



ifgicopter as a new mobile CIR Sensor Platform
in Archaeology

Matthes Rieke

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Project introduction

- Set of problems
 - Creation of **orthophotos** of small areas of interest
 - financial and logistical complex venture
 - areas of interest which are hard to reach
 - Measurements of **all kind of sensor data**
 - are not available in the desired dose or are out of date
 - Hard to reach →



Project introduction

- Aims of the project

1. Individual creation of (infrared) **orthophotos** of small areas of interest

- sustainable environmental monitoring

- vegetation assessment → temporary change of unreachable areas of interest

- terrain acquisition

- Hi-res images

2. Highly flexible usage of a flying sensor platform to gather any kind of sensor data realizable

- No long preliminary work needed

Team and fields of work

- Fields of work

- Planning software (Geoinformatics)
- Communication framework (Geoinformatics)
- Creation of orthophotos (Geography)
- Analysis of climate phenomena (landscape economy)
- DGPS services (Geoinformatics)

The ifgicopter

- Basis is a building kit by www.mikrokoetter.de



- GPS modules already integrated

Communication

- Communication in real-time
 - *Copter* uses a Wi232 module to periodically send data (HF at 868 Mhz → no license needed in germany)
 - Gathering of GPS position and many other useful data
- Uplink
 - Send GPS waypoints to the copter

Application 1: Orthophotography

- **First application** – Creation of Orthophotos
 - Flightroute planning software

Application 1: Orthophotography

- **First application** – Creation of Orthophotos

The screenshot displays the 'Flugplanung' (Flight Planning) software interface. The main map area shows a flight path (red line) over a landscape with various biotopes and landmarks. The 'Camera Parameter' panel on the right shows settings for Sensor Size (9.9), Focal Distance (24), Crop Factor (4.5), and Aspect Ratio (4:3). The 'Routing' panel shows fields for Latitude and Longitude, and buttons for 'Draw Waypoint', 'Overlap Route', 'sendToKopter', 'list Waypoints', 'Clear Waypoints', and 'Help'. A scale bar at the bottom left indicates 100 m and 500 ft. The map title is 'Flugplanung' and the map name is 'Map'.

Application 1: Orthophotography

- Photographs need to overlap about 60% with their neighbours → automatic calculation of waypoints following this requirement
- Planning software is capable of creating a flight route which covers a user-defined area of interest (bounding box, polygon, etc.)

Application 1: Orthophotography

- **The camera:** Panasonic LUMIX LX3 – UV+VIS+IR
 - Internal band-elimination filter removed → photographs in VIS and NIR possible with an additional filter



source: <http://www.digitalkamera.de>

Application 1: Orthophotography

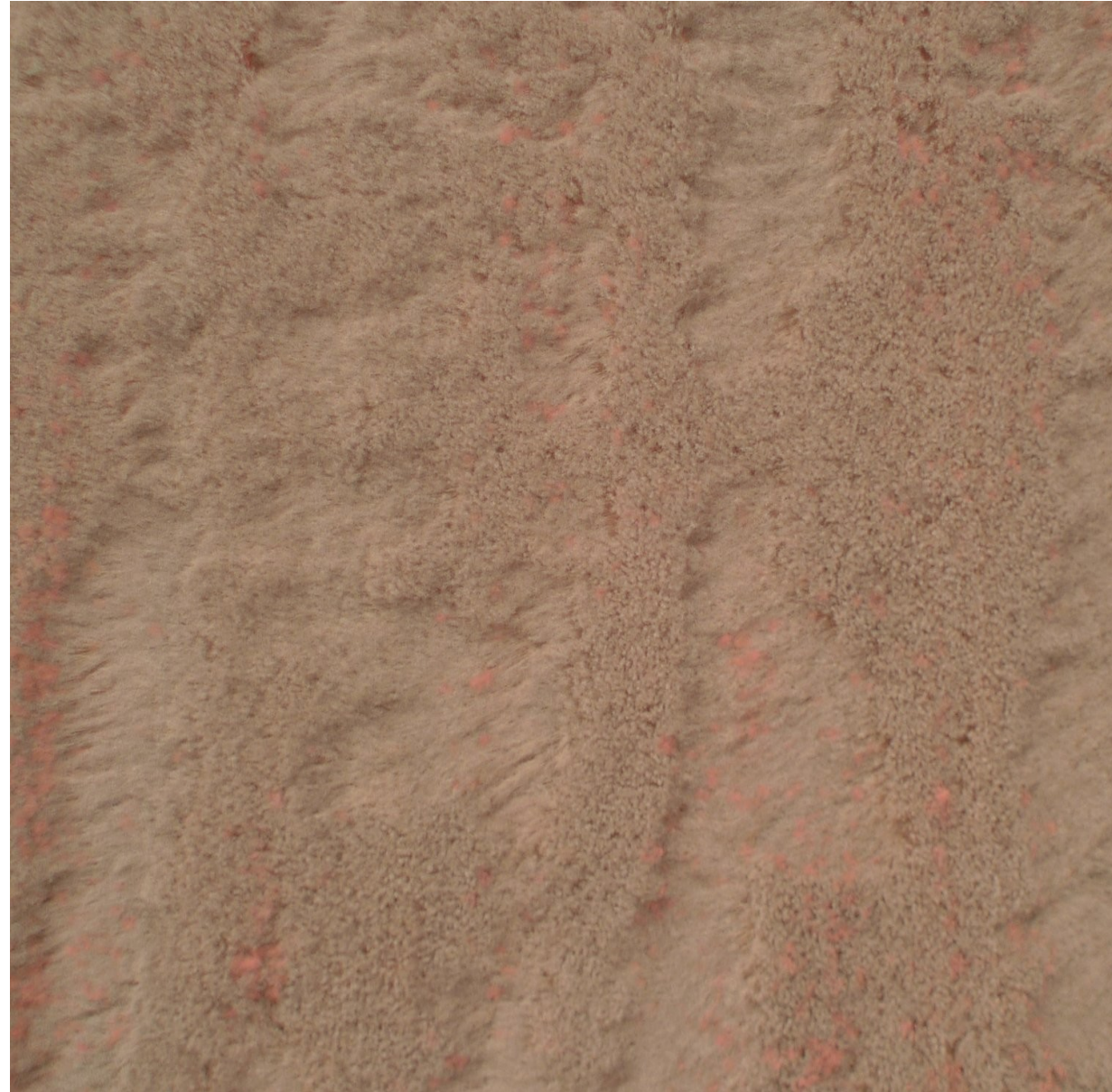
- Example of infrared composite



source:
<http://www.maxmax.com>

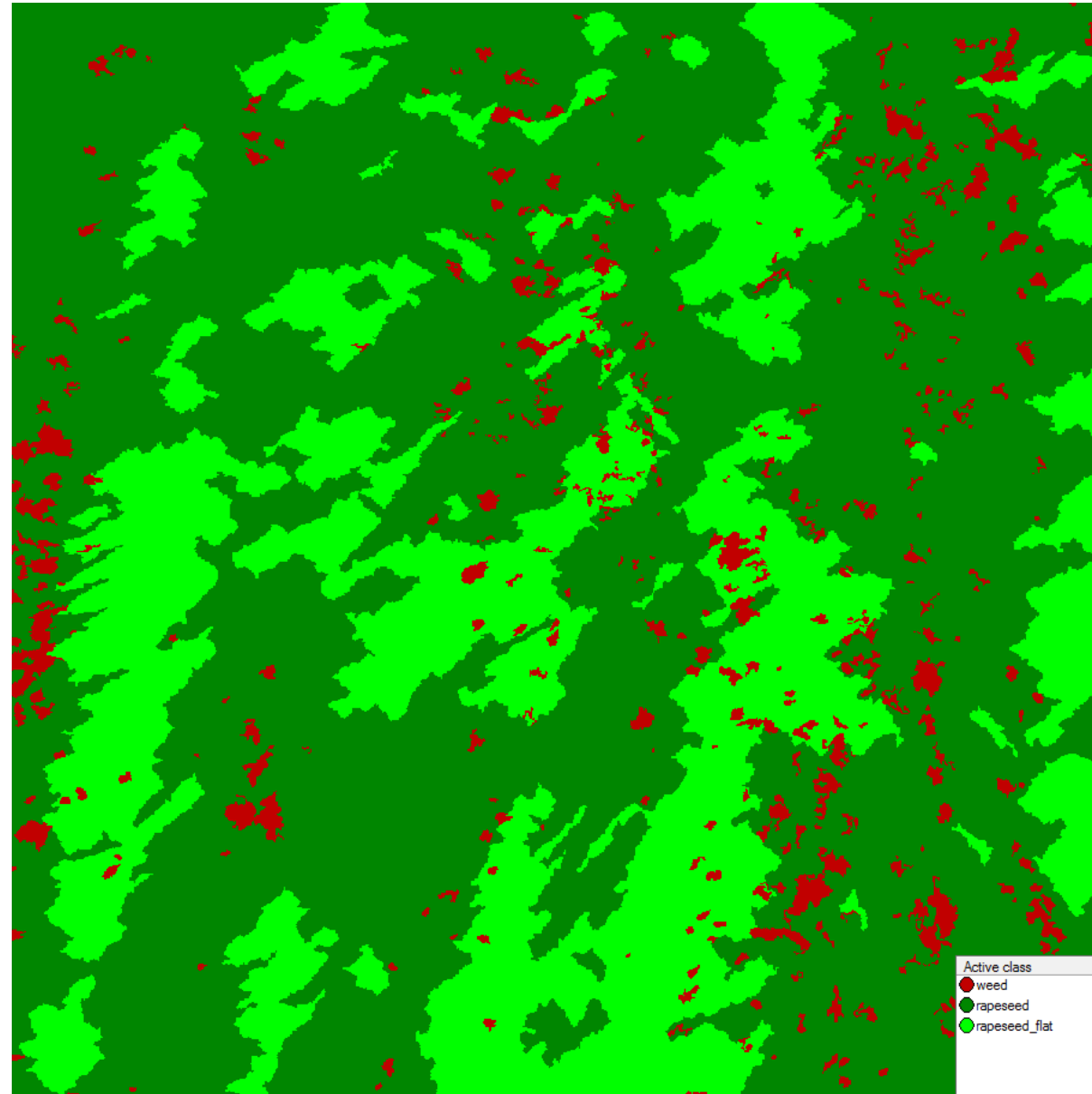
Application 1: Orthophotography

- Classification of a rapeseed field



Application 1: Orthophotography

- Classification of a rapeseed field

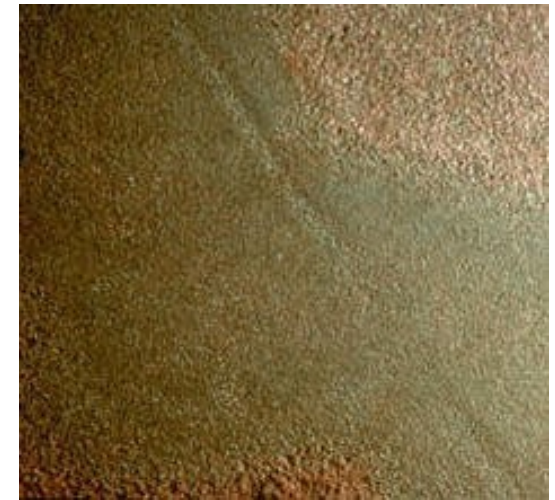


Benefit to archaeology



Color Infrared Photograph showing suspected road.

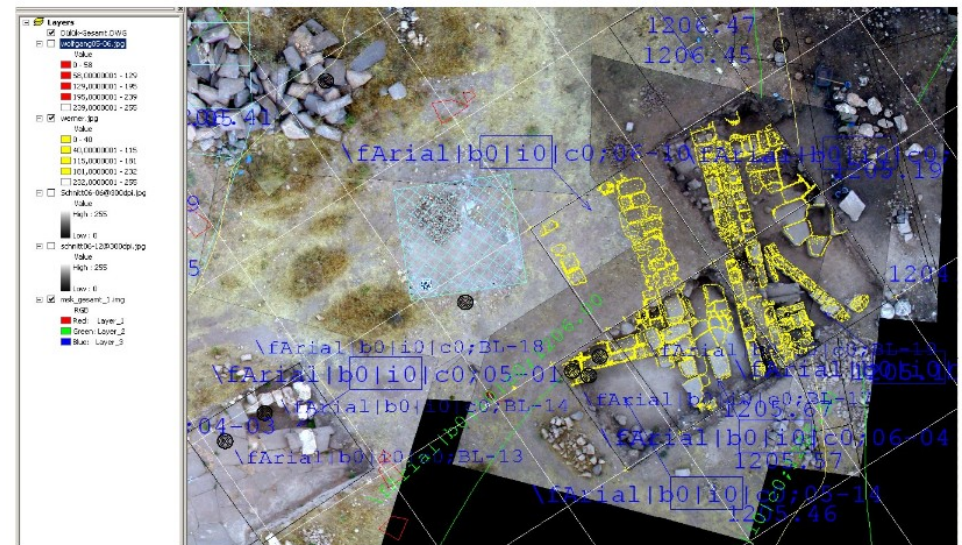
Arenal Region, Costa Rica



Mayan causeway



Excavation of a remotely sensed footpath.



Dülük Baba Tepesi, Turkey

Application 2: real-time data gathering

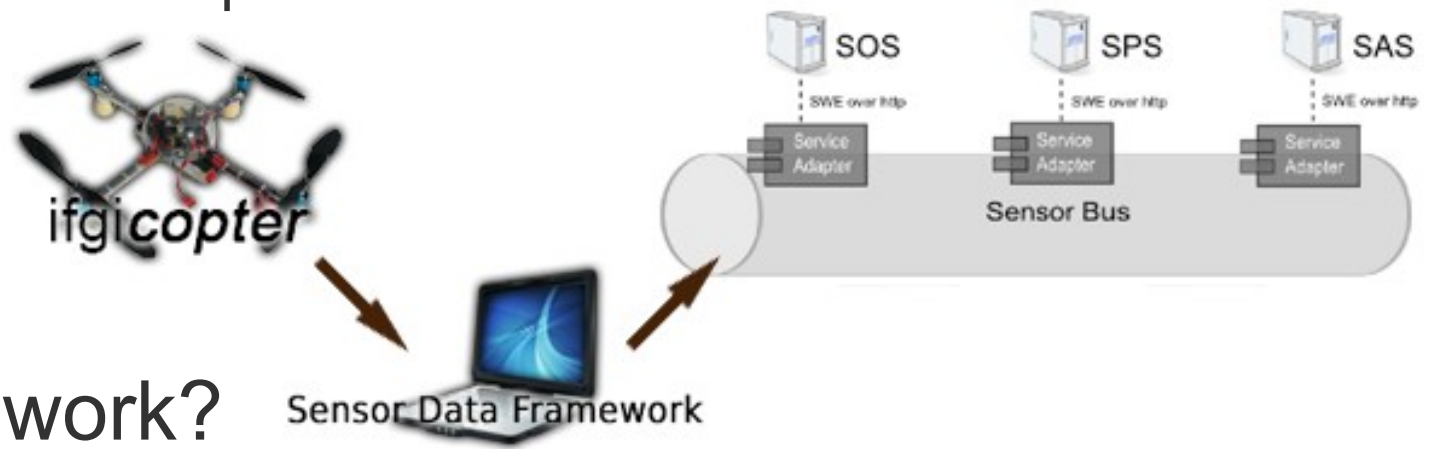
- **Second application** – real-time data gathering
 - Two-tier architecture
 - Transmission of measurements from copter to a groundstation
 - Transformation into standardized data formats (OGC: *Observation & Measurements*) and integration into the Sensor Web



Application 2: real-time data gathering

- Realization using a two-tier framework

- Input in proprietary formats
- Output as interoperable data



- Why framework?

- Not restricted to ifgicopter platform → other sensor platforms easily integrable
- Connection to web services made simple

Future work

- Visualization
- Additional sensors
 - Fine dust
 - LIDAR (laser scanning)
 - Gas sensors
- Digital elevation models
- Autonomic flight (security and surveillance)

Video footage

- Short demo video





Thank you for your kind attention!

Questions?

- Project site:

<http://swsl.uni-muenster.de/ifgicopter>

