#### Cover Sheet

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| **UNIT**  **CODE:**  HSU201  **TITLE:** System Analysis & Design | | **STUDENT/PROJECT/TEAM NAME**  Man Fu Lei | | | |
| **NAME OF LECTURER**  William Kenworthy | | | | **DUE DATE**  June 6, 2014 | |
| **TOPIC OF ASSIGNMENT**  Transportation Management System | | | | | |
| **Group or tutorial**  *(if applicable)*  Group | **Course**  Associate Degree of Network Technology | | | **Campus**  Thornlie | |
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| Attended group meeting regularly and on time. | 5 | 5 | 5 | 5 |
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| Contribute with a constructive input for the group work | 5 | 5 | 5 | 5 |
| Cooperated and encouraged team members to complete the task | 5 | 5 | 5 | 5 |
| Made a sincere effort in finalizing the tasks | 5 | 5 | 5 | 5 |

Student: Man Fu Lei

Student Number: 131306105

Unit Name: System Analysis & Design

Submission Date: May 30, 2014

**Transportation Management System**

**Design a New Transportation Management System for Polytechnic West Australia**

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#### Executive Summary

On Week 11 our company received the project from Polytechnic West Australia (PWA) requesting that we analyze the current transportation management system in PWA and design a new system for them. There are 30 cars running among eight campuses in PWA that are used by staffs for business purpose. Every week there are about 20 people who need the cars to travel among sites. Mostly these are mail delivers inside PWA or teachers who need to attend meetings in the other campus. The new system will be featuring automation of operation comparing to the inconvenience of current system. This report will first demonstrate the mechanism of the existing system, and then discover the disadvantages it has and propose the features the new system should have against the old system, then design a new system represented by diagrams from all aspects to describe the functions of the new system. At the end the author will give the reason why the new system is recommended. In the appendix the user documentation will be included to demonstrate different functions the new system has.

# Introduction

## The Authorization

On Week 11 our company received the project from PWA Management Board.

The transportation management system in PWA manages the cars that can be applied by the staff in PWA for travelling among the eight campuses: Armadale, Armadale Equine Training Centre, Balga, Bentley, Carlisle, Jandakot, Midland and Thornlie. (The Polytechnic of Western Australia, 2014) The cars can only be used by staffs at work for business purposes. As business grows the need for travelling between sites becomes more and more popular. PWA is considering buying more cars and upgrading the management system to facilitate the process and better manage the system. The board thus asked our company for help.

## The Purpose

The project focuses on analyzing the requirement of upgrading the system and designing a new transportation management system to replace the old one.

## The Scope

This report contains a literature review of a modern transportation management system, the disadvantage of current system in PWA, the features the new system is supposed to have and the design diagrams representing the concepts of the new system. User documentation about the new system will also be included in appendix. The information collected will only be used in designing the new transportation management system without inappropriate disclosure to any third-party individual or entity.

## Terms of Reference

The main concern of the project is to design an automatic system which can facilitate the process of sending and processing the requests as well as tracking the cars both en route and in stock. Staffs are users who send the request to apply for a car to travel between campus sites. The cars are upgradable which means a Global Positioning System (GPS) can be installed on them. Driver’s license is the minimum requirement for approving the request.

## Acknowledgements

The author wants to thank these people who helped us a lot during the project:

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# Method



## Online Research

The author went through several webpages about the transportation management systems containing information about their mechanism.

## Group Discussion

The team members talked with one another in order to discover the disadvantage of the old system and find out the requirement of implementing the new system.

## Observation

The team members went to the car park, customer service center to observe how the old system works.

# Requirement Analysis



## Literature Review

Transportation management system is a subset of the management in supply chain concerning the operations of transportation and can be inside the planning system in the deployment of enterprise resource. It includes both inbound and outbound transports that are procurement and shipping. (Transportation Management System, 2014) The main purpose of the system is to minimize the cost of transporting people or goods from one place to another when meeting the needs of each place in time within the capacity of the transportation tools. (Reeb &Leavengood, 2002, p.2) There are several methods in scheduling transportation systems such as northwest corner method, minimum cell cost method and Vogel's approximation method for basic feasible solution. For optimal solution methods there are stepping-stone method and modified distribution method based on minimum cell cost method. These methods are used for working out solutions for models where different stations with different capacities are used to provide services to different sites with different demands. The ideal model is balanced meaning the number of supplies equals the number of demands. For the unbalanced situation, a dummy row or column is created when the supply surpluses demand or demand surpluses supply. The optimal solution has a feature that the minimum distribution of sources to the cells in the table must be more than the sum of numbers of rows and columns minus one. If not it is degenerate and an arbitrary vacated cell must be selected additionally for calculation. Another situation is when all stations have fixed resource for each of them and they must be sent to places for fixed number of resources without duplicating or lacking any of the resources. In this situation the zero-crossing method is used to calculate the best assignment solution with least cost without violation to the constraints. (Transportation and Assignment Solution Methods, n. d, p. 1-24)



## Existing System in PWA



### Mechanism

The existing transportation system in PWA runs mainly by human intervention from requesting to reporting. The users first go to the customer service desk and request for a car where they need to fill in a form stating the purpose, destination and predicted time of return. Then the request will be processed after the secretary delivers the form to the manager in the campus. If the request is approved, users get an index card stamped and bring the card to a custodian who keeps all the keys of cars for business purpose. The custodian authenticates the users and checks the number of users who will use the car. Then he gives the key of the available car to the users and marks the card as used. When users return they go to the customer service desk again and return the index card. Their usage will be recorded in written files documented in the office.

### Advantages

There are advantages for the current system:

* *Files are reliable*: because the files about usage are archived in written format by secretaries in the office so they won’t be corrupted or destroyed;
* *Easy to implement*: users, secretaries and custodian don’t need other knowledge to use and maintain it which was one of the reasons why it was implemented 32 years ago in this way;
* *Low cost*: it only costs paper and doesn’t need additional cost for networking or satellite positioning.

### Disadvantages

There are many disadvantages for current system:

* *Inconvenient requesting process*: users need to go to the counter and fill in the paper form there and wait for the manager to approve their requests;
* *Slow processing time*: the manager needs to go through the database for the users and check if they are eligible for requesting the cars. It consumes a lot of time;
* *No tracking system*: when the users get the car all that binds them is their own consciousness and there is no guarantee that they don’t drive the car to parks if they had time;
* *Inconvenient car maintenance*: if the cars had problem the custodian needs to write a report to the management and the management will decide if they need to have them fixed which costs a lot of time;
* *Inconvenient car assignment*: the custodian needs to keep a log of being used cars and every time a new user comes he/she has to look up the log for available cars.

## The New System

In the new system the information of the usage of the cars will be added into the employee’s card. The cars will also be installed with GPS and a computer is needed inside the custodian’s room connected to the campus network. A new card swipe will also be installed outside the door of the custodian’s kiosk. Based on the disadvantages of the current system, the new system should have following functions:

* *Easy requesting*: a mobile application will be developed and installed on teachers’ mobiles whenever they want to use cars they can simply complete an online form and the request will be sent to the secretaries;
* *Fast processing time*: after receiving the request the secretary only needs to start the program to process the request. The program can load the details of the users and decide if they are eligible, and also check the schedule to determine if there is conflict for those who reserved the cars. When all is checked, the secretary only needs to take a glance on if the purpose and time of return are reasonable. If the request is approved and the data of the user will be added with related information;
* *Easy car assignment*: when the users are permitted they can walk to the car park and swipe the employee’s cards onto the machine outside the custodian’s room and the machine will authenticate the user and display the assigned car for them. Then the custodian can give the users the key of the assigned car without any delay. The machine will also mark the car as being used and the users using the car and transfer the information back to the main server;
* *Easy checking-in for users*: when user arrives at the destination campus they can swipe their employee’s cards on to the card swipe to grant them access to the car park inside that campus. When they want to leave that campus and head for other campuses, they will need only to swipe the card again to access the car. By doing this the users can report to the management during work about where they are approximately;
* *Car tracking system*: when the car is being used the GPS can constantly send the information of the car such as the location and velocity back to the server which can be used by secretaries for tracking the car. When they need to track the car the information can be retrieved immediately. This information can also be requested by the users through their mobile application provided they are connected to the Internet;
* *Detailed traffic information*: users can use the mobile application to check the estimated time for the travel, the distance between sites and approximate time of return. It can also compare the estimated time for the trip in current traffic and without traffic to provide enough information for the users to decide when to make the journey;
* *Fast car maintenance*: every day the custodian will check the cars to see if they have enough fuel or have problems. If they do the custodian only needs to fill out a form for status of the car by the computer inside their kiosk and the system will generate and send the report to the management so that they can decide what needs to be done;
* *Easy management*: managers only need one click to view daily report on cars and their comments can be sent to custodians immediately while being archived into the information centre too. Secretaries only need to submit a tracking form to track the cars instantaneously.

# System Design



## Unified Modeling Language (UML) Diagrams



### Use-Case Diagram



Figure - Use-case Diagram of the System

The use-case diagram can be explained in the following:

The main actors are users, secretaries, traffic center, GPS, manager, card swipe and custodian. Users, secretaries, manager and custodian interact with the system using the mobile application or personal computers. The system contains several functions including request processing system, car tracking system, car assigning system, car returning system and report generating system. An information center will also be included inside the system for central storage of all kinds of data. Every separate function uses the central database to achieve the goal it is set for. The associations are explained as following:

* Many users can use the same request processing system for sending request at the same time when they want to go together but one user can only correspond to one instance of the request processing system;
* Many users can be requesting for the same car tracking information at the same time and one user can retrieve tracking information of several cars too;
* A request can be handled by one secretary at the same time and one request can only be handled by one secretary;
* The traffic center can supply information about many cars at the same time but for one car tracking only one traffic center is available;
* Many GPS installed on cars can reply to the car tracking system at the same time and the same GPS can also respond to many requests for that car;
* Many reports can be presented to the same manager at the same time but one report doesn't have many managers requesting for it;
* One custodian can report for several cars at the same time but the same car report can only be done by one custodian;
* One custodian can handle one and only one car returning request because the users need to queue up and the same car for returning can only be processed by one custodian;
* One custodian can receive only one car assigning message at one time and the same message can only be sent to one custodian according to user’s location;
* One card swipe can be responsible for one returning request at a time and for the same request the card swipe should be unique;
* One card swipe can activate one instance of car assigning system and many card swipes can request for assigning cars at the same time.

### Class Diagram



Figure - Class diagram

The class diagram is explained in the following:

Secretary, Manager, User and Custodian will all be child classes of Staff so they inherited the private attributes of Staff as well as methods. The same goes for Available Car, Assigned Carto parent class Car and GPS, Card Swipe to Devices. For their relationships:

* A manager manages zero-to-many cars because he/she can be assigned to manage the cars or not, and in maximum a manager can manage many cars; a car is managed by one and only one manager. The same goes for manager to custodian;
* A custodian reports one-to-many available cars. Custodian is related to available cars not cars because he/she checks the status of cars at the end of day when all cars have been returned. A custodian can be assigned to one car or many cars. An available car is reported by one and only one custodian; a custodian handles zero-to-one user meaning he/she can either be idle or handle only one user because custodian needs to handle user's request one by one. A user also can either not go to the custodian or be handled by only one custodian;
* A user uses zero-to-one card swipe because every time user swipes the card only one card swipe accepts it and the card swipe is also can only be used by one user at a time. A user tracks zero-to-many cars at a time because a user can either not track any car or track as many cars as they want. The same car can also be tracked by many users at the same time. The user can be served by zero-to-one secretary because only one secretary will be responsible for the user and secretary also can only handle one request at a time because he/she needs to make the decision on their reasons for using. A user can resort to zero-to-one traffic service center because there is only one traffic center and the same center can serve zero-to-many users at a time. A user can drive one car at the most and the same car can be used by one-to-many users because the assigned car must be driven by at least one user and many users can be in the same car;
* A car must have at least one GPS and can only have one GPS installed in the contrast a GPS must be at least on one car and the same GPS can only be on the same car.

## Sequence Diagram



### Request Processing System



Figure - Sequence diagram for request processing system

The diagram is explained as following:

When a user wants to submit the request for applying for a car, he/she will open the program interface and then the system will generate a request Identification (ID) and send a request form to the user. When the user submits the form he/she will receive a confirmation message of submission. Then the system will retrieve the user data from the information centre which is an overall name for the database and the system will receive the user data from it. The request processing system will then determine if the driver's license of the user is valid, the class of the user is eligible for requesting a car and the user has been assigned with a car. If the outcome of every decision is false, the system will request for the information of available cars from the information centre and then it will send these data to the system. The system then determines if there is available car and if it is true it will send the form submitted by the user to a secretary. The secretary will send the request result to the system. Then the system will generate a message for the user to tell him/her if he/she has been granted or denied. The system then updates the user's data to the information centre which will send a confirmation for update. The system finally sends the message to user telling him/her the processing result.

### Car Assigning/Reservation System



Figure - Sequence diagram for car assigning system

The car assigning/reservation system is explained as following:

After the user is permitted for request, he/she must swipe the card in front of custodian's kiosk in order to get the car key right now or reserve a car for later use. When user swipes his/her employee's card, the card swipe will send the ID to the car assigning system. The system will send a reservation form to the custodian's computer and if the user wants to reserve the car he/she can ask the custodian for this. The custodian then sends the result of the form to the system. Then the system will retrieve user's data and find out if the user has been assigned a car, his/her request has been permitted, the user is reserving some car. If all the results of decisions are false, or true according to the names in the diagram, the system will retrieve the information of available cars. The system will assign a car to the user or let the user reserve a car. Then the system sends a message to the custodian about the result of processing and both the user's data and the car's data will be updated. These data will be updated and stored back to information center. Then the custodian will either give the key to the user when the user wants to use the car right now or do nothing if the user wants to reserve the car. In the above steps if the system determines the user has been assigned with a car and the user wants to use it right now by telling the custodian who sends the request for the user, the system will jump directly to update data of user, available car and assigned car and send the information to the custodian executing the following steps.

### Car Returning System



Figure - Sequence Diagram for car returning system

The diagram is explained as following:

When the user wants to return the car, he/she will swipe the card after driving the car back to his own campus in front of the custodian's kiosk, then the card swipe will send the ID to the car assigning system, where is normally the card swipe will send the ID to. The system will send a reservation form to the custodian which contains the option if the user wants to return the car because if the user is merely driving the car to other campus he/she can report his/her location by swiping the card without doing anything but only parking the car there. Then the system determines if the user has been assigned a car as the sequence goes in car assigning system. If he/she has and the custodian chooses the option that the user returns the car, the system will forward the request to car returning system which will retrieve user's data and the available car's data. Then the system unbinds the car from user's ID and assigns a car slot for the returned car. Then the data of user, available car and assigned car will be updated. Finally the assigned slot number will be sent to the custodian who will get the car key and drive the car back to the slot to prevent the case user mistakes the slot number in the car park affecting the effect of future use of database of available cars.

### Car Tracking System



Figure - Sequence diagram for car tracking system

The diagram is explained as following:

When the user wants to track cars he/she sends the request from the mobile application, the request is received by the car tracking system and the system generates a tracking form which is sent back to the user after retrieving the information of assigned cars. The user completes the form and submits it to the system and the system will get the information of GPS from information center. After knowing the information of related GPS such as Media Access Control (MAC) address the system locates the GPS and sends the request of location to GPS. The GPS then replies with its location to the system. The system then sends the location containing longitude and latitude to the traffic center which will confirm the location information first. Then the system sends requests of statistical information about the car including distance, trip time, time left for the trip etc. Then the traffic center replies with these information. The system will then use this information to calculate the estimated arrival time of the car, the returning time of the car and the time for the trip without traffic which is distance divided by average velocity of the car. After combining different information the system will generate a report and send the tracking report back to the user.

### Report Generating System



Figure - Sequence diagram for report generating system

The diagram is explained as following:

At the end of the day the custodian will check all the cars after they have been returned at the car park. These cars have become available cars. Then the custodian will request for report to the report generating system which then sends a report form to the custodian who can fill in the information such as the status of the cars. He/she then submits the form to the system which first retrieves the information of all the cars. Then the system combines the information from the custodian and those written to the car database such as user ID history of the day and generates a report. The report will be sent to the manager who views the report and decides what needs to be done according to the report. The manager then sends his/her comments to the system which will add the comments into the database of the cars. The system will then forward the comments to the custodian.

## Data Flow Diagrams



### Context Diagram



Figure - Context diagram

The diagram is explained as following:

The actors are users, secretaries, traffic center, card swipe, custodian, manager and GPS. There is no car as actor because cars don't directly interact with the system. The case is the transportation management system. Their relationships are:

* The user can request for applying for cars or tracking cars and the system gives tracking report to the user;
* The system sends the request form from users and the secretary handles the requests and sends the results back to the system;
* The system sends the car's location to the traffic center which sends statistical information about the car back to the system;
* The card swipe is only used for sending employee's ID to the system without doing other things;
* The custodian sends the status of the cars to the system which sends the feedback to him/her from the manager;
* The system sends reports of the cars to the manager and the manager sends comments back to the system;
* The system sends the location request to the GPS which sends information of location of the car back to the system.

### Level-0 Diagram



Figure – Level-0 diagram

The diagram is explained as following:

The system is divided by five relatively separate subsystems: request processing unit, car assigning unit, car tracking unit, car returning unit and report generating unit. These functions are:

* The user sends the request to 1.0 which will process it by retrieving user data and forwarding the form to the secretary who then sends back the result to 1.0 which then sends the result message back to user;
* The user swipes the card on card swipe which sends the ID to 2.0 which processes by retrieving user data and available car data while sending message to custodian who will confirm the assignment or reservation and execute respective steps;
* The user sends tracking request to 3.0 which retrieves assigned car data to let user choose. The user submits the tracking form to 3.0 which retrieves location data from GPS, sends location data to traffic center, receives statistical data from traffic center and sends them back to user using tracking report;
* The user swipes the card and tells the custodian the car is to be returned the request will be forwarded from 2.0 to 4.0 which retrieves user data and available car data to process the request and updates the database while informing the custodian of the assigned car slot;
* The custodian sends the status of cars to 5.0 which retrieves the data of available cars and combines them together generating the report to the manager who sends comments back to the system which then forwards the comments to custodian and updates the database.

### Level-1 Diagram for Processing User Requests



Figure - Level-1 diagram for processing request

The diagram is explained as following:

1.1 accepts and forwards the request to 1.2 which generates a request form sent back to user who submits the form to 1.3 which sends the form to 1.9 which combines processing result from 1.4, 1.5 and 1.6 and forwards the form the secretary who makes the decision and sends it to 1.8 which updates the user's data and sends it to 1.9 which generates feedback message to the user telling him/her the result of processing.

### Level-1 Diagram for Assigning Cars



Figure - Level-1 diagram for assigning cars

The diagram is explained as following:

In 2.1 the card swipe identifies the ID and sends the ID to 2.2 which will generate a reservation form to custodian who decides what request to make according to user's opinion and sends to completed form to 2.3 which checks if the user has already be assigned a car by retrieving user's data from database and if not forwards the data to 2.4 which checks if the permission has been granted and if yes forwards the user's data to 2.5 which searches the available cars to find out those not reserved by others and forwards the user's data and available car data to 2.6 which assigns or reserves the car for user and updates all three database while forwarding the user's data to 2.7 which generates the message and sends it to custodian who takes action on user's choice. In 2.3 if user has been assigned a car and he/she wants to use it the user's data will be forwarded directly to 2.6 and the other steps remain the same as above.

### Level-1 Diagram for Returning Cars



Figure - Level-1 diagram for returning cars

The diagram is explained as following:

In 2.0 car assigning system determines the car has been assigned and the custodian sends the request of returning car to 3.1 which accepts the request and forwards it to 3.2 which unbinds the car from the ID after retrieving user's data and forwards it to 3.3 which assigns available slot number from the processing result coming from 3.4 and updates the three database while sending the information to 3.5 to generate the message for custodian to drive the car back to assigned slot.

### Level-1 Diagram for Tracking Cars



Figure - Level-1 diagram for tracking cars

The diagram is explained as following:

The user sends the tracking request to 3.1 which accepts the request and forwards the request to 3.2 to generate a form that will be sent back to the user who will submit the form to 3.3 which accepts the tracking form and forwards the plate number of target car to 3.4 to search the database for MAC address of GPS while forwarding the MAC address to 3.5 which connects the system to target GPS and sends the request for location to the GPS that will sends the location information to 3.6 which will format the location information and sends the formatted data to traffic center which then accepts the data and sends the related traffic data the 3.7 that accepts the data and forwards it to 3.8 which will calculate related statistical information of the car and send the calculated results to 3.9 to generate a tracking report that will be sent back to the user.

### Level-1 Diagram for Generating Report



Figure - Level-1 diagram for generating report

The diagram is explained as following:

The custodian sends the request for reporting the cars to 5.1 which accepts the request and forwards it to 5.2 that will generate the form according to the category of report and send the form back to custodian who then completes the form and sends it to 5.3 which accepts the form and sends the information of reported car to 5.4 which combines the information of the car and the reported information to generate a report in 5.5 which then sends to report to the manager who will give the feedback on the report and sends the feedback to 5.6 which after accepting the feedback updates the status of the cars by overwriting the database and sends the feedback to 5.7 which then generates a feedback message and sends it to the custodian.

## Entity-Relationship (ER) Diagrams

### Conceptual Data Model



Figure - Conceptual data model

The diagram is explained as following:

* A secretary can handle no user or one and only one user because he/she needs to decide on every case; a user can either not request anything or be handled by not more than one secretary;
* A card swipe serves one and only one user and vice versa;
* The traffic center can serve no or many users at a time and a user can only use no or one traffic center;
* The traffic center can send no or many statistical information each of which points at individual car; the statistical information is sent by at least one and only one traffic center;
* A statistical information is generated for at least one car and only the same car; a car has no statistical information if not requested or one information at a time;
* A user can reserve no or one car at most; an available can be reserved by no user or many users at a time according to its capacity;
* A user can be handled by no custodian if not requesting or only one custodian; a custodian handles either no user or one user each time;
* A user can track no or many cars at a time and vice versa;
* A user can use no car or only one assigned car at a time; an assigned car can be used by at least one user and can be used by many users according to its capacity;
* An assigned car is a car and the only car; a car can either be an assigned car or not. The same goes for available car to car;
* An available car must be kept by at least one custodian and only one will be assigned for it; a custodian can keep no or many available cars because some of the custodians can have other tasks;
* A custodian listens to at least one and only one manager; a manager advises no or many custodians because he/she may not be in charge of this area;
* A car has at least one and only one GPS and a GPS is on one and only one car.

### Primitive Transformed E-R Diagram



Figure - Primitive transformed E-R diagram

The diagram is explained as following:

Most of the contents are the same as conceptual data model, only because the relationship between user and the car and that between user and statistical information are many-to-many binary relationships so it is necessary to create separate relations to demonstrate the changes to the database. A new associative entity Tracking Instance is created representing the instance of tracking which will take the primary keys of both user and car as compound primary key. The user can open no or many instances on his/her mobile to track many cars and the individual instance is opened by at least one and only that one user; an instance must at least target a car and only one car and a car is targeted by no instance or many on different user's mobiles. This means only when the user ID and the car plate are both present the tracking instance is unique. The other associative entity Being Transmitted Info is similar to this. The difference is statistical information must have at least one being transmitted information because the information is generated by request. Both created entities have a relationship too. The being transmitted information is aiming at the unique instance and the tracking instance has either no or one being transmitted information because the request for information may be denied by traffic center.

### Full E-R Diagram



Figure - Full E-R diagram

The diagram is explained as following:

The full diagram has been added with primary and secondary keys. The foreign keys are added as indicated in rules for transforming:

* Secretary to User is one-to-one relationship so they have both others’ primary keys as foreign keys indicating they can track each other in the database;
* Traffic Center to User is one-to-many relationship so User has a foreign key from primary key of Traffic Center indicating the user can track the Fully Qualified Domain Name (FQDN) of the Traffic Center in its database;
* Primary keys of the two associative entities Tracking Instance and Being Transmitted Info are decided by primary keys of User and Car as well as Statistical Information so they are unique only when the primary keys of related entities are both present. (Valacich, George &Hoffer, 2012)

# Recommendation

In order to facilitate the process of requesting the cars in PWA it is necessary to replace the old system with the new one described in those sections above. The author recommends PWA management level to implement the new system immediately to adapt in the situation of fast-growing demand for school cars for business purpose. The devices such as GPS, card swipes should be purchased completely before planning for the implementation. (Report Writing: Recommendations, n. d.)

# Conclusions

This report analyzed the existing transportation management system in PWA and described a new system that will replace it in the future. The author first reviewed the popular methods for scheduling in modern transportation management systems and analyzed the requirement of the new system comparing to the existing system in PWA to find out what needs to be achieved in the new system. Then the author describes the functions and mechanism of the new system by drawing different diagrams including use-case, class, sequence, data-flow and entity-relationship diagrams. At last the author recommends adopting the new system immediately to adapt to the changing situation.

# Appendix



## User Documentation of the New System

**PWA Transportation Management System 1.1**

**Short User Documentation**

**Version 1.0**

Man Fu Lei

25 May 2014

1. **Introduction**

This document is an introductory guide to the use of PWA transportation management system. In order to apply for a car for business use in PWA the staff needs to apply for it manually which is inconvenient. For them we offer a better way to achieve the goal in PWA by introducing the automatic transportation request processing system. Most of the functions of the system are done with only limited user interference. Before starting using a car the user must first send the request via his/her mobile application and after the request is permitted he/she needs to go to the card swipe outside the custodian’s kiosk to be assigned or reserve a car. These will be described in following sections. When the car is to be returned the user can swipe the car and inform the custodian for returning the car.

1. **Installation procedure**

The procedure for installing the mobile application is as following:

1. Obtain the file PWATransMgmt.pka from the Web site http://www.polytechnicwest.wa.edu.au/transportation/transport-management-system.php

2. Open the PWATransMgmt.pka in your mobile phone.

3. On the dialogue window choose “I agree”.

4. After the loading bar is completed, click on “Finish” to finish the installation.

1. **Register the Accounts**

The icon created through installation on home page is named PWATrans. Open the file and the initial page of the program allows user to log in to the server. If the user doesn’t have an account, he/she needs to go to the service desks to get to the secretary for registering for a new account in the system. During that the user needs to present their employee ID card, driver’s license and passport. After the registration is completed, the user will receive a password which can be used for logging into the system.

1. **Structure of PWA Transportation Management System**

The application is organized as a collection of different functions including requesting and tracking cars. It is able to perform the following functions:

* Send the online request for applying for a car;
* Track different cars at the same time for the cars which are assigned to other users. The tracking report typically contains information about the distance, estimated time of return and so on;
* Update the list of available cars and assigned cars for the user who requests for them.

1. **How to Request for a Car Using the application**
   1. ***The Request Form***

When a user wants to request for a car, he/she can click on the “Request” button. Then the application will provide a form inside which the user can write down the time for leaving and choose when the car will be returned. The important thing is the user must write down the reason why he/she needs a car because the secretary will decide whether to approve or not based on the reason the user provided. After the user submits the completed form, he/she will receive a message for the confirmation of submission which means the system has started processing the request. The user may need to wait for a few minutes for the request to be processed. More than one user can be included in the same form.

* 1. ***Processing Result***

When the processing of the request has been completed, the user will receive a message from the application stating the result of the processing. If the permission is granted, the user can go to the kiosk of custodian, swipe the employee’s card while telling the custodian whether the car will be used right now or be reserved for later use in the day or he/she can do nothing but wait until he/she feels it is needed to use the car.

* 1. ***Constraints***

The user needs to request again if he/she doesn’t use the car until the next day. Once the car is reserved other user it is not allowed to be used even if he/she can use it in the time other than the time when the one that reserved the car will use it.

1. **How to be Assigned or Reserve a Car**
   1. ***Get a Car***

The user needs to go to the custodian’s kiosk to get the car key. There he/she will swipe the card first and tell the custodian when he/she is going to leave. After that the custodian will send the request for the user to the system and the system will tell the custodian which car has been assigned. Then the custodian will give the car key to the user.

* 1. ***Reserve a Car***

The reservation of a car is quite similar to getting a car except that the user needs to tell the custodian that he/she will need the car in some other time at the same day. The custodian then sends the request to the system which will then tell the custodian the database has been updated and the user has been assigned a car. When the user wants to use the reserved car, he/she can come again and repeat the steps in 6.1 and get the car key.

* 1. ***Reporting Location***

When a user arrives at the other campus via the car he/she can swipe the card outside the kiosk in that campus. The system will then update the user’s information in the database without doing other things. It is also decided by the option of custodian in that campus.

1. **How to Track a Car**

When a user wants to know the information of an assigned car such as its location he/she can click on the “Track” button and then complete the form of tracking by choosing the car plate provided by the system or choose “Track All”. The information of all assigned cars will be displayed in the tracking report. This is particularly useful when a user wants to apply for a car but there is no car available in his/her campus. The user wants to know when the earliest car can return and this information will be contained in the report.

1. **How to Return a Car**

The user needs to return the car back to his own campus by swiping the card again outside the custodian’s kiosk and the custodian will send the request of returning the car to the system. The system will then provide an available slot number to the custodian who will then get the car key from the user and drive the car back to the designated slot. If the user wants to use a car again, he/she can swipe the card and tell the custodian about this and repeat the steps in section 6. Because the user has been granted permission, he/she doesn’t need to request again until the next day.

1. **Software Generalities**

The software is in the beginning of development and it may still have bugs we haven’t found. However it was developed in the purpose of helping users conveniently requesting for the car and staffs processing the request. If there are bugs users can report to the support team by either clicking on the “Bug Report” button or going to our website for complaint submission. If a bug is verified the user will be rewarded by PWA management.

1. **Contact information**

Comments, suggestions and bug reports can be sent to:

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Australia

131306105@polytechnicwest.wa.edu.au

1. **References**

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# Glossary

**Actor:** An external entity that interacts with the system

**Associative entity**: An entity type that associates the instances of one or more entity types and contains attributes that are peculiar to the relationship between those entity instances

**Basic feasible solution: A**ny solution of a linear programming problem satisfying certain specified technical conditions

**Binary relationship**: A relationship between instances of two entity types

**Card swipe**: An electronic reader through which a credit or charge card or cheque guarantee card is passed in order to record the information it bears

**Child class**: A modular, derivative class that inherits one or more language entities from one or more other classes (called super-classes, base classes, or parent classes)

**Class diagram**: A type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects

**Conceptual Data Model**: A detailed model that shows the overall structure of organizational data but is independent of any database management system or other implementation considerations

**Context diagram**: A data-flow diagram of the scope of an organizational system that shows the system boundaries, external entities that interact with the system and the major information flows between the entities and the system

**Data flow diagram**: A graphical representation of the "flow" of data through an information system, modeling its process aspects

**Degenerate**: In transportation tableau with m rows and n columns there must be m+n-1 cells with allocations; if not it is degenerate

**Entity-Relationship diagram**: A graphical representation of the entities, associations, and data for an organization or business area; it is a model of entities, the associations among those entities, and the attributes of both the entities and their associations

**Foreign key**: An attribute that appears as a non-primary key attribute in one relation and as a primary key attribute (or part of a primary key) in another relation

**Fully Qualified Domain Name (FQDN):** A domain name that specifies its exact location in the tree hierarchy of the Domain Name System (DNS)

**Global Positioning System (GPS)**: A space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites

**Index card**: Consists of heavy paper cut to a standard size, used for recording and storing small amounts of discrete data

**Level-0 diagram**: A data-flow diagram that represents a system’s major processes, data flows, and data stores at a high level of detail

**Level-1 diagram**: A DFD that is the result of nested decompositions of a series of sub processes from a process on a level-0 diagram

**Media Access Control (MAC) address**: A unique identifier assigned to network interfaces for communications on the physical network segment

**Method**: functions through which users interact with the objects

**Minimum cell cost method:** As much as possible is allocated to the cell with the minimum cost

**Modified distribution method**: Compute indices for each unused square without drawing all the closed paths

**Northwest corner method:** First largest possible allocation is made in the cell upper left hand corner of the table by subsequently allocation to adjacent feasible cells

**Polytechnic West Australia (PWA)**: A State Training Provider established under section 35 of the Vocational Education and Training Act 1996 (WA) based in Perth, Western Australia

**Primary key**: An attribute whose value is unique across all occurrences of a relation

**Private attribute**: Specify the accessibility of entities in a module as private meaning it can only be accessed by the class itself

**Secondary key**: One or a combination of fields for which more than one row may have the same combination of values

**Sequence diagram**: An interaction diagram that shows how processes operate with one another and in what order

**Stepping-stone method**: An iterative technique for moving from an initial feasible solution to an optimal solution

**Transportation management system**: A subset of supply chain management concerning transportation operations and may be part of an enterprise resource planning system

**Unbalanced situation**: Situation where demand is not equal to supply

**Unified Modeling Language (UML)**: A standardized language for describing and visualizing the different parts of software systems; used for designing software

**Use-Case diagram**: A representation of a user's interaction with the system and depicting the specifications of a use case

**User documentation** : Describes each feature of the program, and assists the user in realizing these features

**Vogel's approximation method**: Used to find the feasible solution for transportation of goods where the solution is either optimal or near to the optimal solution

**Zero-crossing method**: In assignment system reducing the minimum cost from all costs of every row and column and cross out zeroes to determine the best solution

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