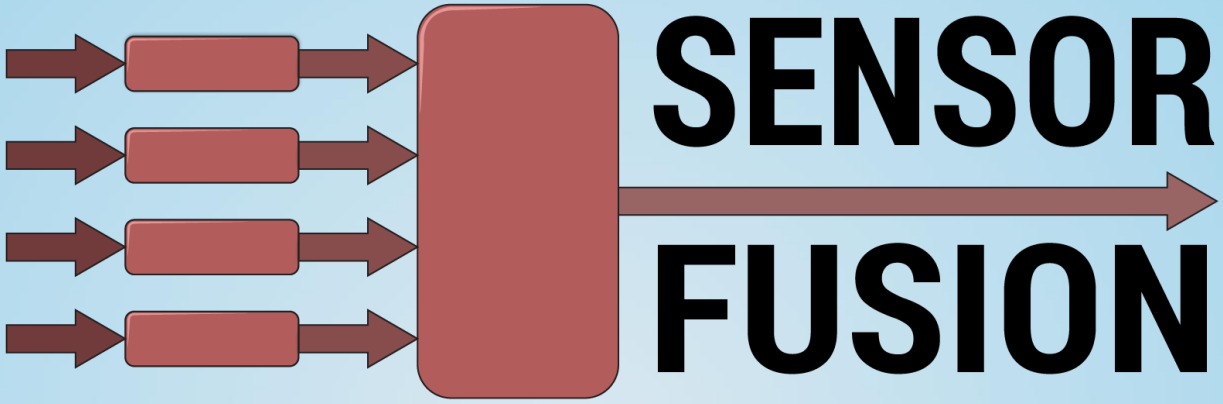
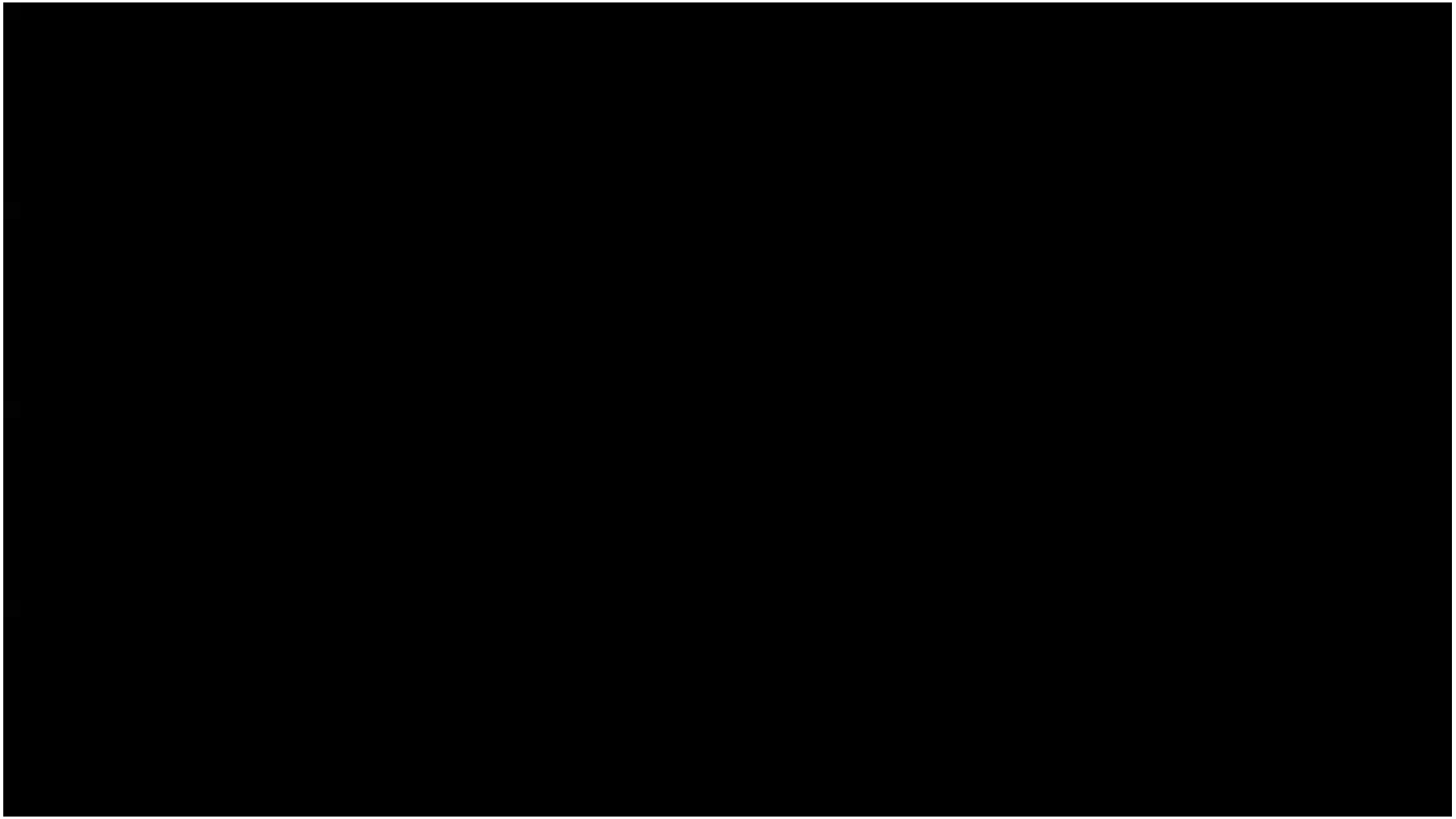



# Localisation of Recco and BLE tags

Presented by Fredrik Gustafsson
Based on work in the sensor fusion group, incl
Jonatan Olofsson and Isaac Skog
at Linköping University, Sweden

# Motivation and Background



# Recco in the world

Over 600 resorts have rescue teams equipped with Recco systems (88 in USA)

# Recco in Big Sky

# Recco Technology

- Tag consists of a diode and two cupper wires
- Scanner transmits 900 MHz and detects received signal strength (RSS) at 1800 MHz
- Scanner has two polarized antenna elements, providing some directional sensitivity
- Analoge construction with audio feedback to user

# Recco project goals

Joint project funded by the Swedish Innovation Agency (Vinnova) in 2019:

- Business case
  - Drone based operation
  - More general SAR operations, rather than only avalanches
- Development
  - HMI support
  - New scanner
  - Video and IR verification of victims
- Research
  - Automatic and adaptive route planning
  - Computerized position estimation

# Recco scanners

- New scanner till complement the two scanner versions manufactured today


| Scanner | Weight [kg] | Range [m] | Accuracy [m] | RSS |
|---|---|---|---|---|
| Handheld | 1 | Tens | 1 | Audio |
| Helicopter | 60 | Thousands | 10 | Audio |
| Drone | 1 | Hundreds | 30 | Digital |

# Presentation overview

- Problem: Localization of an object on ground using radio signal strength (RSS) measurements
- Focus on Bluetooth Low Energy (BLE) tags rather than Recco tags
- RSS generally available measurements in a variety of applications
- Applications:
  - Drone-based Search and Rescue (SaR)
  - Animal tracking (wildlife and livestock)

# BLE tags

Recco tags are passive, Bluetooth Low Energy (BLE) are active

- Also very cheap
- Fairly long battery time (tens of years)
- Includes an ID!
- Simple scanners (standard smartphones can be used)

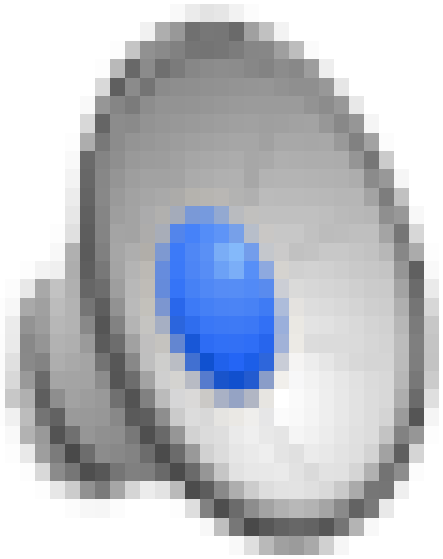
**Longer range enabler**

50m standard BLE

200-1000m with BLE 5

More sensitive receivers with external antenna

# Search and Rescue: Missing People



https://youtu.be/c4MIGQOQGfA

# Search and Rescue Platform

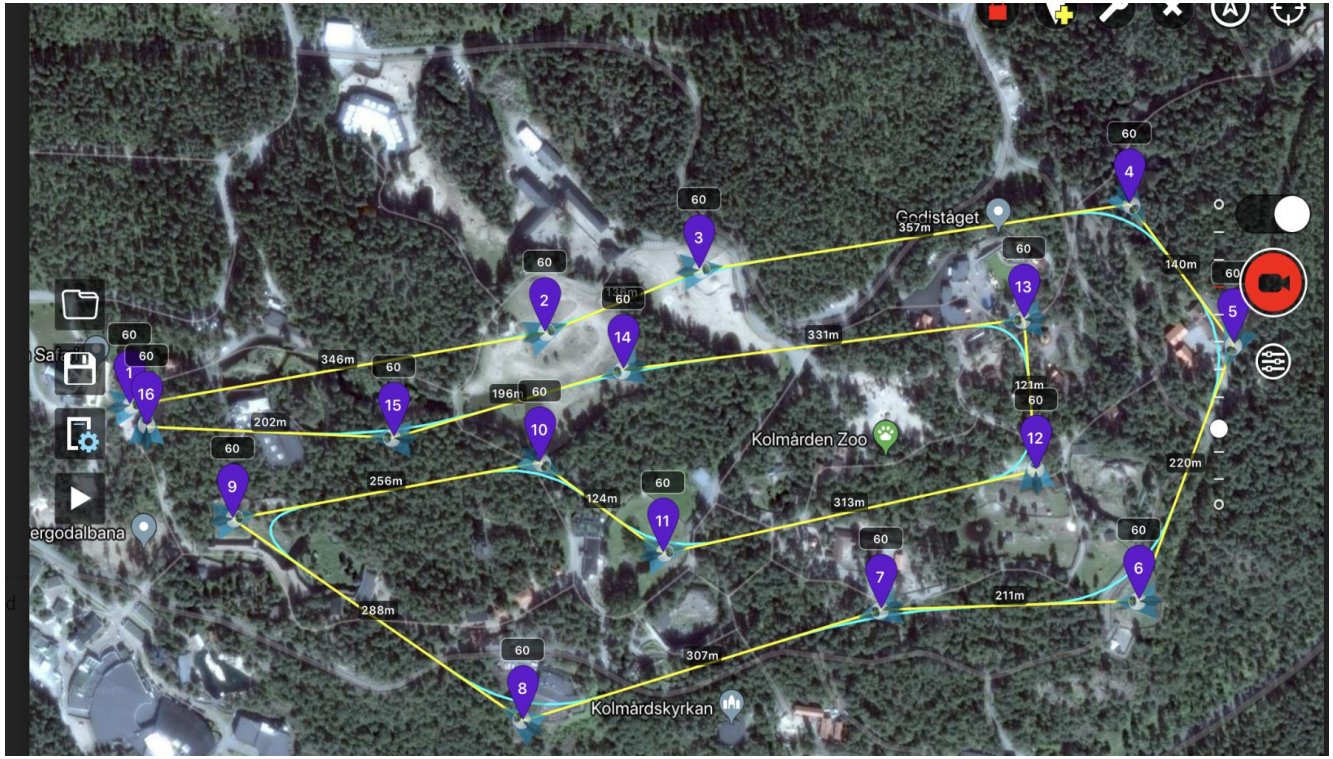
**Platform:**

- DJI Matrice 210
  - Open interface
  - Weather robust
  - Several kg payload
- NanoPI M4
  - WiFi in monitor mode
  - Bluetooth
  - Hexa-core CPU for on-board video processing and control of host Matrice
- Digitally interfaced analog Recco detector

Work done by Jonatan Olofsson

# Search and Rescue: Missing People

Autonomous flying at Kolmården




Phone on a drone concept

Same scanning pattern used morning and evening for two weeks

# Search and Rescue: student project

- Missing examiner
- Task: find him!
- Tools: 2 drones with radio scanner (smartphone) to get a rough position


- Drone measurements result in a heat map as a guide for the search patrol

# Search and Rescue: student project

# Conclusions

- Recco has a handheld (1kg) and an airborne (60kg) scanner
- Recco wanted a drone-based scanner
- We developed one in partnership

- But Recco tags are passive, thus with limited range
- We also investigated the potential of active BLE tags
- But also with limited range (50m)

- Today, the new BLE 5 enables up to 1000m range!