Cost effective system for ice throw detection

Najeem Lawal

Mid Sweden University

Winterwind 2016, Åre, Sweden Feb 8-10

Mittuniversitetet
MID SWEDEN UNIVERSITY

Node deployment

An investigation into visual monitoring system with the objective is to

- Capture deployment requirements
- Achieve cost optimized node deployment
- Investigate use of multiple cameras at a node
- Minimize power and communication requirements

At each node

Investigate:

- Multi-camera system
- Real-time segmentation of sky images for bird detection
- Spectral analysis of NIR images for ice detection
- Path / behaviour analysis
- Reconfigurable architecture for node implementation

Investigations: Deployment

System 1 is a monitoring system base on Intel PC and network storage.

- Capture and store images only. No processing

System 2 is also based on Intel PC. Only sequences of images with objects will be saved.

- Image processing for object detection.
- Less power (by ~180W)
- Lower cost (by ~ SEK 100,000) per node.

System 3 is based on reconfigurable hardware

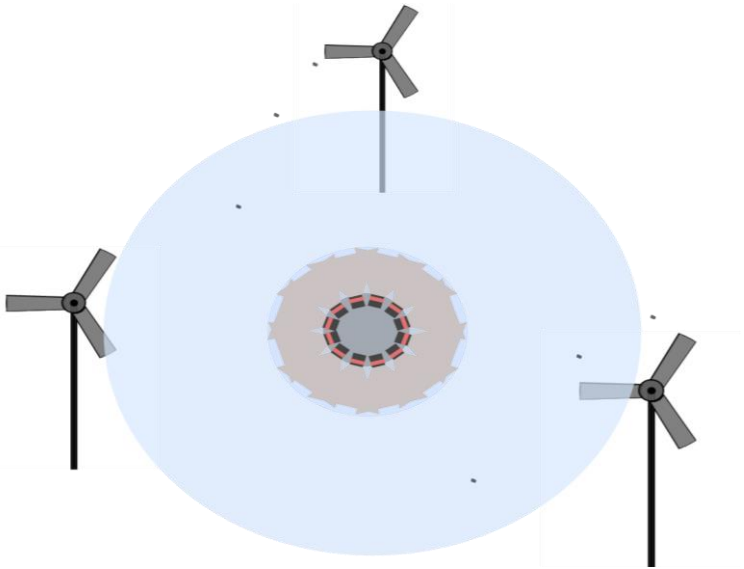
- Capture, detect object and store/transmit information about flight paths.
- Assumes that reconfigurable platform will lower node cost and energy.

System 4 is based on multiple cameras and reconfigurable hardware

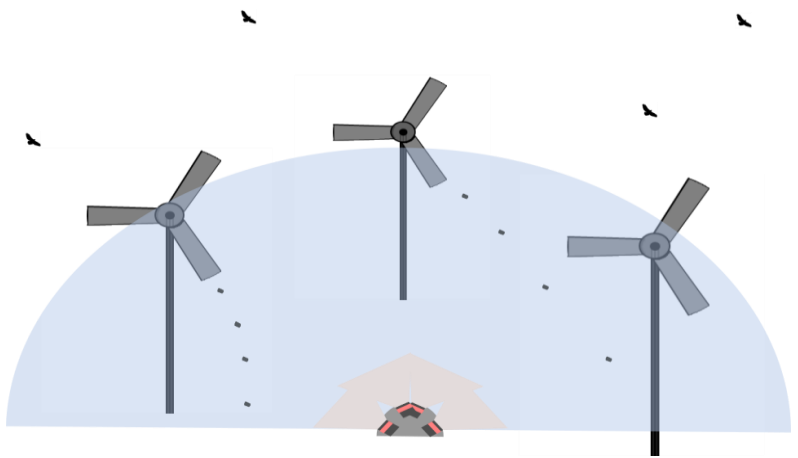
- A dome at each node. Benefits from shared resources.
- The cost and resource requirements/optimization require investigation.

Systems 1-3 use single camera per node with fixed FoV.

Surveillance nodes

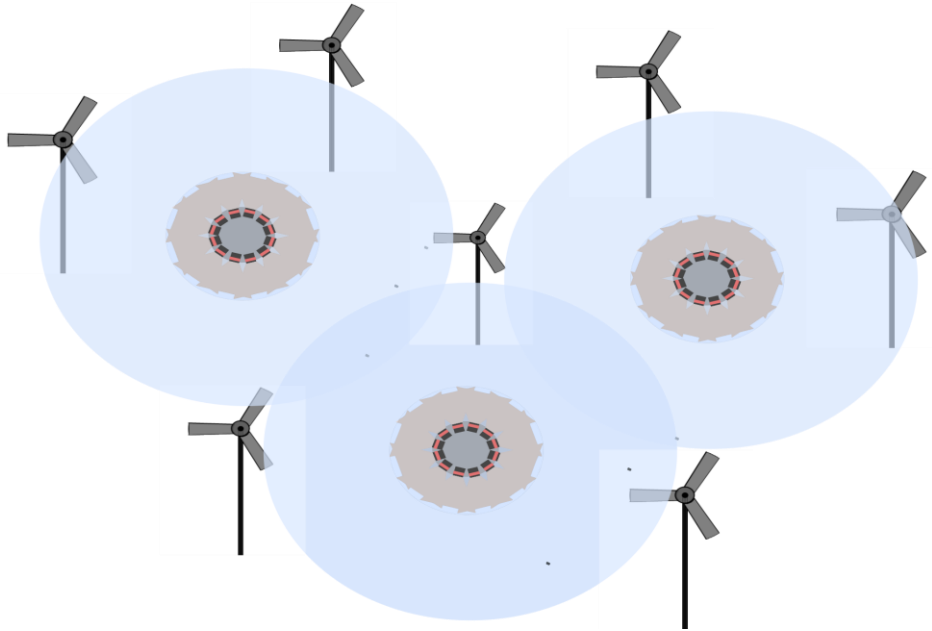


Top view



Side view

Extended to cover large wind park



Scalable implementation

Investigations

Alternative methods for distributed node deployment

Cost estimate of each method

Coverage effectiveness

Detection efficiency

Path analysis

Cost minimization results

Monitoring System	Technology Requirement	Data Produced	Energy Requirements	Memory Requirements	Estimated Cost per node	# of Nodes
System 1	Software platform	Compressed images for 10hrs	4.5 kWh per day	720 gigabytes per day	SEK 150.000 per month	100
System 2	Software platform	Compressed ROI images	1kWh per day	~72 megabytes per day	SEK 50.000 per month	100
System 3	Configurable platform	Sizes, species, positions and age	50 Wh per day	<1 kilobytes per day	SEK 15.000 one-time-cost	100
System 4	Configurable platform	Sizes, species, positions and age	*Requires investigation*	<1 Kilobytes per day	*Requires investigation*	*5*

Summary

- An on-going project
- Analyses sensor specifications, processing and coverage requirements
- Aims to cover large area, (wind par rather than single turbine)
- Aims to minimise the cost of monitoring the area for ice and bird detection.

Partners

This project is in collaboration with:

- Combitech
- Vattenfall
- InSitu Instruments