Application of Client Server Architecture for Automate Vehicle Allocation in Military Domain

RMSB Rathnayake[#], AMCK Gunathilaka and RMM Pradeep
General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka
[#]sanduni.nw89@gmail.com

Abstract *— As a large scale organization in military domain Kotelawala Defence University (KDU) performs many services for the enhancement of tri forces in Sri Lanka. Among the various services providing in university, transport service plays a major roll and it includes all the logistics services required in the university, staff transport and special transport facilities in special events. The management of motor transportation is handled by Motor Transport office (MTO) of KDU. The MTO is facing in challenges of dealing with allocation of vehicles and staff and ensuring no delays and obstacle in the service. The manual scheduling which is adopted at the present has many shortcomings in fleet and crew assignment in daily operations. Therefore this works main objective is to automate the Motor Transport Allocation System using Client Server Architecture. A tool was developed with NetBeans and MySQL by using Java Remote Method Invocation (Java RMI). For the development and testing of this tool it used Agile Development Methodology. The RMI application is to be installed on server that acquires vehicle request information through java virtual machines in different remote hosts in KDU. Then the multi criteria analysis algorithm will be used to prioritize the suitable vehicles to be selected by the MTO. The MTO's selection informs the applicant via an e-mail accordingly. Further the system generates weekly, monthly and annual reports for administrative purposes. Application of this tool in the real environment will reduce all the possible human errors which will reason to increase the productivity. The result of this work shows the Client Server Architecture capability in increase efficiency and accuracy of the logistic vehicle allocation system in the defence sector.*

Keywords *— Client Server Architecture, Vehicle Allocation Automation, Java RMI, Prioritization Algorithm*

I. INTRODUCTION

Optimizing the vehicle allocation for official and personal requirement in large scale organizations is a common resource management problem. Then most of such organizations maintain separate department, but it faces lots of difficulties and errors during the operation due to manual work. To automation of such kind of procedures, it has used methods such as, real time scheduling (Andreev et al, 2009), using web base application(Waspodo et al, 2011) and client server architecture (Merz & Lamersdorf, 2000), which has different pros and cons. In here it aims to identify the importance of vehicle schedule that serves the maximum workload and optimizes several economic objectives while satisfying a set of imperative constraints (Laurent & Hao, 2007).

In this works it considers all the above methods and attempt to automate vehicle allocation process of a large scale military organization. Hence the object of this work is to automate the Vehicle Allocation System of Kotelawala Defence University (KDU) by using Client Server Architecture.

II. METHODOLOGY

A comprehensive system study was carried out in the KDU vehicle allocation manual system to identify the bottle necks. As well it studied the availability of computer equipment which is presently at the university. Based on the finding a client server architecture is proposed and develop a RMI based Vehicle Allocation System using Java and My SQL server. When system is developed it used Agile Development Methodology. Then final product was evaluated accuracy, efficiency and reliability.

A. Present System

It studied that a considerable time is taken to vehicle reservation process in the present system. As well it found that the remarkable human errors generated while vehicle selection process. The present system is shown in Figure 1.

This study found that all the potential users are having computers with connection to the local area network. The outline of network design is shown in the Figure 2

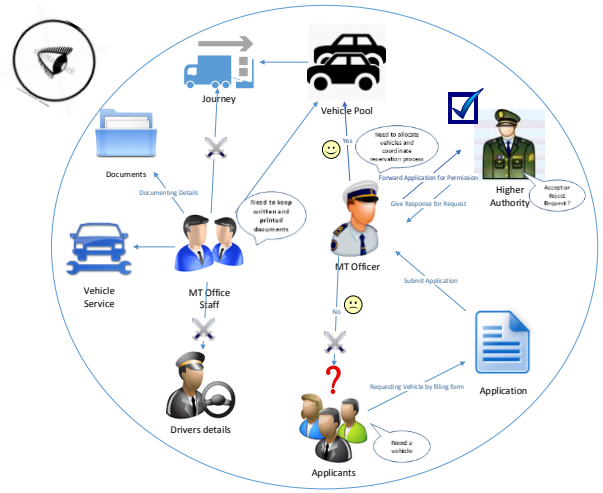

Fig 1. Present Manual System

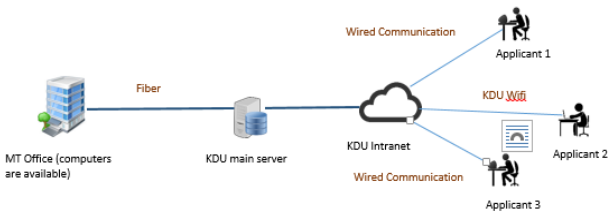

Fig 2. Available Resource at KDU

B. Multi Criteria Vehicle Selection Algorithm

When a transport requirement arises, the MT section, is selecting a suitable vehicle to fulfill the requirement based on (1) Distance to travel, (2) Number of passengers. This study found that this criterion is not equal weight as shown in Table 1.

Table 1. Multi Criteria Vehicle Selection

Criteria	Priority	Weight
Number of passengers	1	0.6
Travel Distance	2	0.4

Based on this multi criteria it proposes an automated algorithm as described in figure 3.

The vehicle selection process is performing by system as follows,

1. Get the values of Distance, No of Passengers, Date & Time, and Purpose from request form.
2. By using data base queries find available vehicles for maximum number of passengers, maximum distance, particular date and purpose.
3. Fuel Cost is predefined in Vehicle Details table and retrieve the average fuel cost for available vehicle.
4. Calculate the priority level of requirement and allocate vehicle with maximum priority value. The functional statement of multi criteria is as shown in the Equation 1.

$$x = f\begin{pmatrix} No\ of\ Passengers, Max\ Passengers, \\ Distance, Fuel\ Cost \end{pmatrix}$$

$$x = (0.4 \times Distance \times 0.6 \times No\ of\ passengers) \ / (Maximum\ No\ of\ Passengers \times 1/Fuel\ Cost)$$

C. Client Server Architecture and Java NetBeans

The present study shows that the one of best combinations available for the automation of manually managed complicated systems is Client Server Architecture and Java. Java API create convenient programming interface to client server communication to access data through the network via Java Remote Method Invocation (IBM, 2011). Java Remote Method Invocation (Java RMI) enables the programmer to create distributed Java technology-based to Java technology-based applications, in which the methods of remote Java objects can be invoked from other Java virtual machines, possibly on different hosts. RMI uses object serialization to marshal and un marshal parameters and does not truncate types, supporting true object-oriented polymorphism (Oracle, 2014). RMI also provides a simple solution to distribute the processing of intensive tasks from the client to the server or among different servers (www.cs.mun.ca, 2015). In another words Java RMI used for the request and respond between client and server (Zaman & Talukder, 2004). Java RMI eliminates all the requirements of traditional networks. It only requires some interfaces that visible to the client. In server side developer has to create a small driver program to start and stop the server. As stated by Gray (2005) “in many ways, Java-RMI is the least resilient of the technologies; its apparent advantage has always been seen as its higher performance.”

D. Proposed Automated System

In here it has considered the bottle necks and available resources, this work propose automated system as shown in figure 4.

The system was developed using Java using NetBeans platform with additional plugins and tools. The database

was developed in My SQL server and used JDBC to handle all the database transactions. The design of system comprises is primarily a client server web based system with multiple user access through various devices. The figure 5 describes the three tire architecture of the software solution for vehicle reservation procedure.

The developed codes and user interfaces were incrementally tested for accuracy and user-friendliness. The multi-criteria selection algorithm was evaluated with sample data as shown in the Table 2.

III.RESULTS

The present work has developed a verified Vehicle reservation System that ready to be deployed. This system provides users to login and forward the transport requirement to the MT section. Then system analysis the requirement and forward the requirement to MT section with opted vehicles to be allocated. MT section is facilitated to select a suitable system with the options, and then system informs the requester accordingly. Few user interfaces are shown as Figure 6, Figure 7, Figure8 and Figure 9.

The study found that the proposed algorithm provides 100% accurate vehicle options match with the manual system as shown in the Table 2.

Table 2. Result of Experiment

Criteria		**Manual Selections** (Vehicle ID)	**Selections of System** (Vehicle ID)
Distance	No of Pass		
5 km	26	P1: V012 P2: V028	P1: V012 P2: V028
21 km	8	P1: V048 P2: V049	P1: V049 P2: V048
13 km	21	P1: V011 P2: V056	P1: V011 P2: V056
39 km	4	P1: V024 P2: V046	P1: V024 P2: V046
4 km	16	P1: V009 P2: V018	P1: V009 P2: V018
12 km	26	P1: V056 P2: V011	P1: V011 P2: V056
46 km	34	P1: V031 P2: V037	P1: V031 P2: V037
9 km	11	P1: V004 P2: V005	P1: V004 P2: V005
12 km	8	P1:V048 P2:V049	P1:V048 P2:V049
24 km	19	P1: V009 P2: V018	P1: V009 P2: V018

DISCUSSION & CONCLUSION

This work demonstrates the application of Client Server Architecture with Java RMI technology for the vehicle reservation in military domain.

ACKNOWLEDGEMENT

The author would like to thank Major RMM Pradeep and Major AMCK Gunathilakata for the guidance throughout the entire work and to the parents, family, and friends, who provide the advice and financial support.

REFERENCES

Academia.edu <http://www.academia.edu/3442775/Car_Rent_and_Online_Reservation_System/>Car Rent and Online Reservation Systems - Accessed 16 January 2015.

Andreev S, Rzevski G, Shviekin P, Skobelev P, Yankov I, (2009).<http://link.springer.com/chapter/10.1007%2F978-3-642-03668-2_30>"A Multi-agent Scheduler for Rent-a-Car Companies"- Accessed 10 January 2015.

A New Vehicle Reservation System For Greater Efficiency- The City of Kelowna employees are now reserving their pool vehicles on-line, California Fleet News, Viewed Nov/Dec 2005.

Azolve (2011). <http://www.azolve.com/>
Azolve Pool Vehicle Allocation Solution, Azolve Limited, Midlothian Innovation Centre, PentlandfieldRoslin Midlothian -Accessed 10 January 2015.

Car Rental Solutions, (2015).

Ceonex, (2015). <www.ceonex.com>
Vehicle Reservation system-Product sheet, Ceonex, Inc. 3 Grant Road, Swampscott - Accessed 11 January 2015.

Gray N A B, (2005). <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1681&context=infopapers> "Performance of Java middleware - Java RMI, JAXRPC, and CORBA"- Accessed 16 January 2015.

IBM, (2011).<https://www304.ibm.com/support/knowledgecenter/SSAHQR_8.4.3/com.ibm.programmingcm.doc/dcmap012.htm> Understanding client/server architecture (Java only)- Accessed 24 March 2015.

JavaSoft, (2015). <http://www.cs.mun.ca/~paul8/jdk1.2beta3/docs/guide/rmi/examples.html>Real World Applications using Java RMI- Accessed 19 February 2015.

Laurent B, Hao J, (2007).

<http://www.info.univ-angers.fr/pub/hao/papers/CIE07.pdf>"Simultaneous Vehicle and Driver Scheduling: a Case Study in a Limousine Rental Company"- Accessed 12 February 2015.

Merz M, Lamersdorf W, (2000). <https://vsis-www.informatik.unihamburg.de/getDoc.php/publications/16/iipes-93.pdf> "Generic Interfaces to Remote Applications in Open Systems" - Accessed 12 January 2015.

Sivakumar R, Raja S, Swaroop D, (2005) <http://c3uv.berkeley.edu/papers/Rathinam_ase06.pdf> "A Resource Allocation Algorithm for Multi-VehicleSystems with Non-Holonomic Constraints"- Accessed 13 January 2015.

Washington State Ferries, (2010). <http://www.wsdot.wa.gov/NR/rdonlyres/5AC735B6-11F3-44F0-B078-E149D0F27825/0/VehicleReservationSystemPhase1Report.pdf/>Washington State Department of Transportation Ferries Division, Final Vehicle Reservation System Phase 1 Outcome s- Accessed 13 January 2015.

Waspodo B, Aini Q, Nur S, (2011). <http://core.ac.uk/download/pdf/11734590.pdf> "Development Of Car Rental Management Information System(Case Study: Avis Indonesia)"- Accessed 10 February 2015.

Zaman A N K,Talukder K A, (2004). <http://www.academia.edu/444308/DEVELOPMENT_OF_A_NETWORK_BASED_BANGLA_TICKET_RESERVATION_SYSTEM_USING_JAVA_RMI>"Development of a Network BasedBangla Ticket Reservation System using Java RMI" presenting in National Coference of Computer Processing Bangla 2004 - Accessed 10 May 2015.