

An Android App for Snow Avalanche Research

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Introduction

This project will consist of developing an Android application for a snow avalanche research device. The device will be able to return information about the snowpack stratigraphy, which is critical information for evaluating the risk of avalanche for somebody evolving in a dangerous terrain. Before this device can be brought to public, we need to test its reliability in various snow conditions, as well as different terrain, and estimate what are its limitations.

The current prototype requires heavy and cumbersome equipment that is limited to thin snowpack, not adapted to mountainous and hard access terrain. The whole prototype can be reduced to a smart phone connected to an Arduino microcontroller for acquiring the data, through the development of an App. By reducing the size and the weight of the device, and also by standardizing the data logger to a common smartphone, we will greatly improve our ability to test the device by multiplying the number of people who could carry it, if equipped of the Arduino/sensor unit (~\$40) and a smart phone running the App.

The phone will sit on top of a pole where the lower tip of the pole will be replaced by the sensor. The distance phone sensor is therefore constant. As the sensor is introduced in the snow, the phone records data from the snow sensor and its internal sensors.

Objectives

The goal of this project will be to develop in collaboration the software necessary to run the App from an Android phone, and if time allows from an iOS phone.

Software description

The software will require a first module, gathering data from the Arduino and the phone sensors, and displaying live the outputs into a graph. As the device will be introduced into the snow, the App will plot the sensor output versus the distance penetrated in the snowpack. The distance will be

estimated using the phone camera and an object of known size sitting on the snow surface.

A second module of the app will be used for displaying data collected in the past and saved on the phone. Figure 1 is a synthetized description of the software requirements.

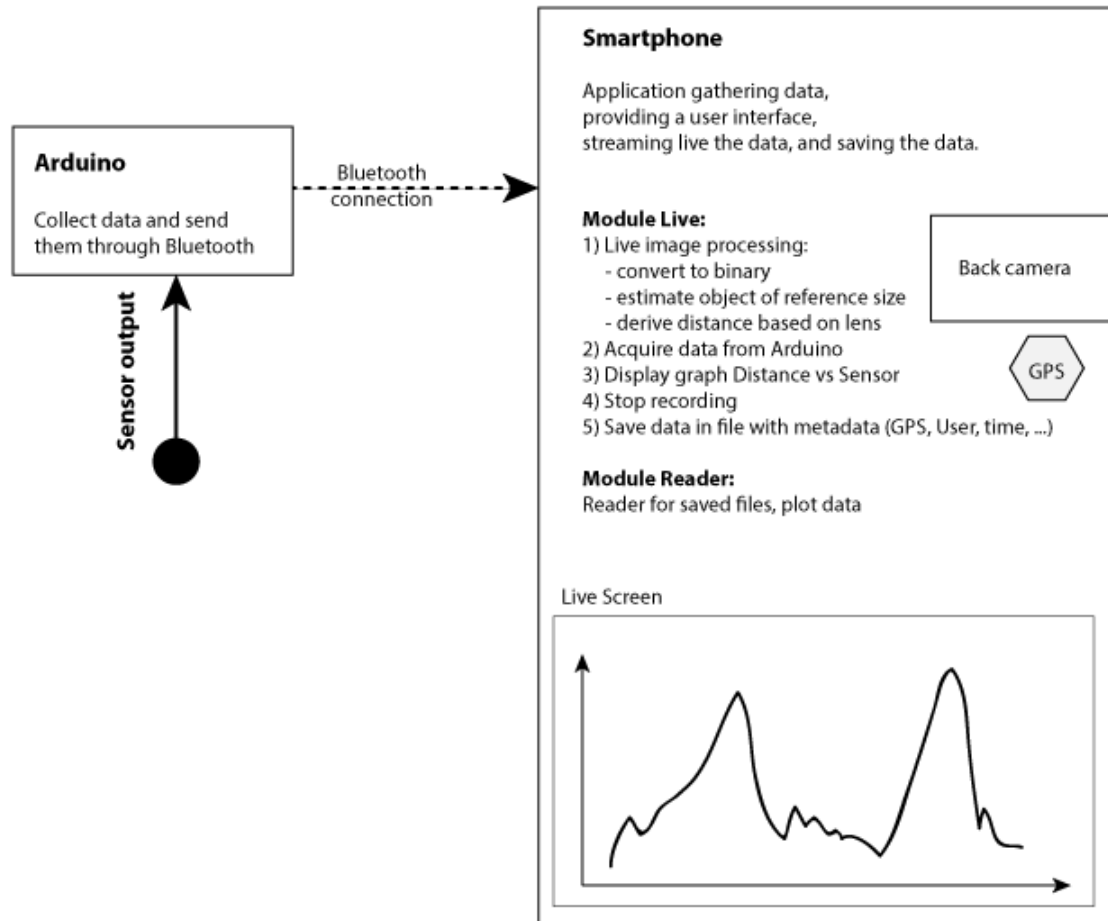


Figure 1: Description of the software requirements for running the snow avalanche device.

The Arduino unit will stream continuously data from the sensor as integers through its serial. Data will be sent to the phone using a Bluetooth unit (HC-06) as soon as the connection is established.

On the phone side, the application will necessitate to access the back camera, the GPS unit, and the accelerometer. The GPS information will be saved with the rest of the data. The accelerometer will also be recorded for

tracking accurately the vertical motion of the phone and the sensor. The camera, looking toward the snow, will video tape an object of a known size located at the snow surface for estimating the distance between the phone and the snow surface (Figure 2). The distance can be mathematically retrieved if the focal lens, the size of the camera sensor, and the size of the object are known.

The Office of Intellectual Property of UAF will copyright the App code under the condition that it can be modified for further improvement.

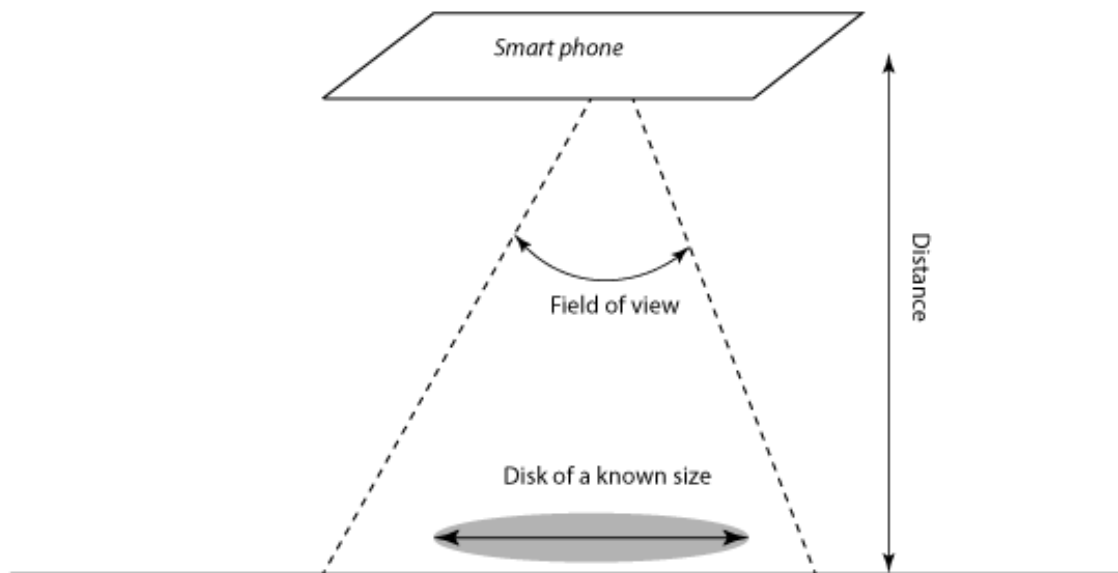


Figure 2: Sketch of the camera set up to estimate the distance between the snow surface and the camera.

Outcome for the Students

The development of this app is a critical step in proving the concept of this device to a broader audience. The app will be an easy way of conveying to scientists and investors the potential of the device. We hope to bring this project to commercialization, so the students involved would be considered in priority for any further possible development of the device.

Students will also gain working in collaboration with a student of another discipline at UAF, and see their work used by scientists.

Biography

Simon Filhol is a PhD candidate in Geophysics at UAF, focusing his research on snow physics. His work focuses on how snow properties combined to wind, vegetation canopies, and topography participate to the redistribution of snow on the ground. Through his projects, he learnt how to develop rudimentary electronic prototypes using the open-source platform Arduino as well as scripting in the language Python for data analysis. Because of his passion for backcountry skiing in the Alps and in Alaska, he realized how one of his prototypes could be used and developed for improving the assessment of avalanche danger.

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