

Rural Intelligent Public Transportation System Design: Applying the Design for Re-Engineering of Transportation eCommerce System in Iran

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ABSTRACT

In order to improve the level of intelligence, availability, convenience, information and humanization of rural public transportation systems, they are more willing to use modern information and communicative technologies. In addition to management services, intelligent transportation systems can provide passengers, drivers and other institutions with other services such as trip planning, tracking and so forth. In this paper the authors have attempted to present a comprehensive design of rural ITS based on cloud and grid computing, RFID, GPS, GIS, etc. through e-commerce and particularly m-commerce in order to improve the rural transportation management and presentation of user-centric services. Also according to the design, intercity transportation services to passengers are re-engineered. The results show proposed design with distribution infrastructure improves the performance of e-commerce and ITS in transportation domain. The system designed on this paper regardless of the possible challenges could efficiently cover the problems of rural transportation of newly developing countries.

Keywords: *Business Process Re-Engineering, Cloud Computing, Ecommerce System, Grid Computing, Information System, Intelligent Transportation System, Mcommerce Rural Transportation, Petrinets, Public Transportation*

INTRODUCTION

Intelligent transportation systems are aimed to promote the efficiency and security of transportation systems by applying Information and communication technology and management strategies purposefully. These systems include the presentation of existing information to the passengers, facilitation and acceleration of transportation, precise, comprehensive and efficient management and control, the real-time

of traffic and appropriate accountability for the emergency needs (Chen, 2011; Wang, 2006; Cheslow, Hatcher & Hsin, 1993).

The studies which are done in the field of ITS are mainly emphasized on urban intelligent transportation systems in order to determine congestion, traffic flow control, routing and so on; and they are less emphasized on rural transportation. Meanwhile, the efficient, accurate and practical service presentation to improve and enhance the public transportation

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can be considered as one of the most crucial actions of government in major communities. The two main objectives of this paper are the following; the first one is to present a comprehensive Rural Intelligent Public Transportation System (RIPTS); this system can offer services to different users whether drivers, passengers, travel agencies, and other relevant transportation institutions as well as control and provide management of rural transportation through applying the integrated wireless communicative technologies such as GPRS, RFID, NFC, WI-FI, and also cloud and grid computing technologies, GIS and GPS; which results in less pollution, fuel consumption, cost and time, and on the other side, increased safety and convenience.

The other objective is to analyze how the proposed design affects the performance of Rural Public Transportation Electronic Commerce Systems (RPTECSs). A RPTECS is considered essentially a subsystem in RIPTS. It provides facility of buying and selling rural transportation services (such as air ticket, train ticket, etc.) through the Internet (or other alternative communication networks). For this purpose, computer modeling and simulation of RPTECS's processes using Petrinets and WoPeD ("WoPeD," 2013) tool are addressed. Computer simulation is the design of an actual physical or a theoretical system, running the model on a computer and analyzing the output of the model. The purpose of stimulation is the study and analysis of the reference system. The foundation of simulation is a model. Each kind of presentation or expression of a system is called a model. A model describes the behavior of a system and simplification, uniformity and unity can be regarded as its properties. One method of modeling is using Petrinets. Petrinets was invented in 1962 by Carl Adam Petri (Aalst & Hee, 2002, p. 36). He was mostly focused on information systems, since then, many groups in different countries were formed to enhance the researches on application of Petrinets. The main application of Petrinets is in transportation, regarding the utilization of Petrinets to

resolve the traffic problems such as: congestion, subways, buses and trains scheduling, traffic lights scheduling, etc. (Spiteri Staines, 2012; Retchkiman, 2008; Darbari, Singh, Asthana, & Prakash, 2010; Huang & Chung, 2008; Qu, Li, Liu, Chen, & Dai, 2010; Filipova, Stojadinova, & Hadjiatanasova, 2002). Furthermore, based on the studies, only Zhu, Wang, Wang, and Tang (2006) could model interaction among the agents in intelligent transportation systems using Petrinets; and Kabashkin (2007) also has performed the reliability analysis in intelligent transportation systems using modeling evaluation of Petrinets. Therefore, no study has been done regarding the effect of modern technologies on function of information systems related to transportation using Petrinets.

The main contribution of this paper is design a complex system as an intelligence system for rural public transportation based on the distributed infrastructure and cloud computing. In system approach, RIPTS is considered as a concrete, open and dynamic system (Ackoff, 1971). Given classification of systems' behavior, it is also a multi-goal-seeking system (Ackoff, 1971). Concept of systems and their classification are well stated by Ackoff (1971). We investigate impact of proposed design on the rural public transportation electronic commerce systems using Petrinets modeling and simulation. It is noteworthy that Petrinets have not been used for investigation of information and e-commerce systems in transportation domain yet.

The rest of the paper is organized as follows. Section 2 briefly reviews the ITS experiments and applied technologies. In section 3 the design of rural intelligent public transportation system and its functional objectives are represented. Section 4 re-engines the process of RPTECS services using the case study based upon the presented design in this paper. Section 5 represents the results of applied proposal design within performance of services. In the final section the summary and conclusion along with the major advantages and challenges are stated.

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