Smart Mobile App for Site Inspection and Documentation

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ICSC15, Vancouver, Canada
June 9, 2015
Background

• Extensive effort spent on inspecting and documenting construction defects.

• For a 20,000-m² conference center,
  • 41 pre-inspections conducted in a year (Lundkvist et al., 2014).
Research Objectives

• Developing a smart application called **InSite Inspector** (Intelligent Site Inspector):
  
  i. taking images and catalog construction defects;
  
  ii. automatically locating defects using GPS; and
  
  iii. producing various types of reports for different inspection purposes.
Current Construction Defect Inspection and Documentation

1. Request for inspecting defects
2. Site inspection (photos, field notes)
3. Transferring photos to PCs
4. Engineers reviewing photos and describing defects
5. Prepare reports of site inspection
6. Expert testimony in arbitration and litigation
Proposed Construction Defect Inspection and Documentation

1. Request for inspecting defects
2. Site inspection with defect classification and reporting mobile app
3. Prepare reports of site inspection
4. Expert testimony in arbitration and litigation

Image processing
Machine learning
Defect image database

InSite Inspector
Current version
Methodology

• Review of the state of practice in site inspection
• Collection of different types of inspection documents
• The Android-based platform (4.1.x with API level 16)
• JAVA/XML technology
Distribution of the Android Platform Versions in early January 2015

- Version 2.2, API Level 8
- Version 2.3.x, API Level 10
- Version 4.0.x, API Level 15
- Version 4.1.x, API Level 16
- Version 4.2.x, API Level 17
- Version 4.3, API Level 18
- Version 4.4, API Level 19

- Version 2.2: 6.7%
- Version 2.3.x: 7.8%
- Version 4.0.x: 0.4%
- Version 4.1.x: 19.2%
- Version 4.2.x: 20.3%
- Version 4.3: 6.5%
- Version 4.4: 39.1%

85.1% of devices were using Version 4.4, API Level 19.
InSite Inspector: Simplified UML Class Diagram
Site Inspection Module

FGCU Buildings
Select a Location
FGCU Campus
Select an Inspector Profile
Long Nguyen

Type of Defect
Window sill crack

Location of Defect
HE 146 window

Inspection Time of Defect
8:57 AM
January 23, 2016

GPS Coordinates
Longitude: -81.77556146627128
Latitude: 26.45360908271372
Altitude: 7.3m

D&W Sub C
Subcontractor
Number of Associated Defects: 1

Stucco Sub B
Subcontractor
Number of Associated Defects: 6

Add an Association
Documentation and Reporting Module
Documentation and Reporting

- Real-world vs. InSite Inspector generated reports

Professional inspection report  InSite Inspector generated report

<table>
<thead>
<tr>
<th>Site notes / Selected Photos for DT with Issues</th>
<th>Address: Florida Gulf Coast University, Fort Myers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2292_RSM21_043.jpg  3/10/2008 : Water leaking under the CE metal and behind the gutter and styrofoam plant-on.</td>
<td>Building Status: Occupied</td>
</tr>
<tr>
<td>2292_RSM21_044.jpg  3/10/2008 : Water leaking under the CE metal, behind the gutter and styrofoam plant-on, and CE metal to leader head transition.</td>
<td></td>
</tr>
<tr>
<td>2292_RSM21_058.jpg  3/10/2008 : 4.00 Concrete Issues</td>
<td></td>
</tr>
</tbody>
</table>

Defects:
- Defect Type: Window sill crack
- Location Description: HE 146 window
- Time Documented: 8:57 AM 1/23/2015
- Longitude: -81.775514662713
- Latitude: 26.4634609082714
- Altitude: 7.3m
- Associated Parties:
  - Subcontractor: D&W Sub C
  - General Contractor: GC A
Conclusions and Future Work

• **InSite Inspector:**
  • facilitates inspectors to record defect information,
  • automatically locates defects using GPS,
  • allows to customize report information and formats,
  • generates reports for different purposes.

• **Future work:**
  • improving the accurate positioning of the defects,
  • utilizing computer vision techniques to automatically classify defects.