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โดยใช้เทคโนโลยีภาพเสมือนจริง



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AN INTEGRATED SYSTEM OF 3D PROCESS SIMULATION, TIME AND COST
BY USING VIRTUAL REALITY TECHNOLOGY

Mr. Noppadon Jokkaw

A Dissertation Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Engineering in Civil Engineering

Department of Civil Engineering

Faculty of Engineering

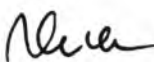
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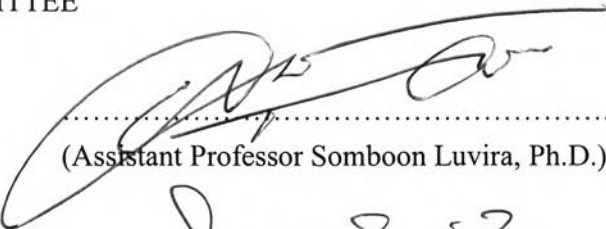
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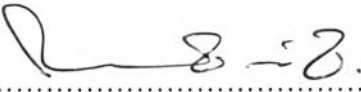
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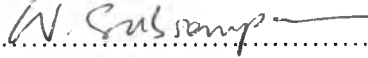
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นพดล จอกแก้ว: ระบบรวมการจำลองขั้นตอนการทำงานแบบ 3 มิติ ระยะเวลาและค่าใช้จ่ายในการก่อสร้างโดยใช้เทคโนโลยีภาพเสมือนจริง. (AN INTEGRATED SYSTEM OF 3D PROCESS SIMULATION, TIME AND COST BY USING VIRTUAL REALITY TECHNOLOGY)
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ในปัจจุบันการวางแผนงานก่อสร้างส่วนใหญ่มักมีการแยกขั้นตอนการวางแผนงานในเรื่องวิธีการก่อสร้าง ขั้นตอนการทำงาน ระยะเวลาและค่าใช้จ่ายออกจากกันซึ่งทำให้การวางแผนงานก่อสร้างไม่มีประสิทธิภาพ รวมทั้งผู้วางแผนงานก่อสร้างมีข้อจำกัดในการคิดรวมขั้นตอนการทำงาน ระยะเวลาและค่าใช้จ่ายในการก่อสร้างในเวลาเดียวกัน เพื่อบรรเทาปัญหาดังกล่าวงานวิจัยนี้จึงมีวัตถุประสงค์เพื่อนำเสนอแนวทางใหม่ในการวางแผนงานก่อสร้างโดยการคิดรวมขั้นตอนการก่อสร้างแบบ 3 มิติ ระยะเวลาและค่าใช้จ่ายในการก่อสร้างเข้าด้วยกัน เพื่อเพิ่มประสิทธิภาพในการตัดสินใจของผู้วางแผนงานก่อสร้าง โดยในการวิจัยนี้ต้นแบบของระบบรวมได้ถูกพัฒนาขึ้นโดยการประยุกต์ใช้เทคโนโลยีภาพเสมือนจริงเพื่อให้ผู้วางแผนงานสามารถมองเห็นภาพเสมือนจริงของวิธีการก่อสร้าง ขั้นตอนการทำงาน และการใช้ทรัพยากรในการก่อสร้าง รวมทั้งได้มีการประยุกต์ใช้วิธีการสร้างแบบจำลองเพื่อคำนวณหาระยะเวลาที่มีความเป็นไปได้ในการก่อสร้างรวมทั้งค่าใช้จ่ายในเวลาเดียวกัน

ในงานวิจัยนี้กระบวนการก่อสร้างอาคารประเภทโรงงานได้ถูกนำมาใช้เพื่อเป็นต้นแบบในการพัฒนาระบบโดยมีเงื่อนไขในการก่อสร้างเสมือนจริง โดยที่โมเดล 3 มิติของทรัพยากรต่างๆ ได้แก่ ส่วนประกอบของอาคาร สิ่งอำนวยความสะดวก งานชั่วคราว และเครื่องจักร ได้ถูกสร้างขึ้นโดยการประยุกต์ใช้ซอฟต์แวร์ 3 มิติ ซึ่งโมเดลดังกล่าวถูกจัดเก็บ รวบรวม และจัดหมวดหมู่ไว้ในคลังข้อมูล (Library) เพื่อสะดวกในการนำมาใช้งานในระบบรวม ในระบบรวมนี้ขั้นตอนการก่อสร้างได้ถูกจำลองในระบบที่มีการเคลื่อนไหวแบบ 3 มิติที่เสมือนจริง และสามารถเชื่อมโยงไปยังฐานข้อมูลของระบบซึ่งประกอบด้วย ข้อมูลวิธีการก่อสร้าง ข้อมูลของเครื่องจักรและอัตราการทำงาน ในงานวิจัยนี้ระบบรวมดังกล่าวได้ถูกตรวจสอบโดยใช้ข้อมูลที่ได้จากงานก่อสร้างจริง ซึ่งผลที่ได้สามารถแสดงให้เห็นว่าระบบรวมดังกล่าวสามารถช่วยให้ผู้วางแผนงานก่อสร้างสามารถเลือกใช้วิธีการก่อสร้าง เครื่องจักรเครื่องมือและขั้นตอนการทำงานได้อย่างเหมาะสม รวมทั้งทราบถึงระยะเวลาในการทำงานและค่าใช้จ่ายในการก่อสร้างในเวลาเดียวกัน นอกจากนี้ระบบยังยังสามารถช่วยในการจัดวางแผนผังและบริหารจัดการพื้นที่ของหน่วยงานก่อสร้างได้อย่างเหมาะสม ซึ่งช่วยให้ผู้วางแผนงานก่อสร้างสามารถตัดสินใจ วางแผนงาน และสื่อสารระหว่างผู้ร่วมงานได้อย่างมีประสิทธิภาพ

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ลายมือชื่อนิติ.....
 ลายมือชื่ออาจารย์ที่ปรึกษา.....
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KEY WORD: INTEGRATED SYSTEM / VIRTUAL REALITY / CONSTRUCTION

NOPPADON JOKKAW: AN INTEGRATED SYSTEM OF 3D PROCESS SIMULATION, TIME AND COST BY USING VIRTUAL REALITY TECHNOLOGY. THESIS ADVISOR: ASSOC. PROF. TANIT TONGTHONG, Ph.D., THESIS CO-ADVISOR: ASSOC. PROF. VISUTH CHOVICHEN, Ph.D., 272 pp. ISBN 974-17-3967-2

Nowadays, construction planning is usually fragmented planning in terms of construction method and sequence, time, and cost. Moreover, construction planners have a limited capacity for the integrated decision-making necessary to determine construction method, time and cost. In order to reduce the degree of these problems, the objective of this research is to propose a new approach of construction planning by integrating the 3D processes of construction, operation time and cost in order to enhance effectiveness of construction project planners' decision making. The prototype of the integrated system was developed by using Virtual Reality (VR) technology to display construction methods, construction sequences and resources used. The proposed system integrates simulation modeling method to provide possible construction duration and cost.

In this research, construction processes in factory construction were selected to develop and implement the virtual construction conditions in the system. The library of building components, facilities, temporary works, and construction machines was created by using CAD software packages. The construction processes were simulated in a dynamic environment by using visualization software and were able to link to the system database of construction methods, equipment and their productivities generated by the database software.

The proposed system was verified and validated by using data from real factory construction projects. The result shows that the proposed system is applied as a tool to assist planners in making decision including selecting suitable equipment, operating logic, construction methods, operation time, cost, construction site layout and construction-space conflict analysis, and it is also able to enhance effective communication among the project-planning team and other construction operators.

Department Civil Engineering
Field of study Civil Engineering
Academic year 2003

Student's signature.....
Advisor's signature.....
Co-advisor's signature.....

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To all readers, due to my intention to present this research pervasively, please accept my sincere apologies for my English usage in this research and any misunderstanding, which may arise from English language.

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