UNMANNED AERIAL VEHICLES (UAVS) FOR INSPECTION IN CONSTRUCTION AND BUILDING INDUSTRY

Dr Ibrahim Motawa
Department of Architecture, University of Strathclyde, Glasgow, United Kingdom
This presentation:

1. Introduction
2. UAV technology
3. Technology used with UAV
4. UAV in construction and building industry
5. UAV operational problems
6. UAV and BIM
7. Conclusions

Dr Ibrahim Motawa, Department of Architecture, University of Strathclyde, UK
Industry 4.0 and UAVs

Industry 4.0: Building the digital enterprise (Engineering and construction) (2016 PwC)
UAV for construction surveying

Dr Ibrahim Motawa, Department of Architecture, University of Strathclyde, UK

Rotorcraft UAV (Source: DJI)  
Fixed Wing UAV (Source: GEM Systems)
UAV for construction surveying

UAV image, Golden 1 Centre construction
Source: CIOB

Overlay of UAV captured data and architectural plans. Source: CIOB

Dr Ibrahim Motawa, Department of Architecture, University of Strathclyde, UK
UAV and traffic

Image, taken from a drone, of traffic passing through a busy junction (Drone U, 2017)
“Roving host”, drone outfitted with an antenna, wireless data exchange card and a camera for piloting (Mascareñas et al., 2008)
UAV and BIM

UAV derived data and its implementation into BIM:

• Progress monitoring
• Site surveying
• Building inspection
• Equipment and material tracking
• Safety inspection
• Facility management

Dr Ibrahim Motawa, Department of Architecture, University of Strathclyde, UK
Defining UAV routes

Routes for multiple UAVs (Jun & D’Andrea, 2003).

Drone navigation using perimeter approach (Irizarry, 2012)
BIM and intelligent UAV
Algorithm steps:

Step 1 Create the BIM model of the building
Step 2 Establish geo-referencing of the BIM model of the building
Step 3 Extract the location of objects
Step 4 Create cameras and photo-realistic images
Step 5 Sequence of automatic routing of the inspection flight
Step 6 Evaluate the routing by digital simulation
Step 7 Execution of the drone flight and collection of information
Step 8 Recognition of objects using Computer Vision (CV)
Thank you
UAV and BIM

**UAV Data Collection (Rodriguez Santos de Melo, 2017)**

<table>
<thead>
<tr>
<th>Project</th>
<th>Period</th>
<th>Number of visits/number of flights</th>
<th>Number of pictures collected</th>
<th>Number of pictures used for safety checklist</th>
<th>Time of video recording</th>
<th>Total flight duration (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Nov/15 to Mar/16</td>
<td>4/12</td>
<td>935</td>
<td>23</td>
<td>16:37</td>
<td>1:47:34</td>
</tr>
</tbody>
</table>

**Non-compliances of Site 1 & 2 (Rodriguez Santos de Melo, 2017)**