Automatic People Detection in Avalanche-Controlled Terrain during All-Weather Conditions

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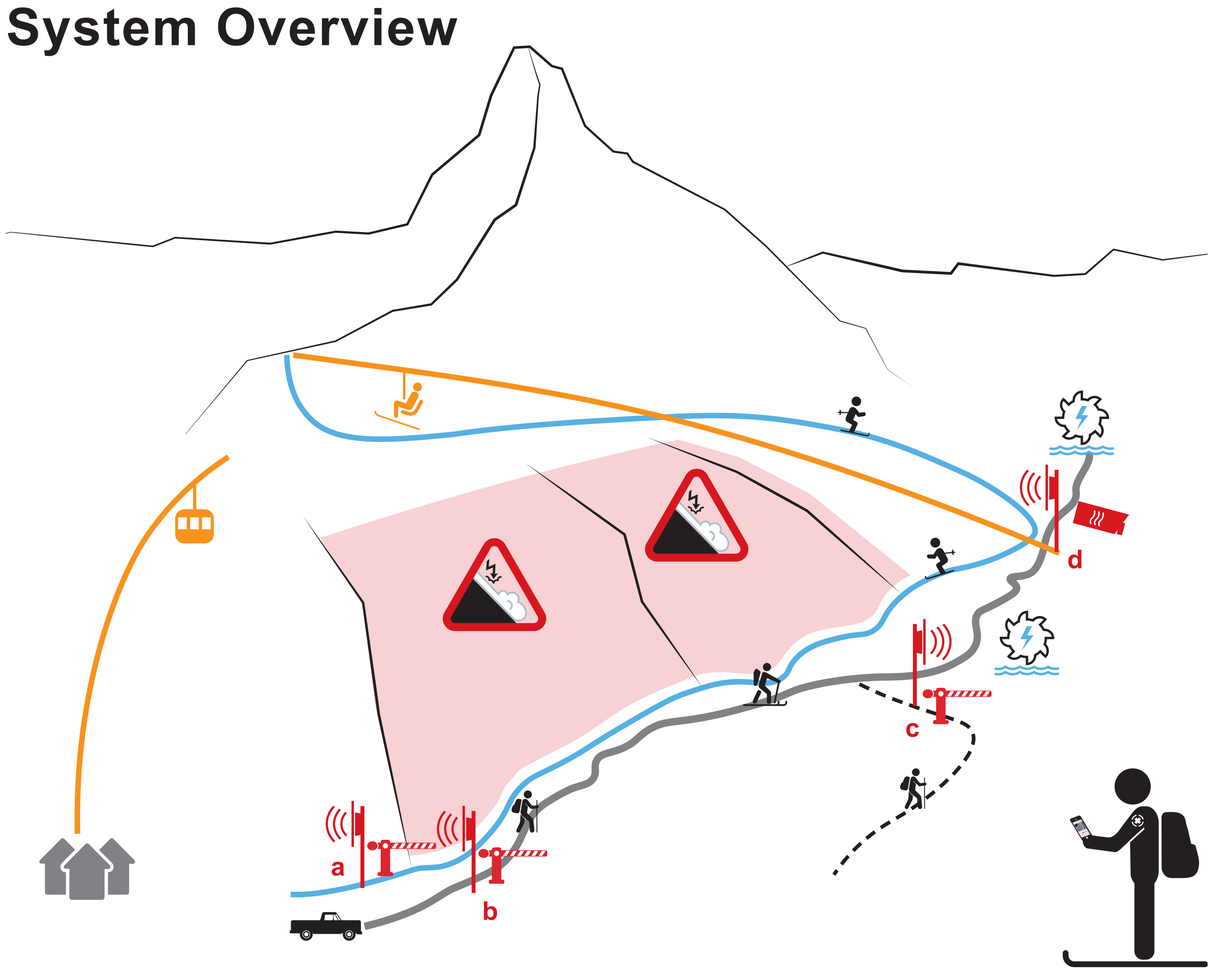
Introduction

Avalanche control within ski resorts, along transport routes or above settlements requires strict safety management and associated area closures. In an effort to increase public and operator safety as well as to decrease closure times, we developed a comprehensive area access monitoring system based on automatic people detection by radar in real-time at typical area entry points. After the test winter 2016/17, the system was extended to four detection stations for winter 2017/18 and has been fully operational since.

Why detection with radar?
Radar is very reliable and...

... works day/night and in all-weather
... can detect skiers, hikers or cars
... and can track objects/people

System Overview



Map symbols

- avalanche control terrain
- ski slope
- road
- lifts
- hiking trail
- hydropower plant
- people radar with webcam and flood lights
- barriers/sirens/beacons
- thermal camera

We designed a modular system based on detection stations, cloud servers for data processing and an online data portal. Each detection station includes a people radar, camera, data logger and communication device. The radar triggers the camera at detection, which automatically takes a picture (or a series of pictures). Cameras can also be used for live views any time.

Detection stations

a) Bielti slope

people radar, webcam, IR flood light, barrier, beacon, siren

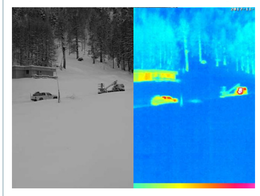
b) Bielti road

people radar, webcam, IR flood light, barrier, beacon, siren

c) Zmutt hiking trail

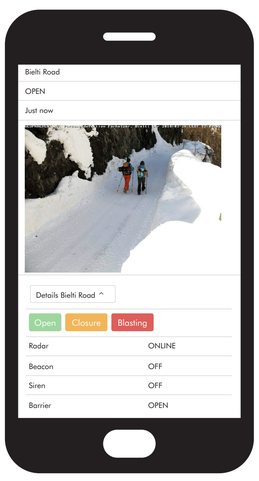
people radar, webcam, IR flood light, barrier, beacon, siren

d) Stafel road/slope

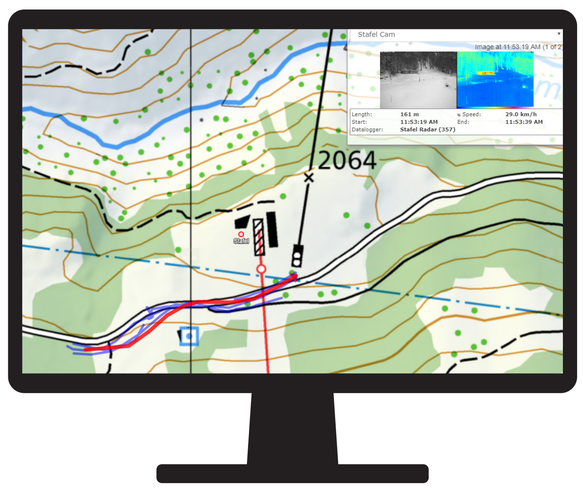


people radar, webcam, IR flood light, thermal camera

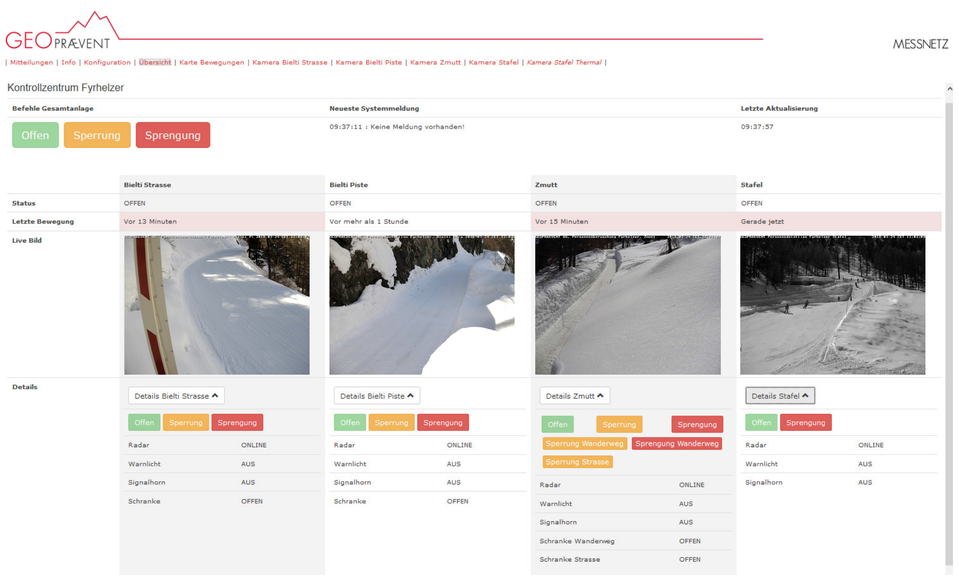
Online data portal



System control with smart phone (left) to close barriers („Closure“ state) and activate sirens and beacons („Blasting“ state). Blasting triggers a local alarm if a person is detected despite closed gates. Online map tracker (right) with associated event pictures and characteristics.



System operation



Overview display on the data portal with all four stations and associated status, detection data and camera view (left). Buttons allow system operation via PC, smart phone or tablet.

Detection station with people radar, webcam, IR flood light, beacon and siren (right).

Practitionier‘s Opinion

Jonas Truffer, Deputy Head of Skipatrol Zermatt:

He is **very happy** with the new detection system.

The system **replaces four workers** for area checks and guarding.

They **no longer** need to go **into the danger zone**.

Overview gained of blind spots.

Very **user-friendly** system operation (e.g. barriers) via smartphone.

Conclusions

This poster describes the **worldwide first automatic people detection system** for access monitoring to a critical avalanche area within a ski area. The comprehensive detection system has made a major contribution to **increase public and worker safety** in the monitored area of Zermatt-Matterhorn ski field and significantly facilitates the work of the avalanche control. In addition, the convenient access to detection data (images, tracks, direction, characteristics) via online data portal has proven very useful for their daily work. With **tens of thousands of detections**, the people radar has demonstrated that it functions correctly and reliably at any time of the day/night as well as in all-weather.

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