R&D Project „InspektoKopter

Flying robot inspects rotor blades of wind turbines

The project idea, aim and innovation

In the framework of the R&D project „InspektoKopter" an interdisciplinary team will develop a modular test system and new methods for the inspection of wind turbines rotor blades using a Multicopter (unmanned aerial vehicle, UAV). The aim of this R&D project is the development and prototypical implementation of a novel non-contact method for the automated and risk-free inspection of the rotor blade of wind turbines using Multicopter, suitable optical sensors and software for virtual inspection. The system is intended to represent a safe and reliable alternative to manual testing.

The innovation of "InspektoKopter" particularly consists of following aspects:
- Automated non-contact method (based on UAV and various optical sensors) to inspect the structural conditions of rotor blades while increasing productivity and safety of employees,
- Innovative anti-collision system to protect the inspecting system (technology and object) based on a visual object recognition

- Real-time position correction of the flight inspection depending on external conditions and position of the UAV to the rotor blade - ensuring a safe flight through integration of different optical sensors on the Multicopter,
- Automation and optimization of the flight path of the Multicopter to shorten the inspection time and increase the reproducibility of the test results (allowing the comparison of tests of different times), based on a new detection method,
- Automatic data transfer from the Multicopter system for virtual inspection system (i.e. the experts will not be provided single images for the subsequent assessment, but different optical sensor data of the entire rotor blade will be provided for the virtual inspection)
- Methods will be developed for aggregation, projection and display of registered sensor data in a VR (virtual reality) model forms the basis for an innovative easy handling inspection software solution - based on a developed 3D model by texture mapping of real image data enables the virtual inspection– 3D based software provides a clear and accurate representa-

tion of the inspection object (i.e. the rotor blade with all its physical status and damages)
- Virtual inspection software support experts in the detailed characterization, sizing and localization of the damages as well as for the first time a direct comparison of the condition of the rotor blades between different test periods.

The development approach

As a basis, the R&D project uses an existing Multicopter which is optimized by modification for use on wind turbines. The UAV is going equipped with modular optical sensor technology that is adapted to perform the damage patterns detection on rotor blades.

The development of the "InspektoKopter" is realized through co-operation with the following subprojects:

(1) Further development of a flying robot with modular measurement and testing technology and an automated inspection method for rotor blades,

(2) Development of methods for projection and display of sensor data recorded in VR model and a software for virtual inspection,

(3) Development of methods for autonomous visual guide (Visual docking) of UAVs along wind turbine rotor blades and the 3D sensor data is linked in a global 3D reference model and

(4) Development of an innovative flight assistance system for a safely fly on blades of wind turbines.

The cooperation partners

The cooperation project consists of two SMEs and two research institutes. The partners have the following expertise:

- GEO-METRIK Ingenieurgesellschaft mbH Magdeburg

The engineering companies in the GEO-METRIK AG group of companies offer a full range of geodetic engineering and photogrammetric services provided by a workforce of around 140 technical experts who have a comprehensive range of skills and expertise, and experience going back to 1991. The engineering company uses most modern technologies, with electro-optical tachymeter, GPS equipment and other technique of measurement. GEO-METRIC uses the method of measurement of the air with the help of UAVs since 2010. (http://www.geo-metrik.de)

- Bitmanagement Software GmbH

A team of software engineers and 3D content specialists as well as and off shore 3D content partner companies Bitmanagement is focused a) on software development for client based interactive Web3D software and b) on services for creation of high resolution 3D city models and 3D content. The product portfolio consists of 3D real-time rendering software for interactive and online capable visualization and workflow software (tools) regarding content preparation for interactive and online usages. (http://www.bitmanagement.com)

- Fraunhofer Institute for Factory Operation and Automation IFF

The Fraunhofer Institute for Factory Operation and Automation IFF, which was founded in 1992 in Magdeburg, is an independent institution within the network of the Fraunhofer-Gesellschaft. The IFF develops and implements functional and image-based sensor solutions and products for the identification, localization and state detection of any objects, for production / material handling equipment, transport and freight transport / logistics. (http://www.iff.fraunhofer.de/)

- University of Applied Sciences, Automation & Computer Sciences Dep.

The Department of Automation and computer science at the University Harz was founded in 1992. Here is actively researched in various fields, such as Polymer fibers, environmental and geographic information systems, internet security and mobile robots. The laboratory Mobile Systems was established in 2004. Current research is conducted in the fields of artificial intelligence, agent technologies, and image and knowledge processing. (www.hs-harz.de)

### - ZPVP Zentrum für Produkt-, Verfahrens- und Prozessinnovation GmbH

The ZPVP Centre for Product, Process and Process Innovation GmbH was founded in 1996 by the city of Magdeburg and the Otto-von-Guericke-University Magdeburg for establishing and operating a stationary on the campus of the University Research and Transfer Centre. Since 2001, the ZPVP GmbH operates the Experimental Factory Magdeburg - a research and transfer center for applied research and development in the field of product, process and process innovation. Since 2004 the ZPVP initiated and supported innovative R&D networks. The ZPVP managed the cooperation network "InDiWa" since 2012 by order of the Federal Ministry of Economy and Energy. (www.indiwa.exfa.de)

Contact

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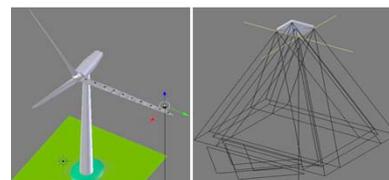Development of air robot with modular measurement / test equipment for inspection of wind turbine blades
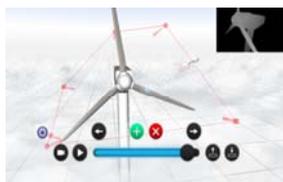
Development of innovative flight assistance system for safely fly on blades of wind turbines

Development of methods for projection and display of sensor data recorded in VR model and a software for virtual inspection

Development of methods for autonomous visual guide (Visual docking) of UAVs along the rotor blades and the 3D sensor data sharing in a global 3D reference model

Project management and controlling, networking with other R & D network projects