Digital Construction development and implementation in the Danish education and industry

Kjeld Svidt
Agenda

• Introduction

• Research
  • Overview
  • Examples and results

• Education
  • BSc and Msc level
  • Digital Days collaboration project
Building Informatics

The 'Building Informatics' research group was established in December 1997.

Professor Per Christiansson (retired)
Associate Professor Kjeld Svidt
Research assistant Maria Thygesen
Communication challenges
Consistent information flow through the entire process
Communication between all actors in all phases

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<th>Ide</th>
<th>Projektering</th>
<th>Udførelse</th>
<th>Aflevering</th>
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**Fælles data/information containere**
Digital building models

• Digital models of the building live from the early design phases through construction to operation, maintenance and use of the building
• Increased focus on integration with analysis tools
• Models are more than geometry
Project examples

Distributed Virtual Workspace for enhancing Communication within the Construction Industry - DIVERCITY

Digital Construction Client requirements – digital hand over

Digital Construction Client requirements - 3D models

IT in Collaborative Building Design (PhD)

IT at the Construction Site

User involvement in the building process/Virtual Innovation in Construction - VIC

Virtual Models Linked with Physical Components in Construction (PhD)
Test project – 3D requirements

• Modernizing a cluster of university buildings
  • more daylight in the corridors, especially by roof light
  • incorporation of social rooms near entrances of the buildings

• Building owner invited 4 architects
  • Gave them IFC model of existing buildings
  • Required IFC model of proposals supplemented by traditional visualisations and descriptions
  • Required all communication to be electronic and handled through a web based document management system, i.e. no paper based letters posters etc.
Test results - 3D requirements

- Participating architects showed a generally positive attitude to the 3D requirements.
- Expressed that the requirements forced the architects to solve some problems in the early phase, which could have caused greater problems later in the project.
- Competences to build object based models for such purposes are not always available in the competition team. The necessary tools are more common in the detail design teams.
Test results - 3D requirements

• Difficult for the involved parties to distinguish clearly between different parts of the requirements, e.g. ‘visualisation’, ‘3D-models’, ‘electronic communication’ and ‘electronic presentation’.

• Digital requirements were associated with pure ‘electronic’ presentations on a projector which has a very limited resolution compared with traditional posters and other paper based presentations.

• Paper is still good for presentations!

• But digital models give new possibilities with interactive display systems.
Virtual Reality : Panorama

Ø 7.1m, 160, H 3.5m
Active stereo
28 persons
Tracking
Augmented reality – mix model and reality

AALBORG UNIVERSITY

Department of Civil Engineering
Division of Architectural Engineering

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Kjeld Svidt
3D-models from design to construction

Architect
Design
Structural
HVAC

Concrete
Carpenter
Painting
Quantities
Planning and control
Quality control
Construction
IT at the construction site

- Project administration
- Time registration and payment
- Material and equipment handling
- Document management, drawings, models
- Quality control
- Security, regulations
- Knowledge sharing, work instructions
Experiences from implementation in industry

- IT-systems don’t implement themselves
- Does the new system communicate with existing systems?
- Will software suppliers solve interaction problems?
- Is the purpose of the new system clear?
- How does it affect company work routines?
- Are the employees aware and ready for the changes in their daily work?
- Do the employees have the right competences?
Education

Student collaboration on Building Information Modelling

Changes start with the new generation of engineers
Education

- **BSc level**
  - Basic CAD (1. semester)
    - Simple drawing objects, lines, circles ....
    - 3D-volumes, faces, coordinate systems
  - Building Information Modelling (BIM) 4. semester
    - Building objects, wall, door, window, slab, ....
    - Introduction to Digital Construction
Education

• MSc level
  • New educations in Building management and Building Informatics
    • Danish and international development projects in digital construction
    • Management theory
    • System development and implementation
    • Data and model representation
Recent student projects

- Knowledge management in the construction industry
- Using the digital building model
- Optimizing information flow at the construction site
- Integrated design and information exchange – use of 3D building models
- 3D scanning for quality assurance in construction
- Efficient operation and maintenance by increased use of information and communication technology
- The smart ICT agreement
- Tools for decision makers overview of BIM implementation
- Digital delivery for operation and maintenance
Future information handling at the construction site

Prototype ‘process card’ application for craftsmen at the construction site
Student project January 2012

Optimizing the Information Flow on the Construction Site

Author
Haraldur Arnorsson

Faculty of Engineering and Science
Aalborg University
2012
Computer aided Facility Management (1)

A review of Computer Aided Facility Management systems
Computer aided Facility Management (2)
Requirements for a mobile application

1. Varemester scanner væggens indelejrede RFID-tag
2. Stamdata om registreret bygningsdel hentes fra database
3. Varemester registrerer i samråd med lejer nødvendig istandsættelse
4. Stamdata om lejer findes på baggrund af bygningsdels placering/lokalitet
5. Priser på leverance af byggematerialer og istandsættelsesarbejder, på baggrund af rammeudbud
6. Lejer vælger procedure for istandsættelse og underskrivelser på skærmens
7. På baggrund af registrerede vedligeholdelsesaktiviteter, priser fra rammeudbud, tidligere registreringer, samlet lejeperiode samt lejers valg af istandsættelsesprocedure fremsendes ordre til relevante håndværkere, besked til boligselskab samt kopii til lejer

Additional requirements include:
- Type (veg, gulv, etc.)
- Mængde (f.eks. areal)
- Andre attributter (f.eks. farve)
- Vedligeholdelsesaktiviteter
- Placering/lokalitet
- Historiske registreringer fra indflytning

Navn
Adresse
Nemkonto
Dato for indflytning
Dato for udflytning
Computer aided Facility Management (3)
Development of a prototype mobile application
3D laser scanning for quality assurance (1)

Scanningsplan: Skjernvej 4A

Dato: 21. april 2009
Scanningsobjekt: Østlige gavlinder og yderside
Antal scanninger: 3 scanninger, 1 indenfor og 2 udenfor

Scanningsopstilling:

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<tr>
<th>Scanning</th>
<th>Afstand til objekt [m]</th>
<th>Opløsning [mm]</th>
<th>Opløsningsvinkel [°]</th>
<th>Antal targets</th>
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<td>5</td>
<td>10</td>
<td>0,100</td>
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<td>10</td>
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<td>8</td>
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<tr>
<td>3</td>
<td>15</td>
<td>10</td>
<td>0,035</td>
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3D laser scanning for quality assurance (2)

Compare scanning result with 3D model of planned building
Education collaboration: The digital days

100 students from 8 different educations at 3 different educational institutions including craftsmen, technicians, architects and engineers.

Two collaborative design teams design a building project during 3 intensive days of digital collaboration.
100 students active in 3 days
They experience problems
They have coordination meetings
They make digital models
They make physical models
They make full scale parts
They are happy when they experience success 😊
Thank you

kjeld.svidt.dk