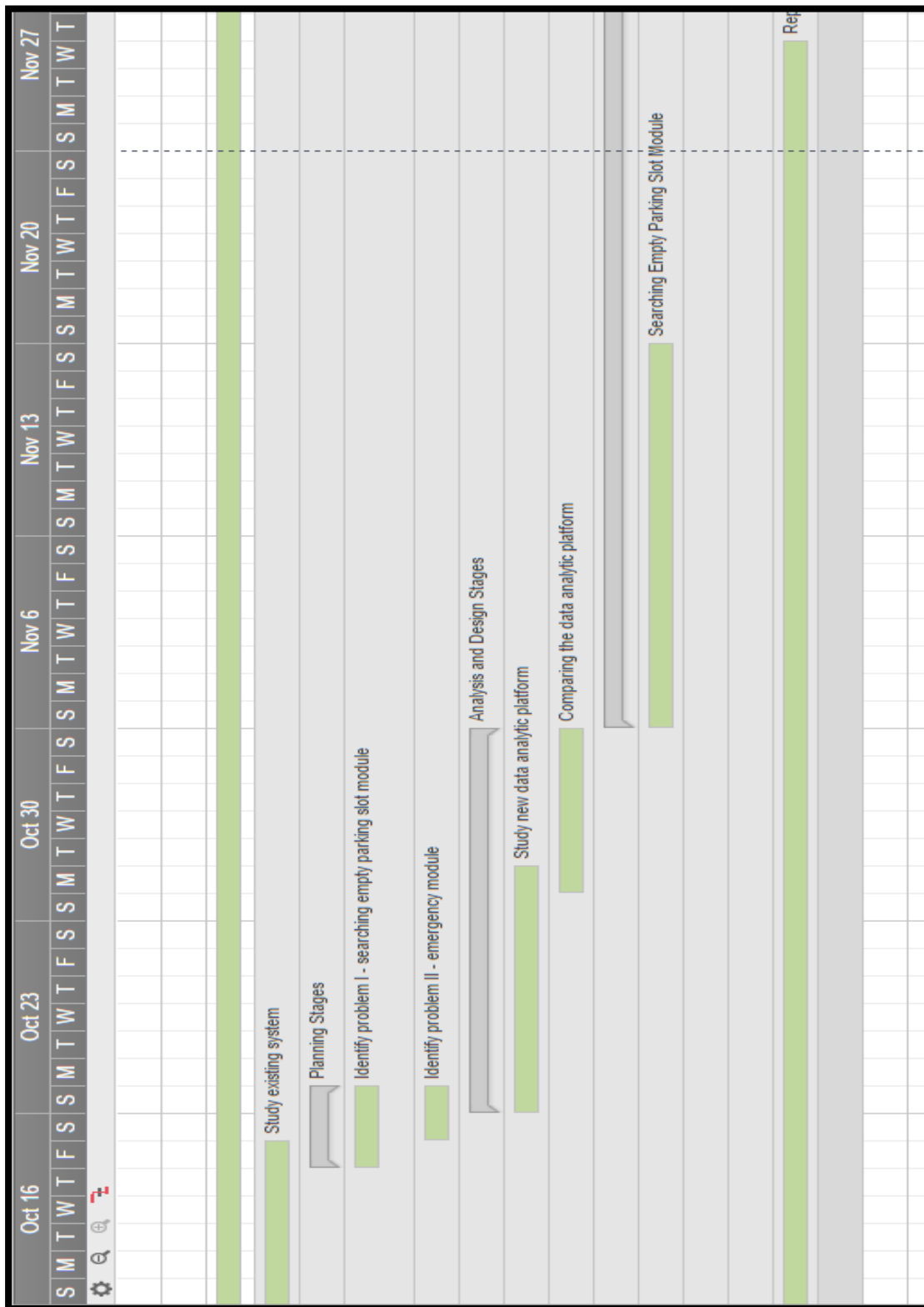
| Task Name | Start Date | End Date | Duration |
|--|-----------------|--|----------|
| Need Help? Learn more about this template. | | | |
| Enter your deadline as start and end date: | 10/16/16 | 04/21/17 | 188d |
| Study existing system | 10/16/16 | 10/21/16 | 6d |
| <input type="checkbox"/> Planning Stages | 10/21/16 | 10/23/16 | 3d |
| Identify problem I - searching empty parking slot module | 10/21/16 | 10/23/16 | 3d |
| Identify problem II - emergency module | 10/22/16 | 10/23/16 | 2d |
| <input type="checkbox"/> Analysis and Design Stages | 10/23/16 | 11/05/16 | 14d |
| Study new data analytic platform | 10/23/16 | 10/31/16 | 9d |
| Comparing the data analytic platform | 10/31/16 | 11/05/16 | 6d |
| <input type="checkbox"/> Development Stages | 11/06/16 | 01/14/17 | 70d |
| Searching Empty Parking Slot Module | 11/06/16 | 11/19/16 | 14d |
| Emergency Module | 01/01/17 | 01/14/17 | 14d |
| Evaluation and Testing Stage | 01/15/17 | 01/22/17 | 8d |
| Report 1 | 10/16/16 | 11/30/16  | 46d |
| Report 2 | 01/16/17 | 04/21/17 | 96d |

Figure 4.1 Timeline Project 1 and 2

Figure 4.2 Gantt Chart Project 1 and 2



5.1 System Implementation

5.1.1 ADOxx Development Toolkit

Step 1: Creation the new class inside the Smart City Dynamic Library as shown in Figure 5.1.

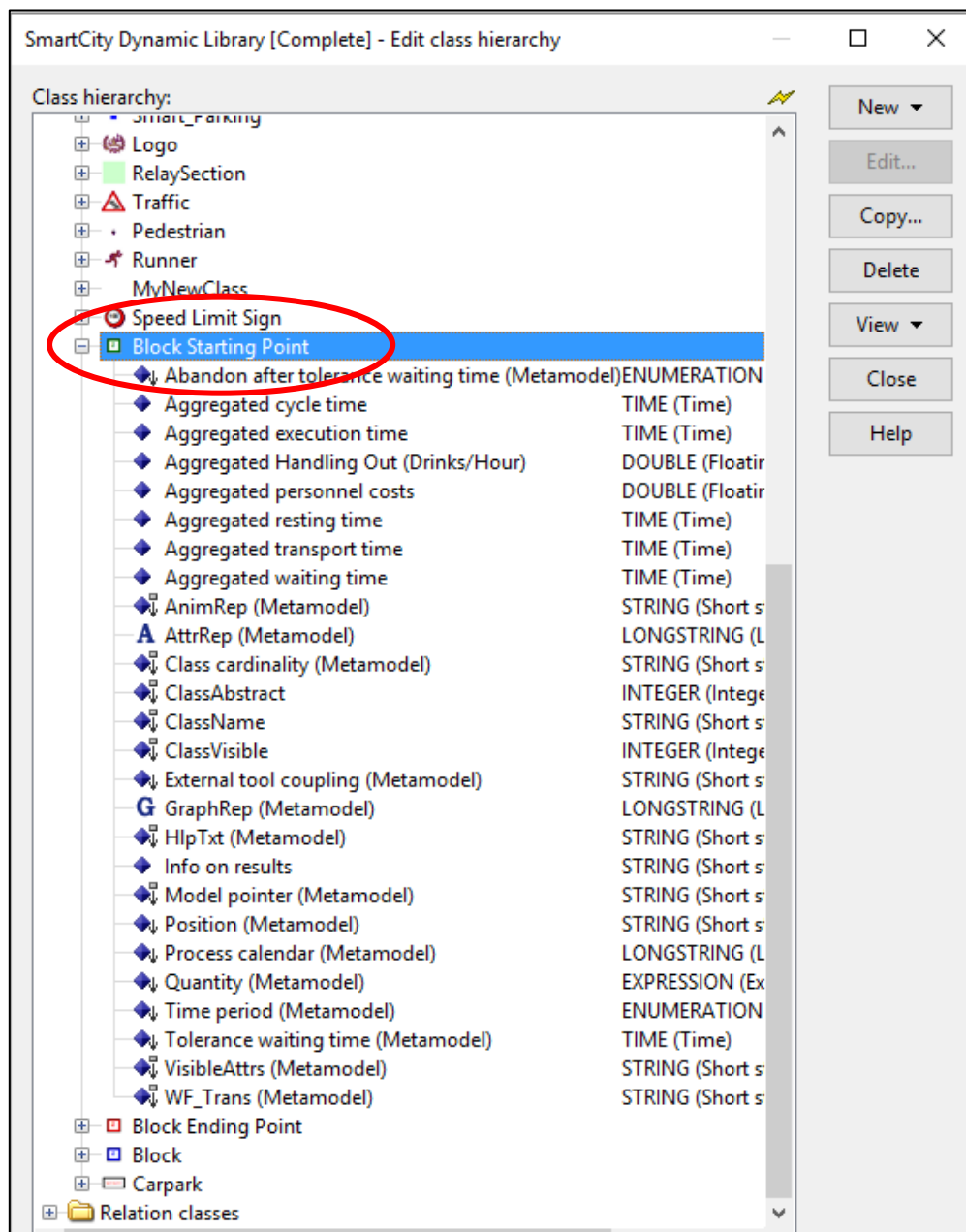


Figure 5.1: Creation of New Classes in Dynamic Library

Step 2: Creation the new classes in the Smart City Static Library as shown in Figure 5.2.

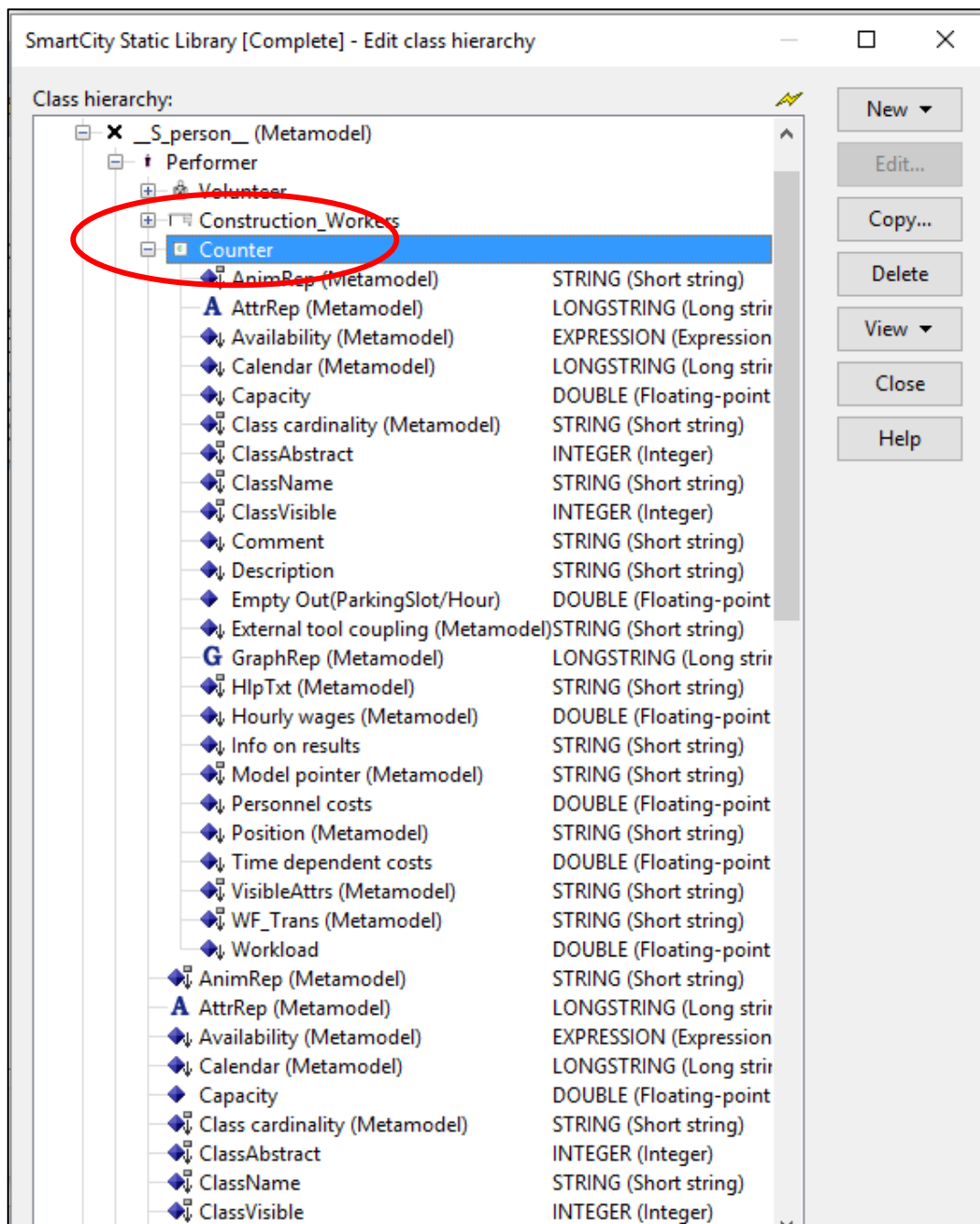


Figure 5.2: Creation of New Classes in Static Library

Step3: Addition the new class in the library attributes as shown in the Figure 5.3.

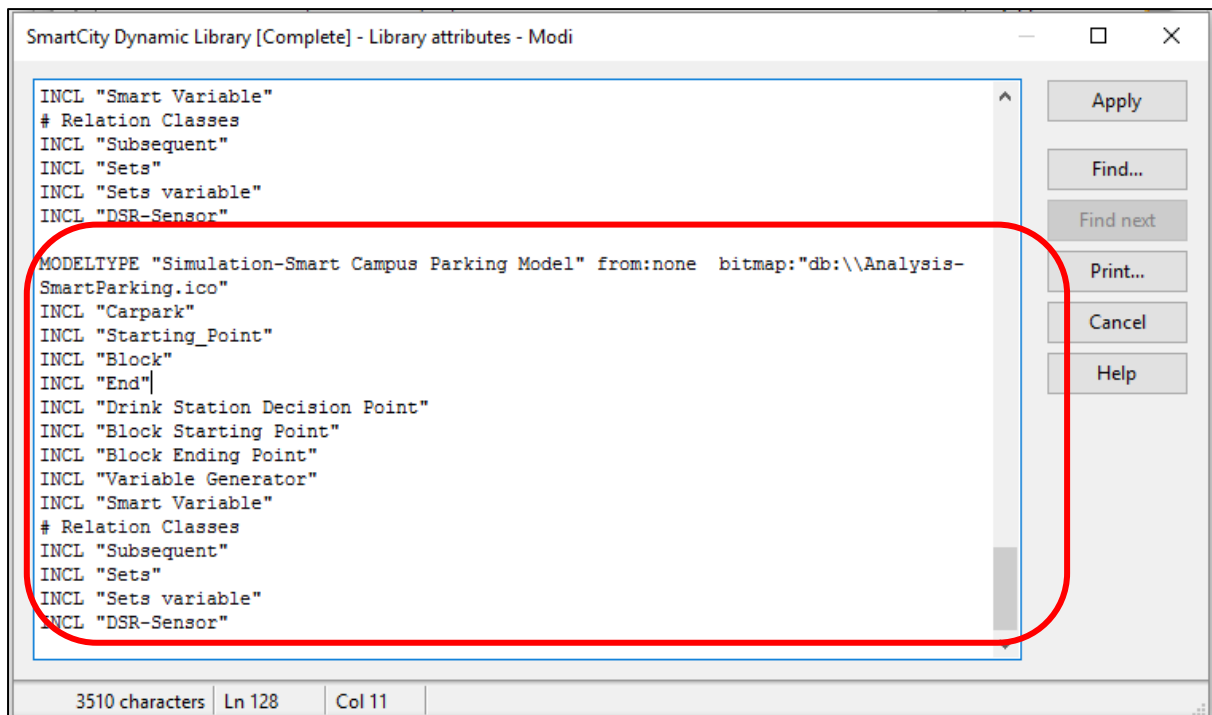


Figure 5.3: Addition the new class in the library attributes

5.1.2 ADOxx Modelling Toolkit

Step 4: Creation of new model as shown in Figure 5.4.

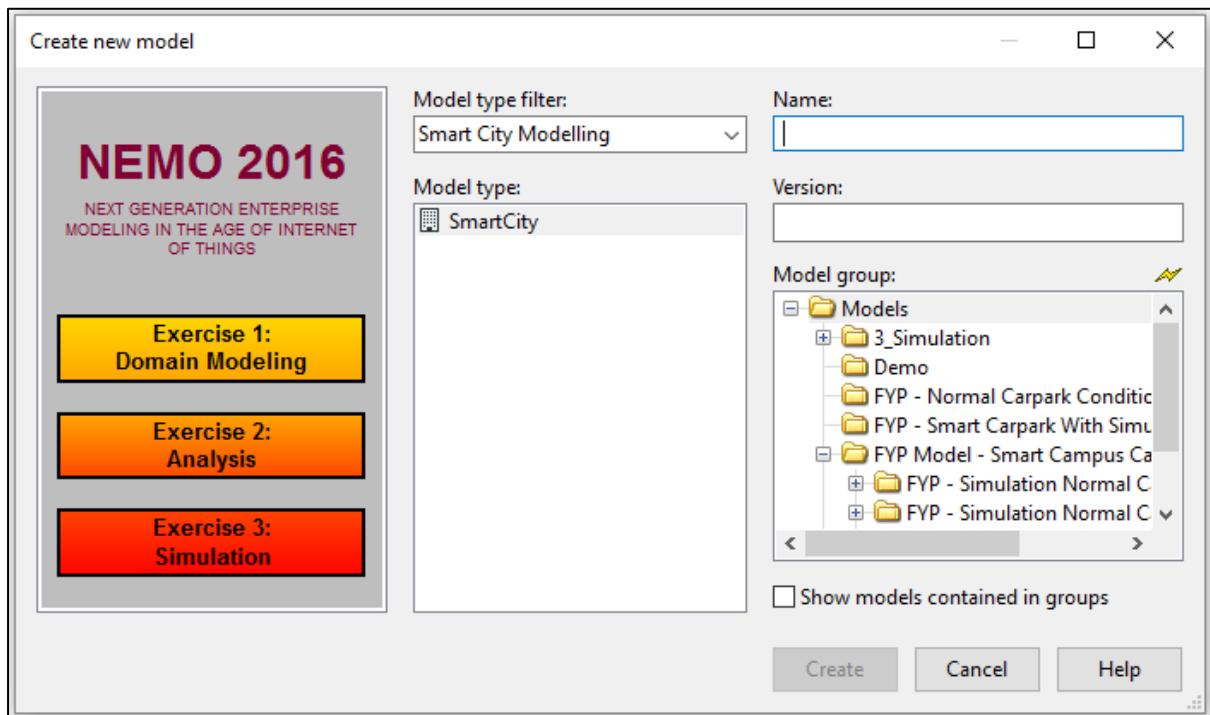


Figure 5.4: Creation of the Model

Step 5: Design the dynamic model as shown in Figure 5.5.

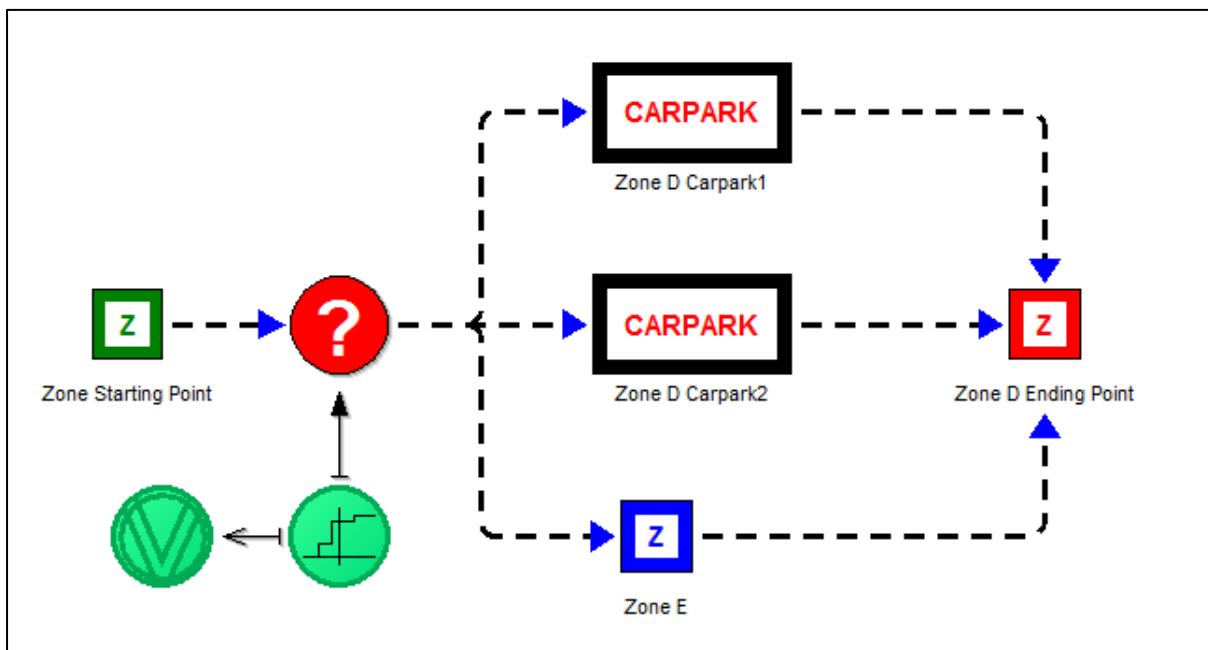


Figure 5.5: Design the Dynamic Model

Step 6: Design the Static Model as shown in Figure 5.6.

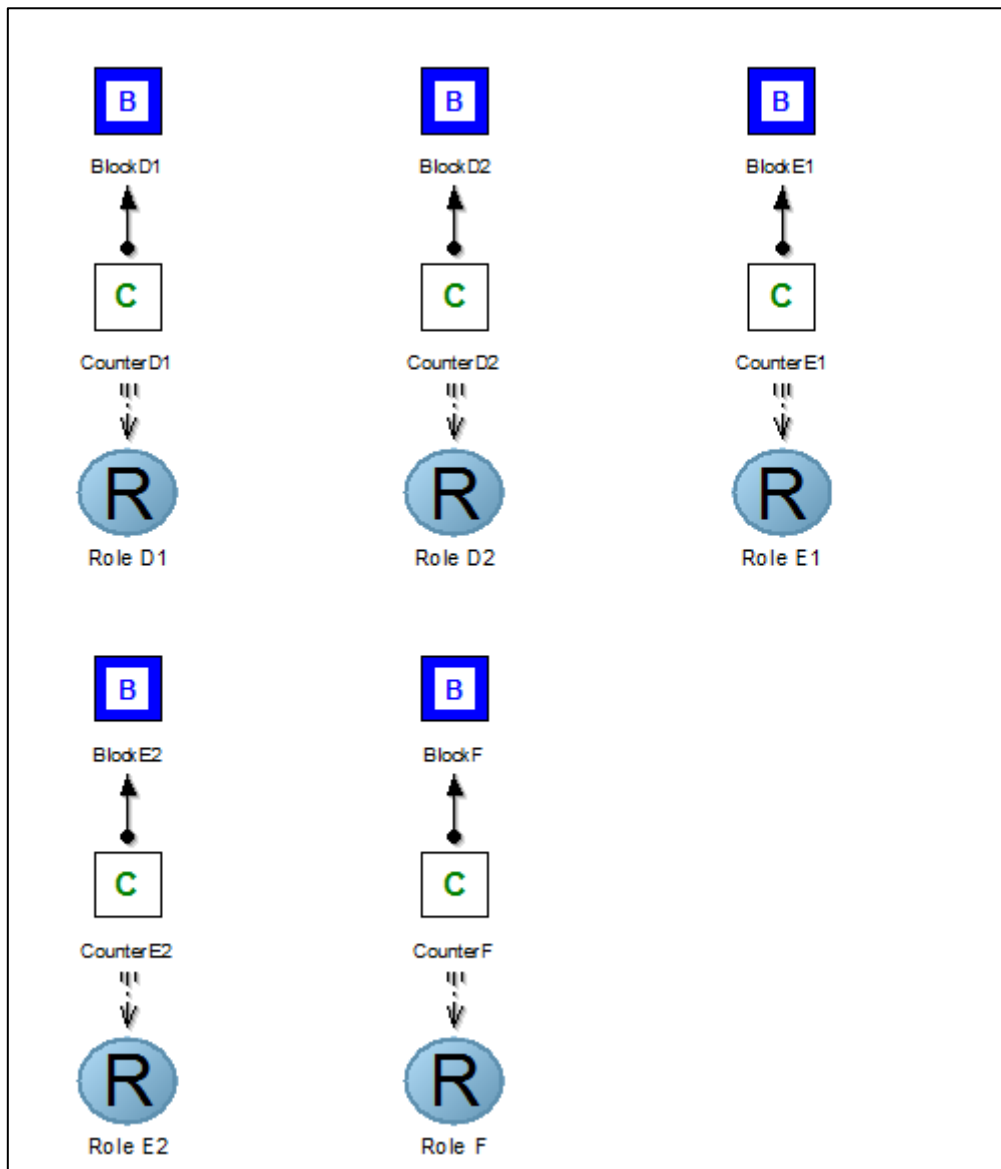


Figure 5.6: Design the Static Model

Step 7: Assign the probability value in the variable generator as shown in Figure 5.7.

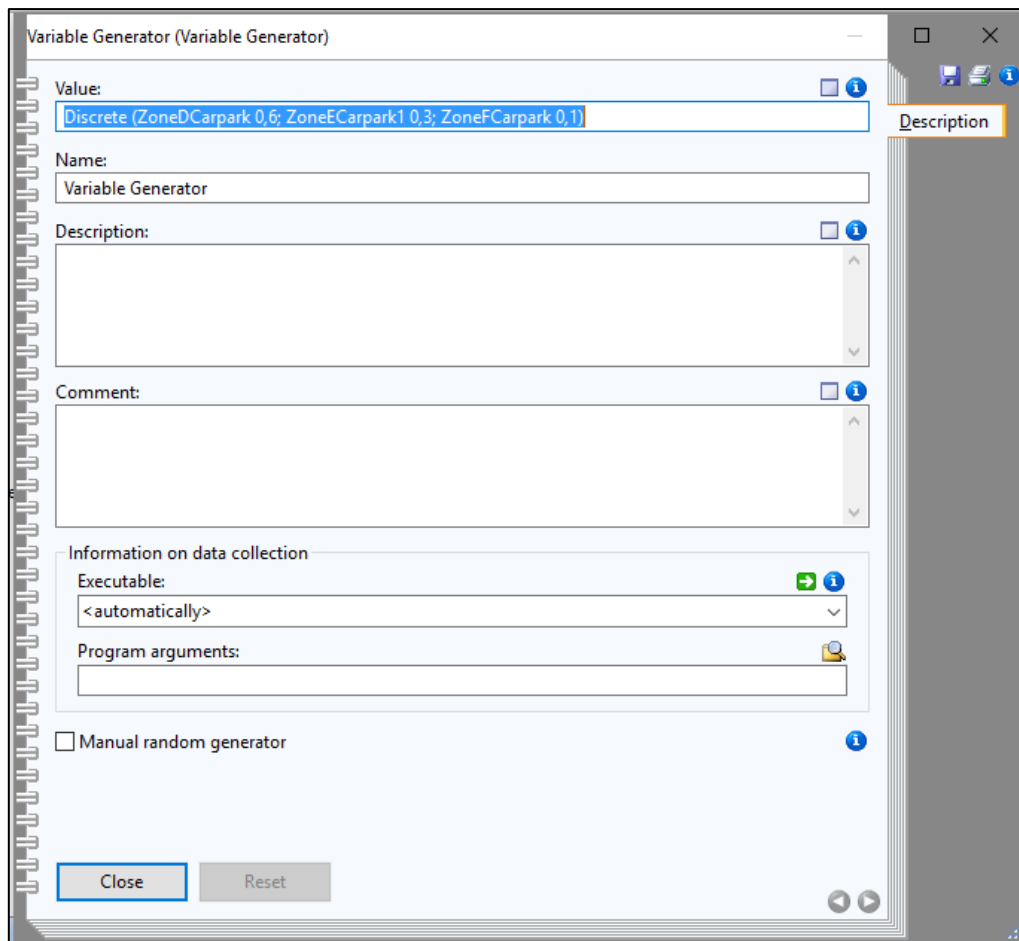


Figure 5.7: Assign the Probability Value

Step 8: Assign the counter (performer) in each Carpark as shown in Figure 5.8.

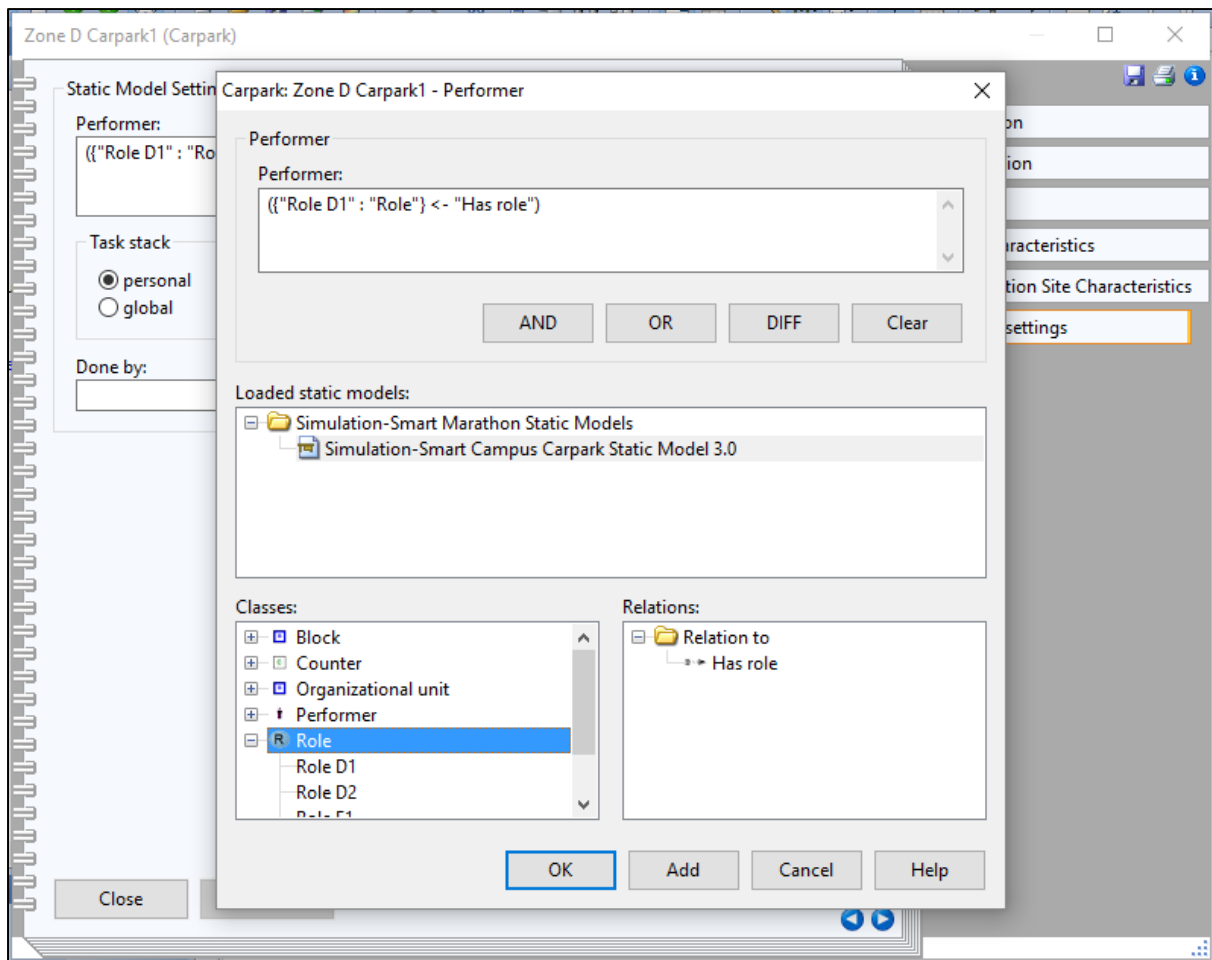


Figure 5.8: Assign the Counter to Carpark

Step 9: Assign the execution time, waiting time to each of the carpark as shown in Figure 5.9.

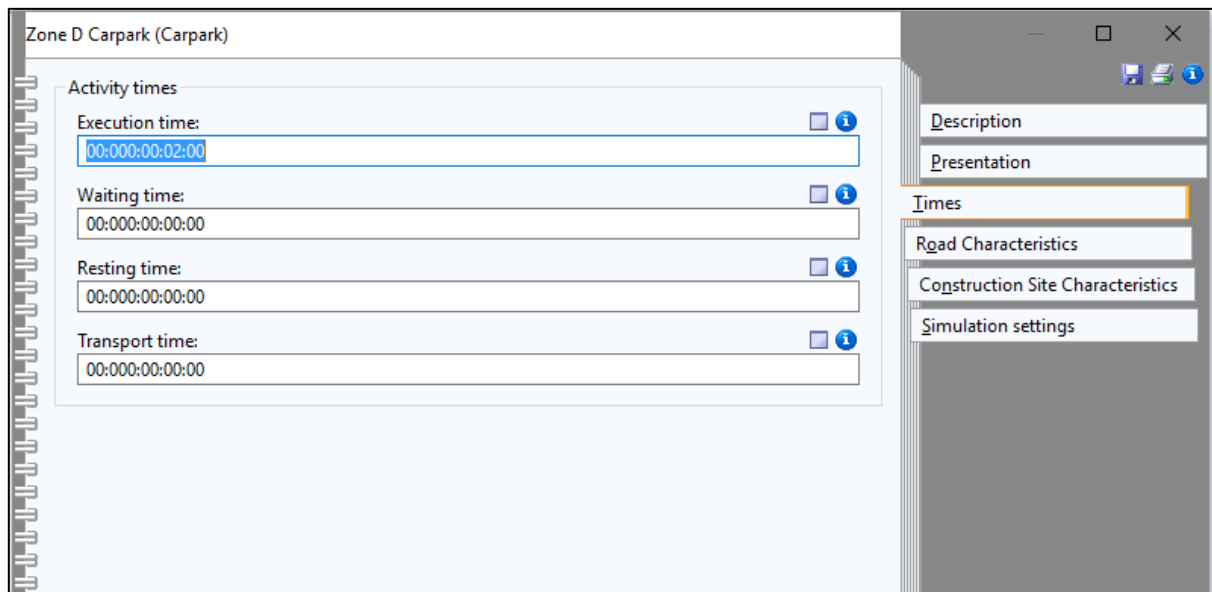


Figure 5.9: Assign the Execution Time to Carpark

Step 10: Start the simulation as shown in Figure 5.10.

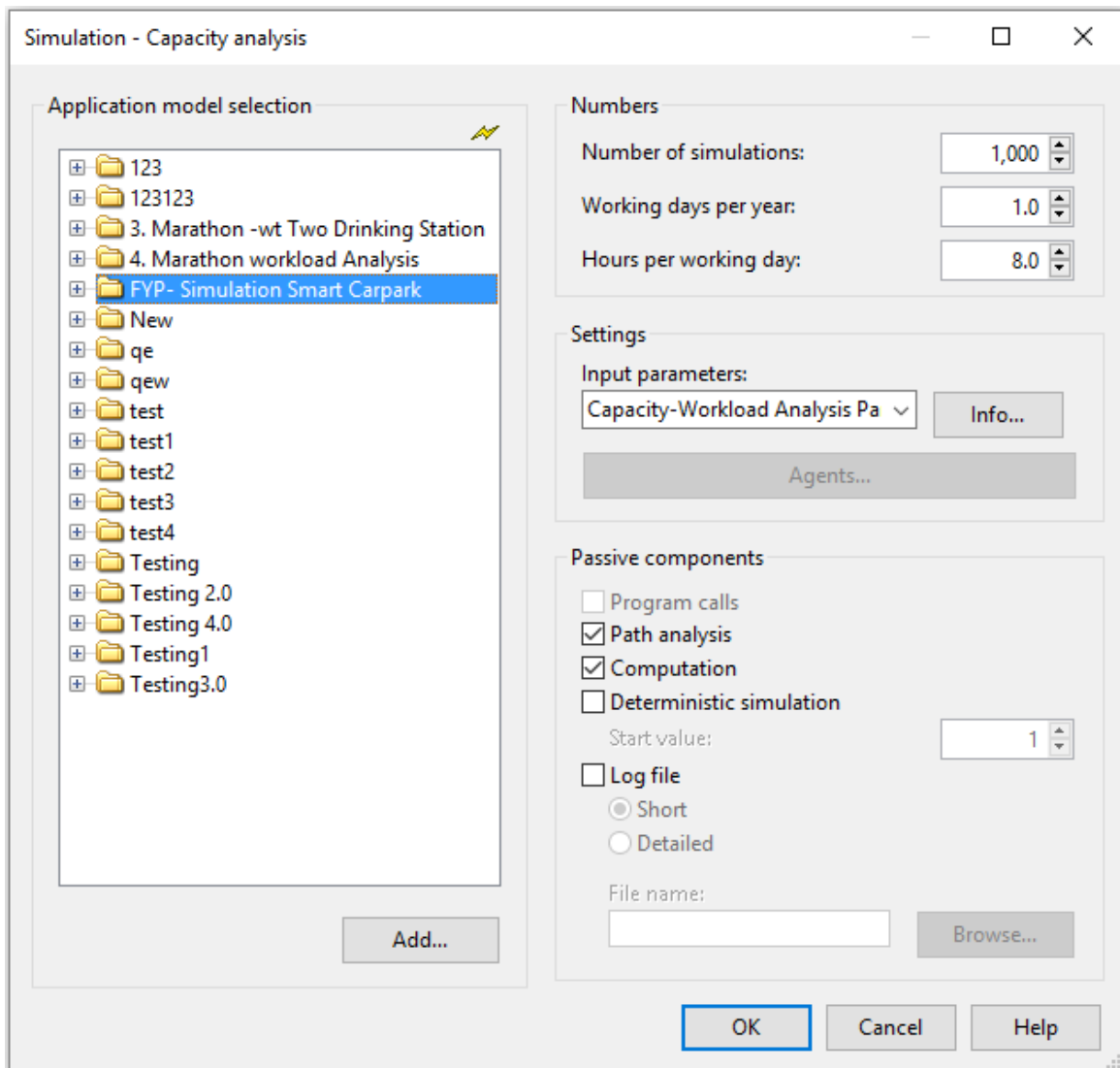


Figure 5.10: Start Simulation

5.2 System Results

5.2.1 Worst Case

Step 1: Assign 200 drivers to the system.

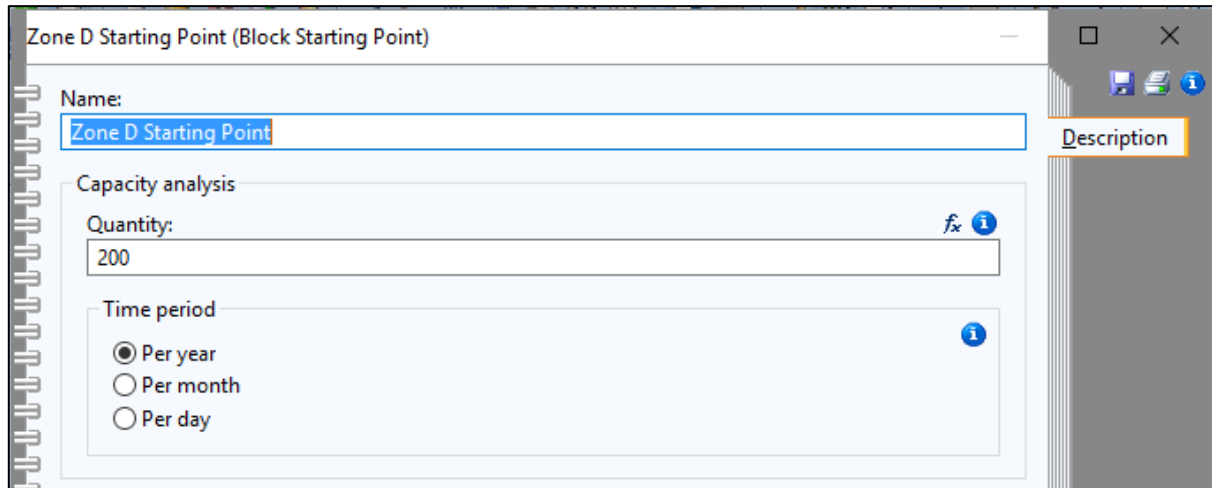


Figure 5.11: Assign Total Number of Drivers

Step 2: Assign the value of:

- i. Execution Time (time for driver takes to find the parking space),
- ii. Waiting Time (time for the event wait for the previous event),
- iii. Resting Time (time for the driver to travel around in the carpark),
- iv. Transport time (time for the driver transport from one Zone to another Zone).

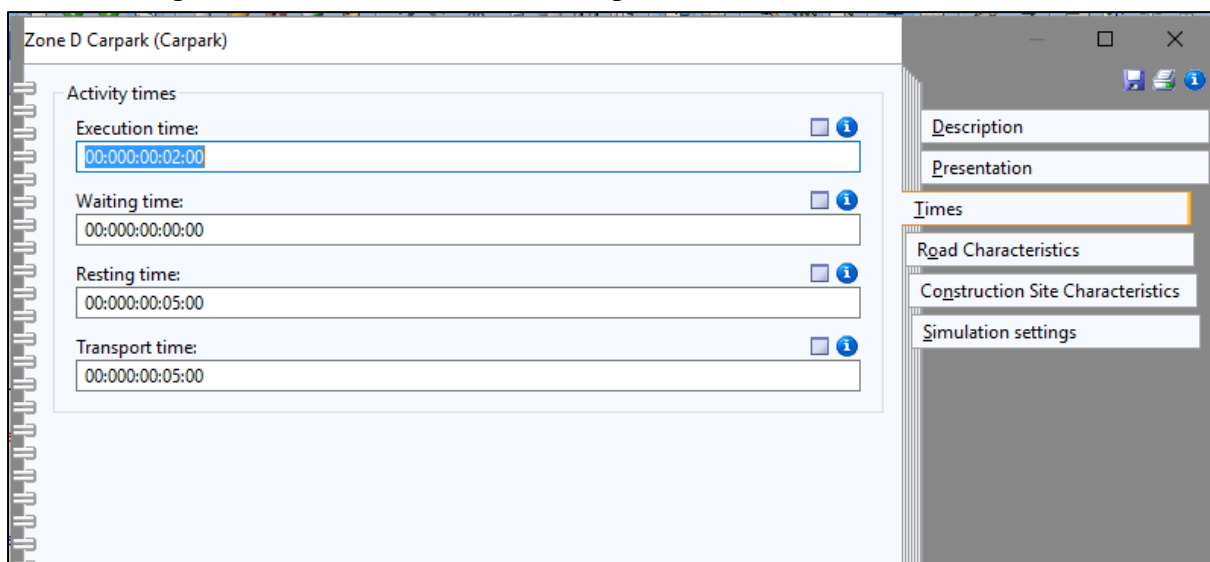


Figure 5.12: Assign Value for Execution, Resting and Transport Time at Zone D Carpark

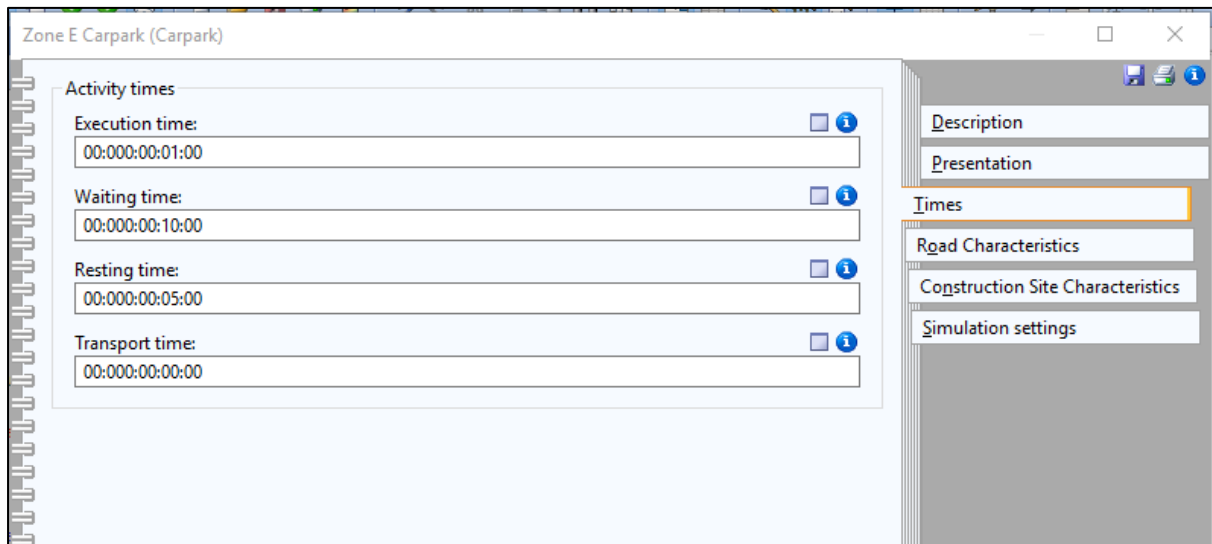


Figure 5.13: Assign Value for Execution, Waiting and Resting Time at Zone E Carpark

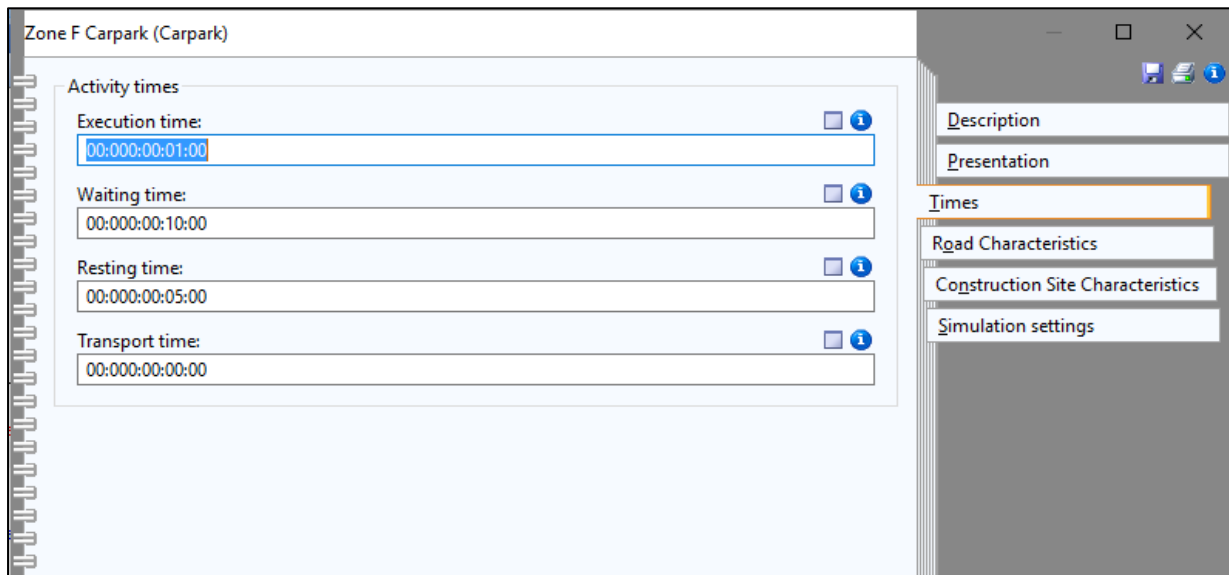


Figure 5.14: Assign Value for Execution, Waiting and Resting Time at Zone F Carpark

Chapter 5 Implementation and Results

Further elaboration on Execution Time, Waiting Time, Resting Time and Transport Time. Refer back the model that build in the Figure 3.22: Worst Case.

The drivers start search the parking space from Zone D then follow by Zone E or Zone F. During the searching in Zone D, it take 5 minutes for the drivers to drive around in the Zone D Carpark (Resting Time). Then, it takes 2 minutes for the drivers to park in the parking space (Execution Time). However, if the driver failed to find the parking space in the Zone D Carpark. The drivers will take 5 minutes to travel from Zone D either to Zone E Carpark or Zone F Carpark (Transport Time).

At the Zone E Carpark, the drivers need to take 5 minutes to drive around the Zone E Carpark in order to find the parking space (Resting Time). Then it also takes 1 minutes for the drivers to park at the parking space (Execution Time). The (waiting time) for Zone E event is 10 minutes to wait for the previous event finish executing.

While at the Zone F Carpark, the drivers also need to take 5 minutes to drive around the Zone F Carpark to find the parking space (Resting Time). Then the driver take 1 minutes to park at the parking space (Execution Time). The waiting time for Zone F is also 10 minutes to wait for the previous Zone D event finish executing.

(Please that note that the Execution Time, Waiting Time, Resting Time and also Transport Time can be change due to time to time. In this project the time that assign is depends on some particular situation.)

Figure 5.15 and Figure 5.16 shows that how each of the time is mean for.

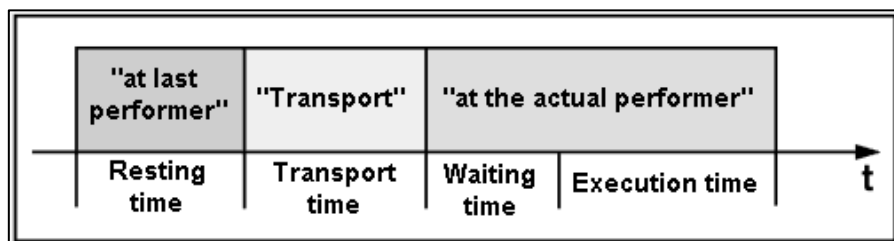


Figure 5.15: Assign of Time

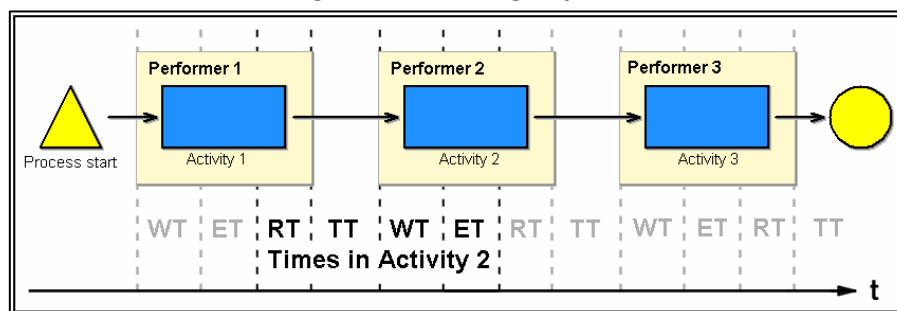


Figure 5.16: Assign of Time

Step 3: Assign the value in variable generator as shows in Figure 5.17. The value is obtain from the equation of Rank Order Centroid shows in Figure 5.18 and the value also follow the rule where the nearer the carpark the higher the probability value.

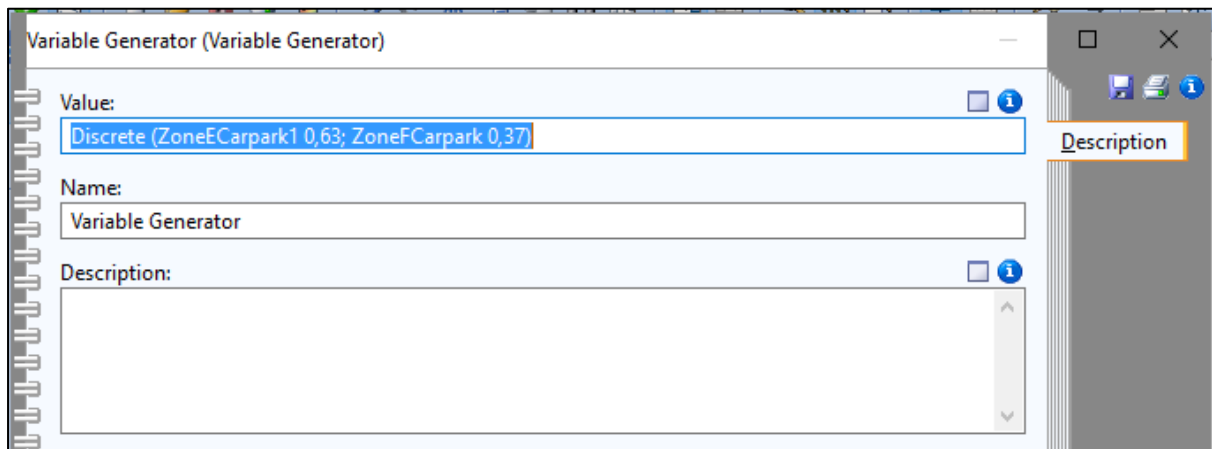


Figure 5.17: Assign Value for Variable Generator

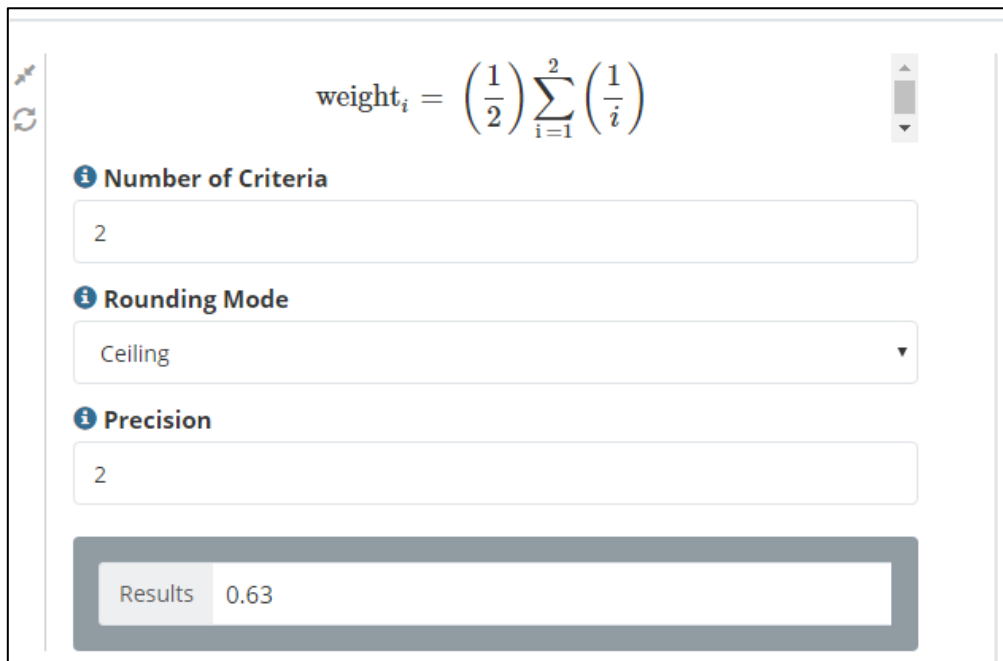


Figure 5.18: Assign Value obtain from Rank Order Centroid

Step 4: Simulation Setting as shows in Figure 5.19.

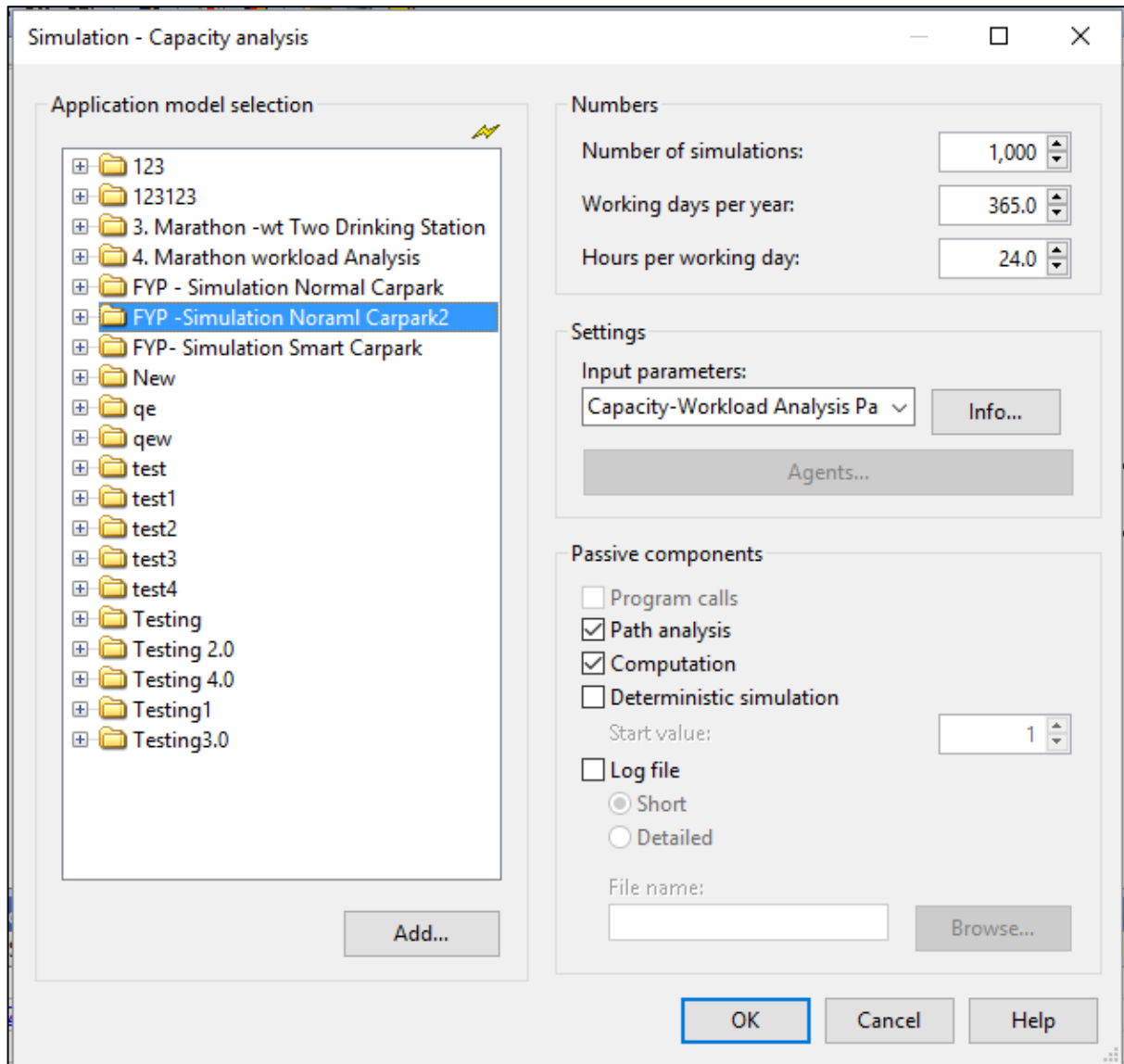


Figure 5.19: Simulation Setting

Number of simulation: 1,000

- Which means that simulation will run 1,000 times before the execution of the results. The more the simulation time, the more accurate the simulated results will be produced.

Working days per year: 365.0 days

- Which mean the simulation will run according to the “real time”. The working day is weekday except Saturday and Sunday.

Hours per working days: 24.0 hours

- When the working days per year set to “real time ” the hours per working days also need to follow the “real time” situation which means 24.0 hours of working.

5.2.1.1 Worst Case Simulation Results

Simulation through capacity analysis system.

| Simulation results - Capacity analysis (Working environment/Per year) - Application model: FYP - Simulation Noraml Carpark2 | | | | | | |
|---|---|--------------------|-----------------------------|--|------------|----------------------|
| | Role | Simulation Process | Road | Volunteer | Number | Execution time (sum) |
| 1. | Role D (Simulation-Smart Campus Carpark Static Model 2.0) | | | | | 00:00:06:40:00 |
| 1.1. | | Zone D 2.0 | | | | 00:00:06:40:00 |
| 1.1.1. | | | Zone D Carpark (Zone D 2.0) | | 200.000000 | 00:00:06:40:00 |
| 1.1.1.1. | | | | Counter D (Simulation-Smart Campus Carpark Static Model 2.0) | 200.000000 | 00:00:06:40:00 |
| 2. | Role E (Simulation-Smart Campus Carpark Static Model 2.0) | | | | | 00:00:02:10:12 |
| 2.1. | | Zone D 2.0 | | | | 00:00:02:10:12 |
| 2.1.1. | | | Zone E Carpark (Zone D 2.0) | | 130.200000 | 00:00:02:10:12 |
| 2.1.1.1. | | | | Counter E (Simulation-Smart Campus Carpark Static Model 2.0) | 130.200000 | 00:00:02:10:12 |
| 3. | Role F (Simulation-Smart Campus Carpark Static Model 2.0) | | | | | 00:00:01:09:48 |
| 3.1. | | Zone D 2.0 | | | | 00:00:01:09:48 |
| 3.1.1. | | | Zone F Carpark (Zone D 2.0) | | 69.800000 | 00:00:01:09:48 |
| 3.1.1.1. | | | | Counter F (Simulation-Smart Campus Carpark Static Model 2.0) | 69.800000 | 00:00:01:09:48 |

Figure 5.20: Simulation through Capacity Analysis System

From Figure 5.20, we can know that at first there are 200 drivers pass through the Zone D Carpark and take the total time of 6 hours 40 minutes. After pass through the Zone D carpark there are 130 drivers choose to go Zone E Carpark and 70 drivers choose to go Zone F Carpark where takes 2 hours 10 minutes 12 seconds and 1 hours 9 minutes 48 seconds respectively.

Please take note that, although the probability that set in the variable generator as shows in Figure 5.17. The probability value for going Zone E carpark is 0.63 and probability value for going Zone F carpark is 0.37. It does not mean that 126 drivers go to Zone E carpark and 74 drivers go to Zone F carpark. Through 1,000 times of simulation, we can found out that 130 drivers have higher chance will choose Zone E carpark and 70 drivers have higher chance to go Zone F carpark. This is more close to the real situation that the drivers will make this choices.

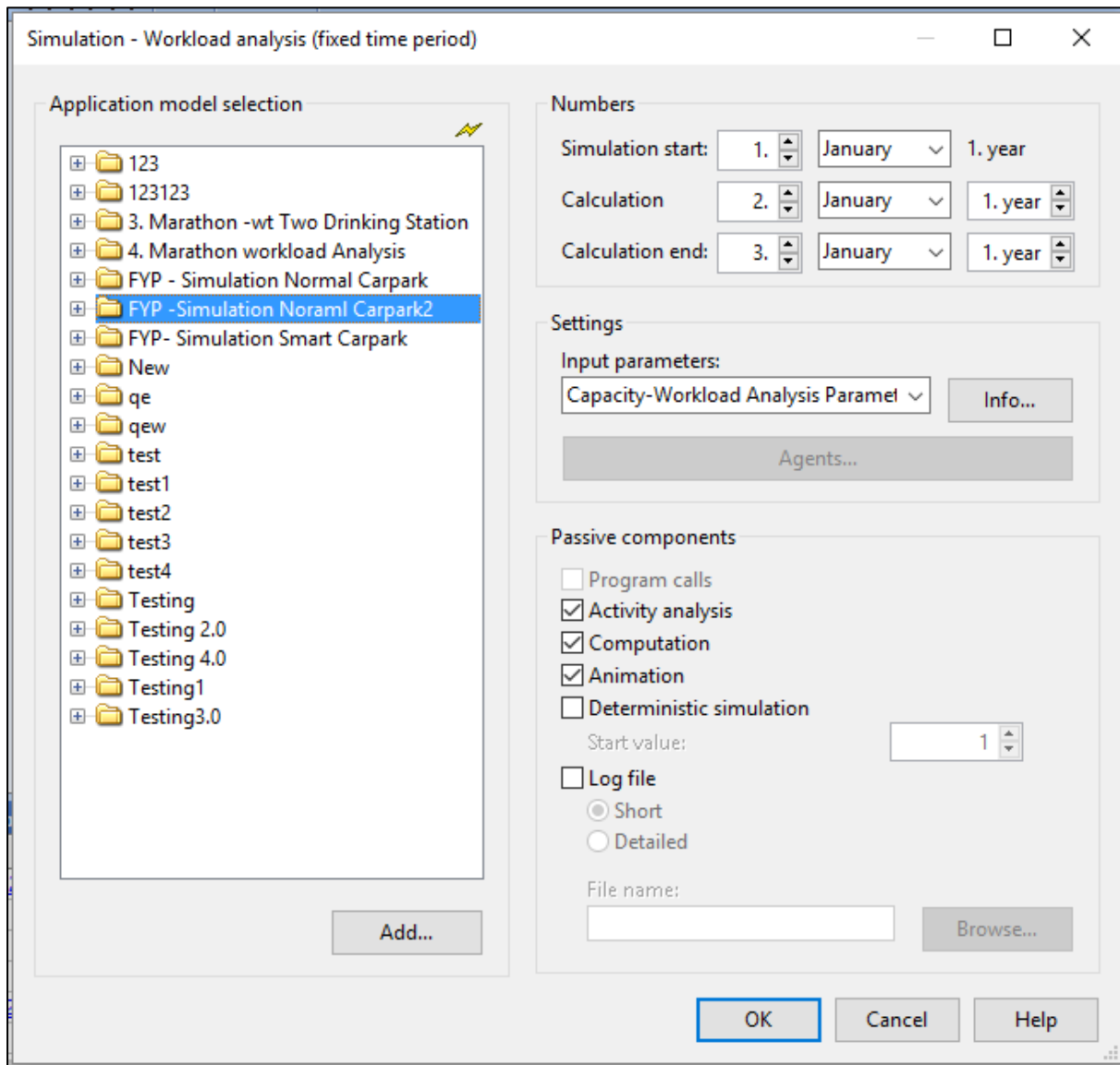


Figure 5.21: Simulation through Capacity Analysis System (fixed time period)

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| Simulation results - Workload analysis (Person related/Evaluation period) - Application model: FYP -Simulation Noraml Carpark2 | | | | | | | |
|--|--|--------------------|-----------------------------|-----------|----------------------|------------------------|----------|
| | Volunteer | Simulation Process | Road | Number | Execution time (sum) | Waiting time (average) | Workload |
| 1. | Counter D (Simulation-Smart Campus Carpark Static Model 2.0) | | | | 00:00:01:12:00 | | 0.085714 |
| 1.1. | | Zone D 2.0 | | | 00:00:01:12:00 | | |
| 1.1.1. | | | Zone D Carpark (Zone D 2.0) | 36.000000 | 00:00:01:12:00 | 00:00:01:25:26 | |
| 2. | Counter E (Simulation-Smart Campus Carpark Static Model 2.0) | | | | 00:00:00:23:00 | | 0.027381 |
| 2.1. | | Zone D 2.0 | | | 00:00:00:23:00 | | |
| 2.1.1. | | | Zone E Carpark (Zone D 2.0) | 23.000000 | 00:00:00:23:00 | 00:00:00:01:17 | |
| 3. | Counter F (Simulation-Smart Campus Carpark Static Model 2.0) | | | | 00:00:00:12:00 | | 0.014286 |
| 3.1. | | Zone D 2.0 | | | 00:00:00:12:00 | | |
| 3.1.1. | | | Zone F Carpark (Zone D 2.0) | 12.000000 | 00:00:00:12:00 | 00:00:00:00:00 | |
| | Total | | | | 00:00:01:47:00 | | |

Figure 5.22: Simulation through Capacity Analysis System (fixed time period)

| Simulation results - Workload analysis (Working environment/Evaluation period) - Application model: FYP -Simulation Noraml Carpark2 | | | | | | | |
|---|--------------------|-----------------------------|--|-----------|----------------------|------------------------|--|
| | Simulation Process | Road | Volunteer | Number | Execution time (sum) | Waiting time (average) | |
| 1. | | | | | 00:00:01:12:00 | | |
| 1.1. | Zone D 2.0 | | | | 00:00:01:12:00 | | |
| 1.1.1. | | Zone D Carpark (Zone D 2.0) | | 36.000000 | 00:00:01:12:00 | 00:00:01:25:26 | |
| 1.1.1.1. | | | Counter D (Simulation-Smart Campus Carpark Static Model 2.0) | 36.000000 | 00:00:01:12:00 | 00:00:01:25:26 | |
| 2. | | | | | 00:00:00:23:00 | | |
| 2.1. | Zone D 2.0 | | | | 00:00:00:23:00 | | |
| 2.1.1. | | Zone E Carpark (Zone D 2.0) | | 23.000000 | 00:00:00:23:00 | 00:00:00:01:17 | |
| 2.1.1.1. | | | Counter E (Simulation-Smart Campus Carpark Static Model 2.0) | 23.000000 | 00:00:00:23:00 | 00:00:00:01:17 | |
| 3. | | | | | 00:00:00:12:00 | | |
| 3.1. | Zone D 2.0 | | | | 00:00:00:12:00 | | |
| 3.1.1. | | Zone F Carpark (Zone D 2.0) | | 12.000000 | 00:00:00:12:00 | 00:00:00:00:00 | |
| 3.1.1.1. | | | Counter F (Simulation-Smart Campus Carpark Static Model 2.0) | 12.000000 | 00:00:00:12:00 | 00:00:00:00:00 | |

Figure 5.23: Simulation through Capacity Analysis System (fixed time period)

5.2.2 Best Case

Step 1: Assign 200 drivers to the system.

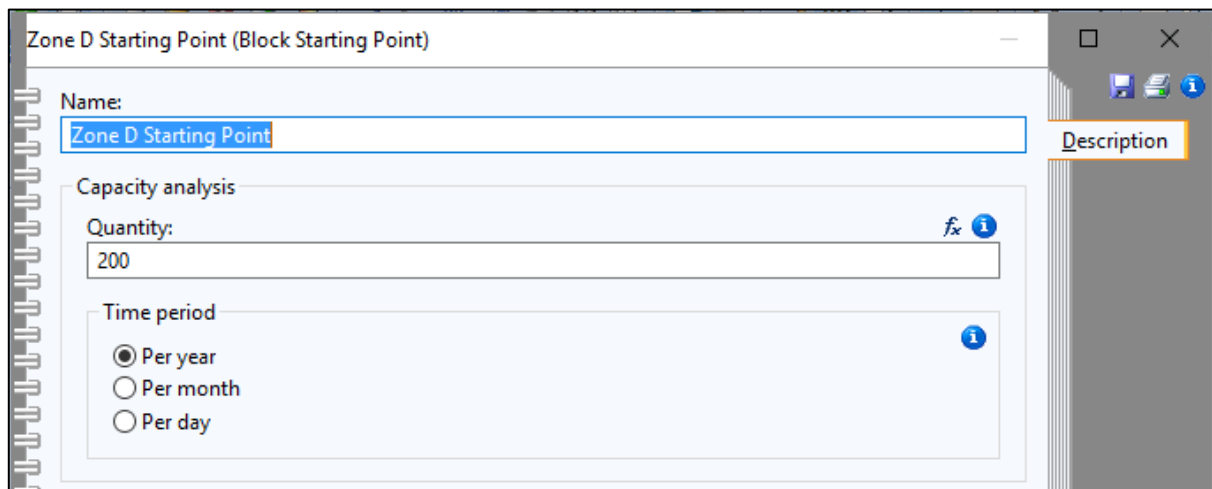


Figure 5.24: Assign Total Number of Drivers

Step 2: Assign the value for the Execution Time and Resting Time.



Figure 5.25: Value for Execution, Resting Time at Zone D Carpark1 and Carpark2



Figure 5.26: Value for Execution, Resting Time at Zone E Carpark1 and Carpark2

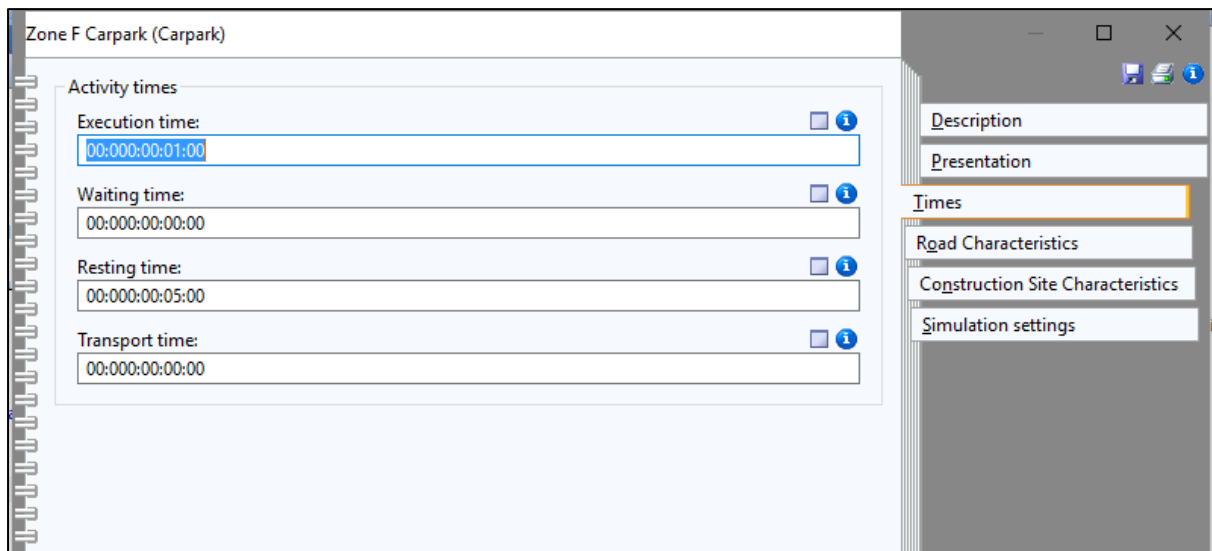


Figure 5.27: Value for Execution, Resting Time at Zone F Carpark

For the best case, there is no any assigned value to the transport time. This is due in the best case the model already assign the particular carpark to the drivers when the drivers enter to the Zone D .Thus, the drivers no need travel from one place to another place to search for the parking space. This will save the drivers' time and also help the drivers to get the parking space in the shortest time. The value of the execution time and resting time for the Zone D Carpark1, Zone D Carpark2, Zone E Carpark1, Zone E Carpark2 and Zone F Carpark has shown in above Figure 5.25, Figure 5.26 and Figure 5.27.

5.2.2.1 Best Case Simulation Results

| Simulation results - Capacity analysis (Working environment/Per year) - Application model: FYP - Simulation Smart Carpark | | | | | | | |
|---|--|--------------------|-------------------------------|---|------------|----------------------|--|
| | Role | Simulation Process | Road | Volunteer | Number | Execution time (sum) | |
| 1. | Role D1 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | | 00:00:04:18:00 | |
| 1.1. | | Zone D 3.0 | | | | 00:00:04:18:00 | |
| 1.1.1. | | | Zone D Carpark1 (Zone D 3.0) | | 129.000000 | 00:00:04:18:00 | |
| 1.1.1.1. | | | | Counter D1 (Simulation-Smart Campus Carpark Static Model 3.0) | 129.000000 | 00:00:04:18:00 | |
| 2. | Role D2 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | | 00:00:01:44:48 | |
| 2.1. | | Zone D 3.0 | | | | 00:00:01:44:48 | |
| 2.1.1. | | | Zone D Carpark2 (Zone D 3.0) | | 52.400000 | 00:00:01:44:48 | |
| 2.1.1.1. | | | | Counter D2 (Simulation-Smart Campus Carpark Static Model 3.0) | 52.400000 | 00:00:01:44:48 | |
| 3. | Role E1 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | | 00:00:00:14:36 | |
| 3.1. | | Zone D 3.0 | | | | 00:00:00:14:36 | |
| 3.1.1. | | | Zone E Carpark1 (Zone E 3.0) | | 14.600000 | 00:00:00:14:36 | |
| 3.1.1.1. | | | | Counter E1 (Simulation-Smart Campus Carpark Static Model 3.0) | 14.600000 | 00:00:00:14:36 | |
| 4. | Role E2 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | | 00:00:00:03:24 | |
| 4.1. | | Zone D 3.0 | | | | 00:00:00:03:24 | |
| 4.1.1. | | | Zone E Carpark 2 (Zone E 3.0) | | 3.400000 | 00:00:00:03:24 | |
| 4.1.1.1. | | | | Counter E2 (Simulation-Smart Campus Carpark Static Model 3.0) | 3.400000 | 00:00:00:03:24 | |
| 5. | Role F (Simulation-Smart Campus Carpark Static Model 3.0) | | | | | 00:00:00:00:36 | |
| 5.1. | | Zone D 3.0 | | | | 00:00:00:00:36 | |
| 5.1.1. | | | Zone F Carpark (Zone F 3.0) | | 0.600000 | 00:00:00:00:36 | |
| 5.1.1.1. | | | | Counter F (Simulation-Smart Campus Carpark Static Model 3.0) | 0.600000 | 00:00:00:00:36 | |

Figure 5.28: Simulation through Capacity Analysis System

From Figure 5.28, there are 200 drivers at first they will make decision whether want to search parking spaces at Zone D or Zone E. Next in the Zone E, they can make second decision which want to look for parking space at Zone E or Zone F. From the result we can conclude that there are 129 drivers who park at Zone D Carpark1, 52 drivers park at Zone D Carpark2, 15 drivers who park at Zone E Carpark1, 3 drivers who park at Zone E Carpark2 and 1 drivers who park at Zone F Carpark.

Comparing the simulation result at Figure 5.20 and Figure 5.28, we can conclude that the best case have a better traffic control compare to the worst case when there is in the peak hour. For the best case, during the peak hour, the drivers no need travel from one carpark to another carpark. The drivers can save their time by following the information that provide from the model. This is because in the worst case, we assume that the carpark in Zone D is already full, thus all the 200 drivers need to search the parking spaces after leave the Zone D carpark. So at this point, we will ask how if some drivers are rushing for time they still need to travel until Zone E or Zone F carpark. This not a very convenience method to them. Thus, by following the information and instructions in the best case, the system will assign the drivers go to the particular carpark.

Chapter 5 Implementation and Results

| Simulation results - Workload analysis (Working environment/Evaluation period) - Application model: FYP- Simulation Smart Carpark | | | | | | | |
|---|--------------------|------------------------------|---|-----------|----------------------|------------------------|--|
| | Simulation Process | Road | Volunteer | Number | Execution time (sum) | Waiting time (average) | |
| 1. | | | | | 00:00:00:46:00 | | |
| 1.1. | Zone D 3.0 | | | | 00:00:00:46:00 | | |
| 1.1.1. | | Zone D Carpark1 (Zone D 3.0) | | 23.000000 | 00:00:00:46:00 | 00:00:01:07:29 | |
| 1.1.1.1. | | | Counter D1 (Simulation-Smart Campus Carpark Static Model 3.0) | 23.000000 | 00:00:00:46:00 | 00:00:01:07:29 | |
| 2. | | | | | 00:00:00:22:00 | | |
| 2.1. | Zone D 3.0 | | | | 00:00:00:22:00 | | |
| 2.1.1. | | Zone D Carpark2 (Zone D 3.0) | | 11.000000 | 00:00:00:22:00 | 00:00:00:01:30 | |
| 2.1.1.1. | | | Counter D2 (Simulation-Smart Campus Carpark Static Model 3.0) | 11.000000 | 00:00:00:22:00 | 00:00:00:01:30 | |
| 3. | | | | | 00:00:00:01:00 | | |
| 3.1. | Zone D 3.0 | | | | 00:00:00:01:00 | | |
| 3.1.1. | | Zone E Carpark1 (Zone E 3.0) | | 1.000000 | 00:00:00:01:00 | 00:00:00:00:00 | |
| 3.1.1.1. | | | Counter E1 (Simulation-Smart Campus Carpark Static Model 3.0) | 1.000000 | 00:00:00:01:00 | 00:00:00:00:00 | |

Figure 5.29: Simulation through Capacity Analysis System (fixed time period)

| Simulation results - Workload analysis (Person related/Evaluation period) - Application model: FYP- Simulation Smart Carpark | | | | | | | |
|--|---|--------------------|------------------------------|-----------|----------------------|------------------------|----------|
| | Volunteer | Simulation Process | Road | Number | Execution time (sum) | Waiting time (average) | Workload |
| 1. | Counter D1 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | 00:00:00:46:00 | | 0.054762 |
| 1.1. | | Zone D 3.0 | | | 00:00:00:46:00 | | |
| 1.1.1. | | | Zone D Carpark1 (Zone D 3.0) | 23.000000 | 00:00:00:46:00 | 00:00:01:07:29 | |
| 2. | Counter D2 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | 00:00:00:22:00 | | 0.026190 |
| 2.1. | | Zone D 3.0 | | | 00:00:00:22:00 | | |
| 2.1.1. | | | Zone D Carpark2 (Zone D 3.0) | 11.000000 | 00:00:00:22:00 | 00:00:00:01:30 | |
| 3. | Counter E1 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | 00:00:00:01:00 | | 0.001190 |
| 3.1. | | Zone D 3.0 | | | 00:00:00:01:00 | | |
| 3.1.1. | | | Zone E Carpark1 (Zone E 3.0) | 1.000000 | 00:00:00:01:00 | 00:00:00:00:00 | |
| Total | | | | | 00:00:01:09:00 | | |

Figure 5.30: Simulation through Capacity Analysis System (fixed time period)

5.3 Result Analysis

| Simulation Process | Road | Number | Workload |
|----------------------------|--|-----------|----------|
| | | | 0.054762 |
| Zone D 3.0 | | | |
| | Zone D Carpark1 (Zone D 3.0) | 23.000000 | |
| | | | 0.026190 |
| Zone D 3.0 | | | |
| | Zone D Carpark2 (Zone D 3.0) | 11.000000 | |
| | | | 0.001190 |
| Zone D 3.0 | | | |
| | Zone E Carpark1 (Zone E 3.0) | 1.000000 | |

Figure 5.31: Best Case - Simulated Results

| Simulation Process | Road | Number | Workload |
|----------------------------|---|-----------|----------|
| | | | 0.080952 |
| Zone D 2.0 | | | |
| | Zone D Carpark (Zone D 2.0) | 34.000000 | |
| | | | 0.015476 |
| Zone D 2.0 | | | |
| | Zone E Carpark (Zone D 2.0) | 13.000000 | |
| | | | 0.025000 |
| Zone D 2.0 | | | |
| | Zone F Carpark (Zone D 2.0) | 21.000000 | |

Figure 5.32: Worst Case - Simulated Results

By comparing the simulated results from the worst case and best case in Figure 5.31 and Figure 5.32. We can conclude that by using the best case scenario we can further reduce the occupancy (workload) of the carpark. When the occupancy of the carpark is reduce, it can afford more car to park.

Furthermore, in Figure 5.31, there are quite a numbers of drivers prefer go to Zone D Carpark1, Zone D Carpark2 and also Zone E Carpark1. Thus, the threshold for the carpark can based on the workload of each carpark which are 5.5%, 2.6% and 0.01% respectively. For example, when the workload of the Zone D Carpark1 is below 5.5%, the system will allows the drivers to come in and look for empty parking space. However, if the workload is above 5.5%, the system will alert the drivers the carpark got limited parking spaces but the drivers still can search in this carpark but the chances to get the empty parking spaces is very low.

6.1 Future Work

There are few recommendations and further improvement for the system.

1. Adding numbers of parking spaces.

By adding the numbers of parking spaces in the software will allows the user to do further calculation for the total amount of the parking spaces and after the drivers have park their car in the empty parking spaces. The user can know how many parking spaces still left.

2. Adding a random variable.

There have some random cases that the user unable to predict, such as how if the drivers not going to follow the instruction of the system. Some of the drivers prefer randomly search for the empty parking spaces. This kind of behavior will definitely spoil the whole system. Thus, the purpose of adding a random variable inside the model is to prevent this kind of behavior happened and hence the model can make more predictions for all kind of unpredictable actions.

3. Adding the total distance travel by the drivers.

This is an extra suggestion because by adding the total distance travel by the drivers. The user may know how much time the drivers have travel, how long the distances that the drivers have travel. By knowing this information, next time the system will assign the shorter distance for the user to search for the parking spaces.

6.2 Conclusion

This project manage to obtain the threshold value. The important of the threshold value is to alert the drivers when the carpark is full with car and have limited place to park. By applying the smart simulation carpark module in the ADOxx software, it helps to imitate some real situation and problem that might be face by the drivers during finding for parking spaces.

By obtaining the threshold value, the model can solve the four problems that pointed out before which is:

1. There is not enough parking spaces,
2. The carpark is far from the class,
3. Searching for empty parking space will consume lots of time,
4. Need to walk a long distance if the carpark is too far from the destination.

In future the university authorities can use the threshold value that produce from the model to alert the drivers if there is limited parking spaces or have enough parking spaces. Besides, by knowing the `threshold of all the carpark in the campus, the drivers can easily find the empty parking spaces near to their destination. Hence save the time and energy of the drivers.

Finally, the university authorities also can manage well the carpark and traffic flow inside the campus by applying the model to any specific condition, for example during convocation, the particular carpark can occupy how many car, or if the university authorities want to build a new carpark how big the size of the carpark is needed or how many parking spaces needed in order to fit in the numbers of drivers in particular Zone.

References

Actian. (2016) Actian Analytic Platform [Online] Available at <http://www.actian.com/products/big-data-analytics-platforms-with-hadoop/> [Accessed on 15th August 2016, 12.00pm.]

ADoxx, Introduction to ADoxx. [Online]. Available at <https://www.adoxx.org/live/adoxx-documentation>. [Accessed on 18th August 2016, 8.00pm]

Google, 2012 Google BigQuery – Real time big data analytics in the cloud. [Online] Available at <<https://cloud.google.com/files/BigQuery.pdf> > [Accessed on 20th August 2016, 12.00pm.]

Google, Analytics Data Warehouse. [Online] Available at <https://cloud.google.com/bigquery/> [Accessed on 20th August, 1.30pm.]

Ionuț ȚĂRANU (2015) Big Data Analytic Platforms analyze from startups to traditional database players, vol VI, no1/2015 [Online]. Available at http://www.dbjournal.ro/archive/19/19_3.pdf. [Accessed on 13th August 2016, 10.15pm.]

Lye, GX 2014, Study user behavior through event sharing module in mobile UniCAT system, Final Year Project, UTAR. Available at UTAR Institutional Repository. [Accessed on 1st July 2016, 1.00pm]

Sajee Mathew. Amazon Web Services Principal Solutions Architect. (2016) Overview of Amazon Web Services [Online] Available at <https://d0.awsstatic.com/whitepapers/aws-overview.pdf> [Accessed on 17th August 2016, 6.30pm.]

Sells, C, Product Manager, Google Cloud Developer Tools. (2016) Making ASP.NET apps first class citizens on Google Cloud Platform. [Online] Available at <https://cloudplatform.googleblog.com/> [Accessed on 20th August 2016, 1.00pm.]

Shieh, YX 2014, Re-engineering and performance optimization of university cyber agent (UniCAT) system, p.4, Final Year Project, UTAR Available at: UTAR Institutional Repository. [Accessed on 5th July 2016, 9.00pm.]

Verzani, J (2011) An Integrated Development Environment for R Getting Started with RStudio [Online] Available at BCS (Hons) Computer Science Faculty of Information and Communication Technology (Perak Campus)

<http://www.cs.utexas.edu/~cannata/dataVis/Class%20Notes/Getting%20Started%20with%20RStudio.pdf> [Accessed on 18th August 2016, 6.00pm]

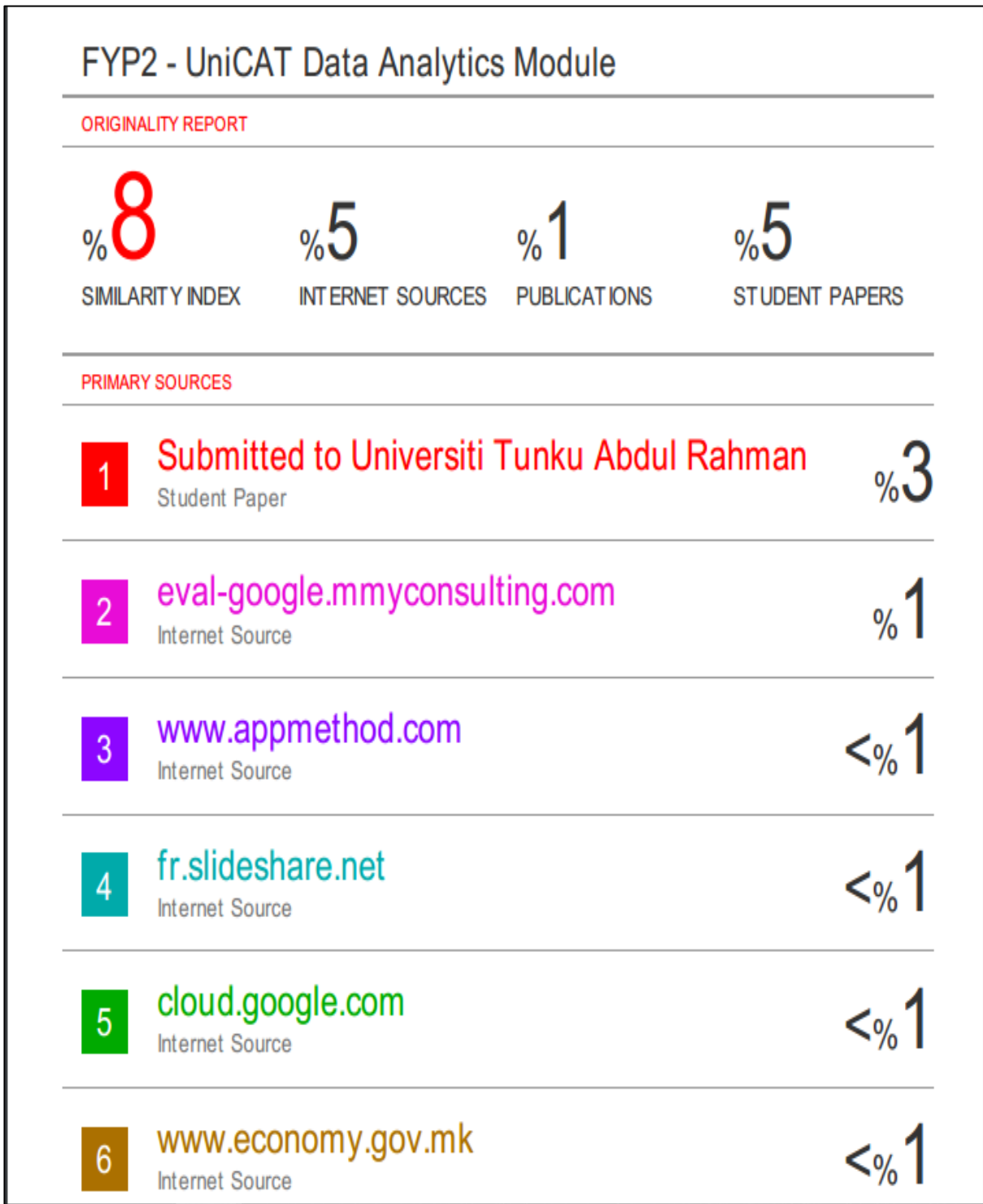
ER/Studio Enterprise Team Edition [Online] Available at

<https://www.idera.com/er-studio-enterprise-data-modeling-and-architecture-tools> [Accessed on 1st November 2016, 3.00pm]

PowerDesigner Enterprise Architect [Online] Available at

<http://go.sap.com/product/data-mgmt/powerdesigner-data-modeling-tools.html> [Accessed on 31th October 2016, 1.00pm]

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**FYP2 - UniCAT Data
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 By Wei Loong Chew

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ABSTRACT University Cyber Agent (UniCAT) is a graphical social networking system. The objective of this system is to study the behavior of the local population

in University Tunku Abdul Rahman (Perak Campus), The UniCAT system contain event sharing module, trading module, bus schedule checking module and so on. The main idea of the system is to implement the concept of smart campus which benefits the student and the staff in this campus. The project will focus on enhance the UniCAT system by solving the parking problem inside the campus. However, the project will mainly focus on introduce one suitable software to simulate the parking problem. Which mean the software able to imitate the operation of a real- world process or system over time. After studying the existing documentation of the software, it has been found that the software able to simulate the some parking scenario and hence it could provide some better solutions to solve the parking problem. There are some calculation and data analytical method need to conduct after the simulation. At the end of this project, the developer will know how to implement the new parking module according to the data and solution that provide by the software. In conclusion, this project will enable the future developer to implement a smart parking module according to the results and the data that obtain from the software. 1.1 Motivation and Problem Statement Motivation As a driver inside the UTAR campus will encounter few problems such as: 1. There is not enough space, 2. The parking slot is far from the class, 3. Searching for empty parking slot will consume lots of time, 4. Need walk very long distance and consume many times if park very far. Thus, the aim of this project is to encounter the problem above. It brings the motivation to solve the parking problem because it will gain plenty of benefits, such as the driver inside UTAR campus able to save their time by searching around to find parking slots, the driver can save time and energy by parking their car near to their destination. Problem Statement To introduce one software which able to analyze and simulate the parking problems encounter by the students and staffs inside the campus. 1.2 Project Scope The scope of this project is to provide a software which will able to imitate the parking condition inside the campus. The software will go through a simulation process, the simulated results will be use to conduct some calculation. Next, the results that obtain from the calculation will become a useful parameter for the further developer to develop a smart parking module.

1.3 Project Objectives The objectives of the projects is to develop a modelling platform

in analyzing and solving the parking problems. The project is interest to solve the parking problems by finding the threshold value that alert the driver. 1.4 Proposed Approach The project will help to solve the parking problems by using a software called, ADQxx. First of all, the software able to represent the component of the parking scenario into a data model form which name as "attribute". By using the data model, it is easier to know which one is Block, Zone, Carpark and so on. Besides, the software able to link the attribute together with some particular relationship. The purpose of this is to provide a convenience way for the system and people who use the software to recognize the relationship between the attribute. Next, the software allow to perform some analyze and simulation process. In the simulation process, the software able to imitate the real parking scenario such as how the traffic follow inside this campus, where the drive can search the carpark, how the driver can search the carpark and so on. By go through numbers of cycle, the simulated results will go through some calculation. At the end the threshold value will be produced. The purpose of the threshold value is to alert the driver if the carpark is above the threshold. That means that have lower chance for the driver to get an empty parking space. Besides that, this platform will help in improving the traffic condition inside campus by go through the simulation process. Inside the simulation process, the users able to set the condition which relate to real life by initializing the parameter. After that, the platform will go through simulation process and produce the results for the further analyze use. 1.5 Background information

University Cyber Agent (UniCAT) is a graphical social networking system. The objective of this system is to study the behavior of the local population

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Title – UniCAT: DATA ANALYTICS MODULE



Introduction

UniCAT is a graphical social networking system. The objective of this system is to study the behavior of the local population in UTAR. To enhance the system, this project will focus on solving the parking problems inside the campus. However, at the end of this project will only mainly focus on selecting one suitable platform to solve parking problem.

Problem Objective

The objectives of the projects is to **develop a model which is able to analyze and simulate the parking problems** encountered by the students and staffs inside the campus.

Result

| Simulation results - Workload analysis (Person related/Evaluation period) - Application model: FPP - Simulation Smart Campus | | | | | | |
|--|---|--------------------|------------------------------|-----------|----------------------|-----------------------------------|
| | Volunteer | Simulation Process | Road | Number | Execution time (sum) | Waiting time (average) (Workload) |
| E 1. | Counter 01 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | 00:00:00:46:00 | 0.054762 |
| E 1.1. | | Zone D 3.0 | | | 00:00:00:46:00 | |
| 1.1.1. | | | Zone D Carpark1 (Zone D 3.0) | 23.000000 | 00:00:00:46:00 | 00:00:01:07:29 |
| E 2. | Counter 02 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | 00:00:00:22:00 | 0.026190 |
| E 2.1. | | Zone D 3.0 | | | 00:00:00:22:00 | |
| 2.1.1. | | | Zone D Carpark1 (Zone D 3.0) | 11.000000 | 00:00:00:22:00 | 00:00:00:01:30 |
| E 3. | Counter 03 (Simulation-Smart Campus Carpark Static Model 3.0) | | | | 00:00:00:01:00 | 0.001190 |
| E 3.1. | | Zone D 3.0 | | | 00:00:00:01:00 | |
| 3.1.1. | | | Zone E Carpark1 (Zone E 3.0) | 1.000000 | 00:00:00:01:00 | 00:00:00:00:00 |
| Total | | | | | 00:00:01:09:00 | |

Problem Statement

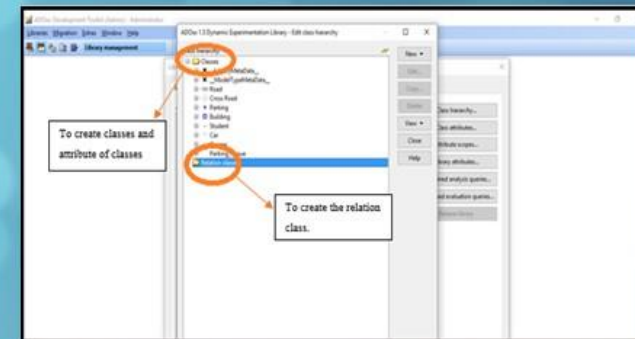
As a driver inside the UTAR campus will encounter few problems such as:

1. There is not enough space,
2. The parking slot is far from the class,
3. Searching for empty parking slot will consume lots of time,
4. Need to walk a long distance if the parking lot is too far from the destination.

Methodology



Prototype



| | | | |
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