

Glacial Crevasse Radar

Project

Detect glacial crevasses remotely

- Mountaineers often need to navigate glacial crevasses covered in snow
- Ice-penetrating radar provides method to see into glaciers
- GCR uses ice-penetrating radar to automate crevasse detection, giving user appropriate warning



[Snider]

Figure 1: Rescuing a mountaineer from a crevasse fall

System

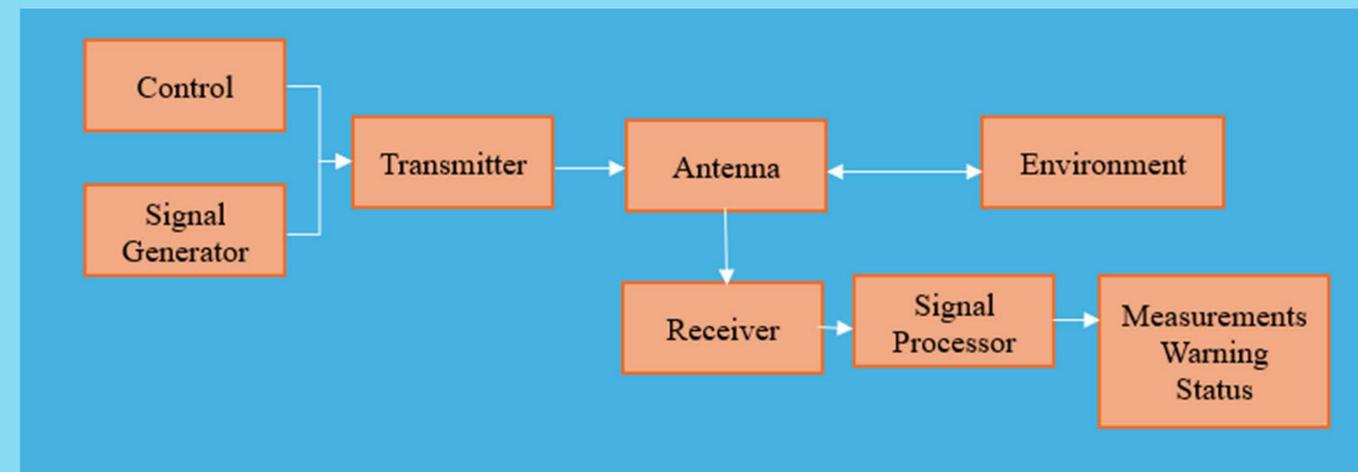
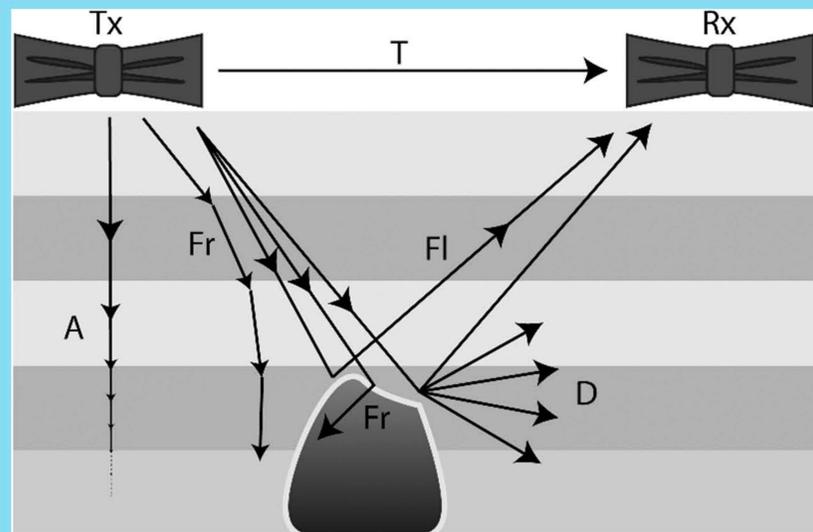


Figure 3: GCR functional block diagram

Methods

- Radio waves partially reflect from media interfaces
- 70 cm (~440 MHz) radio wave penetrates ice and snow
- Software-defined radio (SDR) generates and transmits a chirped radar pulse
- The reflected wave is analyzed for reflections
- Reflections are filtered by amplitude and distance to find crevasses
- When a crevasse is detected, the GCR sounds an alarm



[Williams]

Figure 2: Reflections from a crevasse relevant to a bistatic (receive and transmit are in different locations) radar. (GCR is a monostatic radar)

Conclusion

- The SDR both transmits and receives successfully.
- I learned SDR use, radio system architecture, and the virtues of different frequency-modulated continuous wave (FMCW) radar schemes.
- In the future, I would like to implement the processing on a microcontroller, include a distance indicator, and improve the GCR into a reliable tool for expeditions.

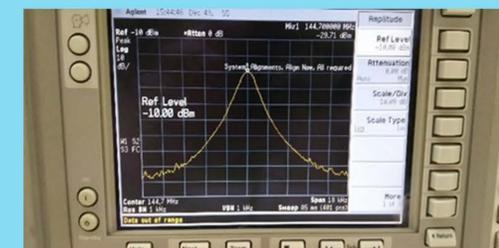


Figure 4: Transmitted signal from an SDR as shown on a spectrum analyzer

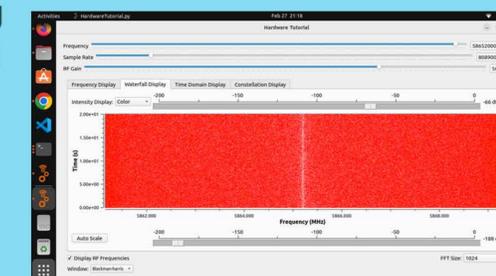


Figure 5: Wi-Fi signal received on SDR, as shown on a waterfall plot