Abstract

The ability of providing quick maintenance services and necessary service parts for certain products and facilities can be considered as core competitive advantages in the maintenance service logistics. In order to guarantee such seamless business processes on the maintenance service logistics network, the business partners (facility manufacturer, parts suppliers, and customers) should collaborate for the efficient exchange of relevant information. This paper proposes an architecture of software agent-based maintenance service logistics support system for such a purpose.

The first issue of paper is to tackle the problems in sharing and exchanging information through multi-agent communication. In this paper, the author adopts Resource Description Framework (RDF) to model required information in maintenance service logistics. The author also uses Extensible Markup Language (XML) serialization method to express an RDF-based message for agent communication. By virtue of using RDF and XML, software agents can correctly understand the contents of a received message, and can consistently process it. The feasibility of proposed agent communication architecture is demonstrated with preventive maintenance execution process and service parts supply process.

Meanwhile, the expansion of company size requires using lots of sophisticated facilities, which increases maintenance costs followed by decreasing the profitability of a company. Recent trend in maintenance management focuses on reducing the maintenance costs and improving the quality of services by outsourcing the entire maintenance tasks. The second issue of paper is dealing with the coordination of maintenance service schedule for multiple customer companies who outsourced their maintenance tasks from one service providing company.

Previous studies on maintenance service scheduling can be considered as centralized batch scheduling using integer linear programming model. Not to mention the optimality of their model, the approach has fundamental limitations in reflecting continuously changing site information. Therefore, it is difficult to use such models for recurrent coordination and
modification of service schedules caused by emergency service requests or change of situation in individual customer sites. The author proposes agent-based problem solving technique that enables utilizing current site information for determining and continuously modifying a maintenance service schedule.

The key idea of the technique is Guided Distributed Constraint Satisfaction (GDCS) algorithm that incorporates cooperative distributed problem solving among multi-agents. This algorithm delegates the coordination task of service schedule to autonomous software agents who run at the individual customer sites. They communicate with each other to generate feasible service schedule that satisfies all the currently related constraints. In other words, the relevant site information required for the coordination of service schedule can be communicated and reflected to the schedule in real time via automated agent communication, which differentiates this approach from previous researches.

As well as for the maintenance management tasks, the multi-agent technologies proposed in this paper can be applied to the various inter-business information exchange and problem solving tasks, which might contribute to the automation of business processes.

Keywords: Maintenance service logistics, Multi-agent technology, Cooperative distributed problem solving, Distributed constraint satisfaction algorithm, XML, RDF

Student Number: 97406-810