Mobile Multi-Site Construction Project Management for Developing Countries

DISSERTATION

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ABSTRACT

Under booming construction demands in developing countries, especially in Vietnam construction firms usually perform simultaneous multiple projects on different places which may be hundreds or thousand kilometres away from the head office. This basically leads to the concept of multi-site construction project management.

Construction projects can be described as high uncertain executing environments, where unplanned changes regularly occur. This is because of the fact that the construction projects are often greatly influenced by variations in weather, incomplete design scope, productivity of labour and equipment as well as in quality of materials etc. Because of these uncertain problems, the understanding communication and effective collaboration among project participants play crucial roles in the internal management system of a construction firm. In these, the information exchanges must often be timely and exactly transferred and reported to the corporate levels in order to determine the proper business strategy that aims to satisfy the different requirements and to make the benefits.

In order to deploy multi-site construction project, there are often thousand of parts, systems and equipments to be required. For solving daily risks and reaching main business strategies of the entire construction firm, the responsible managers must heavily rely on effective scheduling methods which, can take in calculation the mesh of relations and interdependencies among projects, can quickly solve complex problems that occur in construction sites. Additionally, in order to effectively solve unanticipated events at the construction sites, these scheduling methods must be inputted with the real-time data. The incomplete information on the project variables as well as the ambiguity in project parameters at worksites leads to inadequate knowledge in making decisions.

In developing countries, typically is in Vietnam, construction project sites are often established in places where wired telecommunication infrastructure is unavailable or limited that leads to the restricted applications of the wired network technologies for information exchanges. Construction personnel who work on construction sites are still limited to paper-based information and mainly conducted to face-to-face communication. This is a communication barrier to achieve real time and accurate information transfer in the internal multi-site construction management.

Additionally, in traditional multi-project scheduling methods, most researches have not considered the impact of resource moving time among construction projects. The resource moving time is often assumed to be negligible. This assumption is unsuitable and has many shortcomings for properly modelling of the real world constraints. Especially, in developing countries that contain an inconvenient transport system. Typically is in Vietnam, when construction projects are deployed far away from others and from the head office, transferring a resource from one project to another is greatly constrained, and it always involves extra costs and time loss.

With the growing popularity of powerful connected mobile devices such as Smartphones and PDA phones and mobile web services technologies together with recent developments in mobile wireless communication, it is a sufficient condition to establish a framework for augmenting project information management system with mobile wireless devices. Construction managers at construction site will be able to use these mobile devices as data transfer tools with the project information repository in real-time.

The research objectives of this thesis are that, to develop and propose real-time project management methods, which are processed within a new framework – *Mobile Multi-Site Construction Project Management* (MOMUSCOM). This is the combination of mobile devices, wireless technology and a new scheduling method *Multi-Site Construction Project Scheduling* – MCOPS, applying for the consistent management and continual solving the unexpected changes such that conform to actual situations in multi-site project environments and more importantly, for generations of overall business strategies of construction firms. The new scheduling method MCOPS is used to construct a feasible and stable schedule for multiple construction projects, which are geographically distributed in different places. The focus of this method is to solve the problem of minimising construction multi-project duration in combination with the moving time of required resource among activities/projects under limited available conditions of renewable resources (labour, machines and equipment).

Though the efforts in this thesis are based on the Vietnamese construction conditions, the proposed methods can be usefully applied in other developing countries which have similar construction conditions.

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LIST OF ABBREVIATIONS

AON	Activity-On-Node
CPM	Critical Path Method
CDMA	Code Division Multiple Access
EST	Earliest Start Time of activity
EFT	Earliest Finish Time of activity
EDGE	Enhanced Data Rates for Global Evolution
FCFS	First Come First Served
GSM	Global Systems for Mobile Communication
GPRS	General Packet Radio Service
GUI	Graphical User Interface
HSCSD	High Speed Circuit-Switched Data
HSDPA	High-Speed Downlink Packet Access
HTTP	Hypertext Transfer Protocol
IEEE	Institute of Electrical and Electronics Engineers
LALP	Longest Activity Longest Project
LFT	Latest Finish Time of activity
LST	Latest Start Time of activity
MAXSLK	Maximum Slack First
MAXTWK	Maximum Total Work Content
MINSLK	Minimum Slack First
MINTWK	Minimum Total Work Content
MinRMT	Minimum Resource Moving Time
MOMUSCOM	Mobile Multi-Site Construction Project Management
MCOPS	Multi-Site Construction Project Scheduling
MOF	Maximum Operation First
PDA	Personal Digital Assistant

P-SGS	Parallel Schedule Generation Scheme
PERT	Program Evaluation and Review Technique
QC/QA	Quality Control/Quality Assurance
RCMPS	Resource-Constrained Multi-Project Scheduling
SGS	Schedule Generation Scheme
SASP	Shortest Activity from Shortest Project
SOF	Shortest Operation First
RFI	Request For Information
RMN	Resource Moving Time Network
RMT	Resource Moving Time
SIM	Subscriber Identity Module
SMTP	Simple Mail Transfer Protocol
SOAP	Simple Object Access Protocol
TDMA	Time division multiple access
UMTS	Universal Mobile Telecommunications System
UDDI	Universal Description Discovery and Integration
W-CDMA	Wideband Code Division Multiple Access
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WSDL	Web Service Description Language
WST	Web Services Technologies
XML	eXtensible Markup Language
2G, 2.5G,3G, 4G	Second, Second to Third, Third and Fourth Generation Wireless Systems