The Web Integration of the GPS+GPRS+GIS Tracking System and Real-Time Monitoring System Based on MAS

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Abstract. In this paper, the Multi Agent System (MAS) Architecture, GPS, GIS, and Wireless Communication technologies were discussed. New application architecture of complex vehicle Location Based Service (LBS), and Navigation and Intelligent Transportation systems based on the MAS architecture were proposed. The implementation and Web performance of this methodology on the urban garbage trucks management in the Shanghai Putuo district were introduced. The final system testing results were evaluated. And the future potentials of the MAS based approach to solve complex urban management problems and monitoring information network systems were prospected.

Keywords: Software Agent, Multi Agent Systems, GPS, GIS, Wireless Communication.

1 Introduction

In the research field of the Software Agent, implementations are more advanced than other theory studies. As an important computation and construction unit of the digital world (with the development of the computer and communication hardware and software), there have been many innovations and diversified applications about the Agent system, first from a single Agent, then Multi Agents, and now Mobile Agents.

Actually, Agent technology is becoming the most important component in constructing the socially organized system of the cyber world. Agent applications include information services, multi-dimension designs, robots, e-business, computer aided cooperation, computer games, education and training, intelligent environment, society simulation, artificial life and so on.

Location Based Service (LBS), Navigation and Intelligent Transportation are the hot research topics now. There are many wonderful solution methods emphasis on above topics, e.g. PDA (Personal Digital Assistant)/Pocket PC and GPS (Global
Positioning System) integration, embedded navigation software development, GIS(Geographic Information System) based transportation commanding center building, and so on. But our objective using Agent technology and Multi Agent System architecture is to find a total solution approach to cover the main questions in this area.

Research on Location Based Service (LBS) and Navigation and Intelligent Transportation generally tackle three basic questions (Shih-lung Shaw, 2005):

1. Where am I? (How to calculate my position)
2. What is around me? (How to express the objects and environment around some place)
3. How can I go to that place? (Best way of getting from A to B)

Question 1 can be solved now by the integration of the GPS (Global Positioning System) or Satellite Positioning System, sensor network positioning and embedded GIS (Geographic Information System) software. The position information can now be transferred to the users’ PDA or smart mobile phone using Short Message Service (SMS) or push technologies (GPRS- General Packet Radio Service, WAP- Wireless Application Protocol, etc.).

Question 3 can be tackled by the research on network analysis models and algorithm for way-finding. Some familiar way-finding algorithms [1][2][3] include Depth-first searching algorithm based on the network limitations; Dynamic programming algorithm in an acyclic network graph with direction identification; Dijkstra algorithm based on the adjacency matrix; Maximum dependence edge algorithm; and Dijkstra algorithm based on the greed and heuristic game etc.

But for question 2, the transportation monitoring system distributed at different road junctions and crosses is a better method to offering the real-time environment video frequency information around us.

So new methodology should be proposed, which integrates GPS installation in vehicles, data transmission through wireless network services (e.g. SMS- Short Message Service, GPRS- General Packet Radio Service); direction promotions supported by the GIS based way-finding algorithms; and Web real-time video capture systems. This methodology gives us the possibility to solve total Location Based Service (LBS), Navigation and Intelligent Transportation questions.

This paper proposes a MAS architecture implementation to solve these two important problems in the Web integration of the GPS+GIS+GPRS Tracking System and Real-time Monitoring System.

The Agent here is not only a modern, advanced, computation technology as people wish, but also a new solution methodology and a new concept model and implementation tool to study the complex, distribution and interaction system.

2 Software Agent and Multi Agent Systems

Referenced to the Agent concept by M. Minsky (1994), the famous computer scientist and the one of the Artificial Intelligence founders, Software Agent are self-governed software/integrated software package with special skills, with regard to one computer system. When you need accomplish a task without any knowledge about the inside...