BUILDING INSPECTION
BY DRONES

MEFMA
Middle East Facility Management Association
جمعية الشرق الأوسط لإدارة المرافق

EJADAH
UAV (Unmanned Aerial Vehicle), popularly known as Drone, is the most advanced technology available on the UAE market, able to provide a method for general aerial survey, which is the result of the high demand for non-destructive testing.

As part of inspection strategy Ejadah adapts UAV Building inspections to ensure the availability, safety, and reliability of assets, and the sustainability of business operations - technological innovation -service built for all requirements.

The main problems found in the newly built skyscrapers:

- Abnormal energy consumption in the building
- AC high costs
- Inconstant temperature, registering huge discrepancies between apartments with the same orientation
- Creation of humidity on the curtain-walls, with mold formation
- Presence of dust / sand, even without windows
- Seepages
- Pavement concrete surface detachment
- Rebar steel corrosion
- Humidity, water, mold
- Detect moisture damages
- Locate protective concrete damages
- Map drainage and other buried pipes
- Water leakage

General discomfort for the tenants, despite being a new building
AERIAL BUILDING INSPECTION

WHY YOU SHOULD CHOOSE UAV FOR ENGINEERING SURVEY SERVICES?

99.9% Safe, no humans risk, cost reduction compared to the traditional method, data always available for future investigations and comparisons, less resources employed, reduced downtime, accuracy of data, fast response times, preventative maintenance planning, inspection of area difficult to reach, 75% percent time saving.

Specifically, for Drone Building Inspection, the survey with drones can provide: quantification of any kind of damage of the building, facility management support, as-built 3D model and photogrammetry report, building insurance data records, support during construction phase.

• Cost effectiveness.
• Accurate services.
• Quality of presentation to clients.
• Constantly trained professionals, experienced, and friendly staff.
• Ability to cover all your project needs.
• State-of-the-art technologic equipment.
• Consistency of service in a tight labour market.
• Ability to expand to larger scale, long term projects.

Aerial
Aerial Inspection
DRONE
Infrared
Infrared Thermography
Survey
Topographic Mapping
GPR
Ground Penetrating Radar Scanning

AERIAL BUILDING INSPECTION

WHY YOU SHOULD CHOOSE UAV FOR ENGINEERING SURVEY SERVICES?

It eliminates all the shortcomings of the traditional methods, providing comprehensive results in a very short amount of time with no danger to human life due to the remote control.

The Drones provide several reliable, cost-effective and safe applications for: Building Inspection, Oil & Gas, Environment, Land Survey, Security and Monitoring.

A combination of Thermal and Optical cameras installed on a drone is currently the best solution for having a full external visual inspection of the building, being able to gather all the necessary information to elaborate a report on the existing problems such as defects, thermal bridges (air leakage), water leakage, defects glasses, the sealing, defects of the surface of the panel, and anomalies (humidity - water etc.), roof status.
The most advanced technologies available today on the market will be used to perform the site surveys and the subsequent analysis: High Definition Thermography and Multi Array Ground Penetrating Radar Scanning (GPR).

Thermographic survey is a non-destructive diagnostic technique, enabling the evaluation of the surface temperature by measuring the infrared radiation emitted by a source.
Applying underground survey allow to identify the areas affected by water infiltration in the Tower basement.
POST PROCESSING

All the frames and data of the surface, will be processed with a software and it will be analyzed. Subsequently these images will create an ortho-photo mosaic enabling the owner of the building to quickly identify where the damage is located and take action.

HUMIDITY-SAND-MOLD APARTMENT

All the frames and data of the surface, will be processed with a software and it will be analyzed. Subsequently these images will create an ortho-photo mosaic enabling the owner of the building to quickly identify where the damage is located and take action.

Inspections with drones are successfully replacing traditional methods.
This method, which is the result of the high demand for non-destructive testing, eliminates all the shortcomings of the traditional methods. Providing comprehensive results in a short amount of time and with no danger for the operator.

**ACQUIRED DATA**

Through the post-processing and the analysis of the collected data, we obtain 3 different types of pictures (visual, thermic and 3D-cloud point) which can be overlapped.

*General visual inspection to identify major problems of the facades*

*Post-processing and analysis of the collected data*
CASE STUDY

Facade inspections
The most advanced technologies available today on the market have been used to perform the site surveys and the subsequent analysis: Thermo graphic Survey and optical Survey conducted with the drone, carrying thermos-camera and high definition optical camera.

Main Advantages

<table>
<thead>
<tr>
<th>COST</th>
<th>SAFETY</th>
<th>TIME</th>
<th>ACCURACY</th>
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<tbody>
<tr>
<td>1</td>
<td>Cost effective with our services</td>
<td>Safe conditions of operation.</td>
<td>Data collection and analysis with multiple sensors.</td>
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<tr>
<td></td>
<td>Real time inspections</td>
<td>Operators are not required to reach dangerous areas.</td>
<td>High Quality of Equipment</td>
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<td></td>
<td>Minimal disruption</td>
<td>Personnel are kept at safe distance from operating equipment.</td>
<td>U-HD, 4k, 6k data definition</td>
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Post Processing

ANALYSIS THERMAL CAMERA
In this phase, all the frames and data for the entire facades were processed with special software, and, during the analysis, all the thermal problems were identified.

From a large amount of information collected and using filters only the areas and the spots that presented a minimum difference of 4°C degrees at the surface of the facades were extracted.

For each area selected as per procedure mentioned above, frames data was created.

All thermal frames were post-processed, one by one, using FLIR Tools Software. During this phase of work, the clarity of the image was verified, and reflections phoneme temperature was removed.

At the end of all analyses, we selected only confirmed areas and spots that presented problems.

ANALYSIS CLADDING MARBLE
Using the multi colored filter method (photogrammetry) we have identified the different defects, dividing by category of intervention.
CASE STUDY

Sample Thermal Image

Reference Image No. F1_P0000_0000_1000
SOUTH ELEVATION
23RD – 24TH – 25TH FLOORS

Cladding panels at rear façade of building show large amounts of different temperature.

The panels need to be checked.

Reference Image No. F1_P0000_0001_0601
SOUTH ELEVATION
20TH – 21ST – 22ND FLOORS

Cladding panels at rear façade of building show large amounts of different temperature.

The panels need to be checked.
CASE STUDY

Localization and mapping

[Image of a grid with squares marked in red and yellow, indicating areas of interest or testing.]
CASE STUDY

Sample of Cladding Marble

Reference Image No.
SOUTH ELEVATION
Line 15 C 4

Cladding Marble at façade of building show visible scratch in the panel.
The panels need to be checked.
Monitor and verify the integrity of marble with GPRS

Reference Image No.
SOUTH ELEVATION
Line 32 C 15

Cladding Marble at façade of building show visible defect in the panel.
The panels need to be checked.
Monitor and verify the integrity of marble with GPRS

DRONE USAGE

Possible applications of drone-assisted building inspection:

• Obtaining Building Completion Certificate (new constructions)
• Classification and energetic certification of the buildings (old & new)
• Facility management support;
• As-built 3D model and photogrammetry report
• Building insurance data records
• Quantification of any kind of damage of the building
• Support during construction phase
## Why use Aerial building inspection?
Unrivaled experience covering all aspects of construction. As a result, the skills you need for comprehensive assessment, supervision and inspection of all your construction projects – regardless of size or location.

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<thead>
<tr>
<th></th>
<th>New</th>
<th>vs</th>
<th>Traditional</th>
</tr>
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<tbody>
<tr>
<td><strong>Safety</strong></td>
<td>99.9% SAFE NO HUMAN AT HIGH ALTITUDES</td>
<td>SAFETY</td>
<td>RISK OF FATAL INCIDENTS</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>TIME NEEDED TO ACQUIRE DATA IS GREATLY REDUCED</td>
<td>TIME CONSUMING + PROBLEMS CAN GET WORSE</td>
<td></td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>EFFECTIVENESS – AVERAGE IS 35% OF CLASSIC METHODS DATE AVAILABLE FOR FUTURE INVESTIGATIONS</td>
<td>COST</td>
<td>RISK OF FATAL INCIDENTS</td>
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