INSPECTION OF HIGH VOLTAGE OVERHEAD POWER LINES WITH UAV’S

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ABSTRACT

The goal of this paper is to explain the methods and procedures found by CME – Construção e Manutenção Electromecânica, SA to execute Inspections of overhead power lines – Visual and Thermal - with an intelligent flight done by UAV’s – Unmanned Aerial Vehicles leading to significant cost benefits, in contrast to conventional systems (helicopters, industrial climbers, etc).

Nowadays power Utilities Operators have huge costs for identifying problems in Overhead power lines. Power line inspection involves examining the pylons, connectors, loose bolts and nuts and their high voltage insulators. This process is increasingly being performed by helicopters. Typically the smallest team is made up of an observer using dedicated equipment and a pilot flying over the Power Line. The inspection frequency depends on transmission line size. The helicopter usually hovers at a horizontal distance close enough for observation. This means that the noise produced by the inspection limits the hours the helicopter can fly. Also we need to highlight security questions. Usually Electricity operators commission this service to helicopter companies.

INTRODUCTION

CME proposes using UAV’s – Unmanned Aerial Vehicles to replace helicopters and Fixed wing planes.

We are prepared to offer our clients services such as:

- Overhead Power Lines visual inspection – Video and images;
- Overhead Power Lines Thermal inspection;
- Overhead power Lines Corridor Mapping and DTM;
- Troubleshooting Reports.
- LIDAR and GIS data Services
- Vegetation under Power Lines Control and Maintenance Reports.

Using UAV’s Platforms CME can reduce costs in operation due to lower personnel usage, reducing inspection period and at the same time increase the safety conditions for both personnel and infrastructures.

Our platform is equipped with state of the art sensors, video and photo cameras and also thermal infrared cameras that allow us to send real time footage and data to the operator which can be sent at the same time to the power company's control center for reviewing and analysis.

OVERHEAD POWER LINES

Video and Image

Taking video and images data from the Power lines will allow us to perform high level inspections, necessary to find some common problems in Poles and conductors. Usually is performed when the Power operator has already identified the problem.

Thermal inspection

Thermal inspections are very important to find over heating hot spots in the power line accessories. We can monitor the accessories conditions and anticipate some possible coming problems.

Corridor Mapping and DTM

Creating a Digital Terrain Model will allow the power Operator to more efficiently design new routes for new power lines and make changes on the existing ones. Using the same method we can use the collected data to elaborate mapping or cartography to help on the low level design of overhead power lines.

Troubleshooting Reports

This task is probably the most important in an overhead power line inspection. Not only will allow to identify the major problems, but also, present the specific solutions to
outcome and improve the observed snags. This task is made in real time using a wireless video and image receiver to transmit the data to back office. At the same time, a report is being issued to the Power operator with all identified risks and ways to get over them.

LIDAR and GIS data Services

By taking LIDAR actions, the Power operator can use the acquisition data to perform Low level design to the Power line and identify major risks close to the conductors, namely vegetation, new buildings and overhead power lines crossing. Also, we can survey all the assets in the power line and get the output data to increase the level of the information in a GIS system.

Vegetation under power lines Control and Maintenance reports

One of the important tasks in a Power line preventive maintenance is to control the vegetation height and proximity. By taking these actions we can perform a preventive maintenance report and prevent common problems such as falling trees over the power lines. We can also identify vegetation species and anticipate growth periods.

ONLINE PLATFORM

All the collected data will be presented in an online platform. This way the Power operators can analyse in real time and on day to day basis the surveyed Network. The images, videos, thermal data and troubleshooting reports will be updated in real time on the online platform, either directly from the site, using a common internet connection, or at the back office control room, after data handling. The collected data is represented in a user friendly way to allow technical or non-technical persons to analyse it. All the data can be managed by specific authorizations, and only the interested people will be allowed to see it. Different departments will have different levels of editing and/or visualizing it. The same will happen with different power operators. Each and every one will only be allowed to visualize their own network and data.

COLLECTED DATA

Due to our experience in constructing and maintaining overhead power lines we developed a survey matrix that will allow us to set a rigorous inspection. First of all we meet with the power operator and set the rules to the incoming inspection. The inspection can be performed with the help of the power operator, or only by our engineers. Inspections can be preventive, routine, periodic or on an emergency level.
The surveyed assets can be as follow:

- Pole foundations;
- Signaling and safety;
- Earthing;
- Pole conditions;
- Insulators;
- Conductors;
- Protection equipment;
- Maneuver equipment;
- Underground Transitions;
- Animals protections;
- OPGW cable;
- Conductor Unions;
- Line anti vibrators;
- Overhead power lines crossing;
- Overhead Power lines distances;
- Vegetation control;
- Substations;
- Thermal

After all the data is collected and analyzed we can estimate a time window to perform any alteration needed in the power line and accessories. These actions can be categorized on a criticality level.

Level 4 – High risk – Actions need to be taken on a very short time window;
Level 3 – Moderate risk – Actions need to be taken on a moderate time window;
Level 2 – Low risk - Actions need to be taken on a long time window;
Level 1 – Very Low Risk – Actions can be performed on a very long time window. Not urgent.

CONCLUSION

Using UAV’s – Unmanned Aerial vehicles to perform overhead power line inspections allowed us to decrease our and power operator costs. It also allowed us to act on a short time window with no restrictions, besides weather and local authorizations.

It is an enormous step to facilitate the Power operators Overhead power line management.