Feasibility Study of Mobile Phone WiFi Detection in Aerial Search and Rescue Operations

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Search and Rescue

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ORIGINAL RESEARCH

Dead Men Walking: Search and Rescue in US National Parks

Travis W. Heggie, PhD; Michael E. Amundson, BS

Results.—From 1992 to 2007 there were 78 488 individual incidents ended with 2659 fatalities, 24 288 ill or injured i there were 11.2 SAR incidents each day at an average cost of 1992 to 2007 were $58 572 164. In 2005, 50% of the 2430 S

there were 11.2 SAR incidents each day at an average cost of $895 per operation. Total SAR costs from 1992 to 2007 were $58 572 164. In 2005, 50% of the 2430 SAR operations occurred in just 5 NPS units. Grand Canyon National Park (307) and Gateway National Recreation Area (293) reported the most SAR operations. Yosemite National Park accounted for 25% of the total NPS SAR costs ($1.2 million); Wrangell-St. Elias National Park and Preserve ($29 310) and Denali National Park and Preserve ($18 345) had the highest average SAR costs. Hiking (48%) and boating (21%) were the most common activities requiring SAR assistance. Hiking (22.8%), suicides (12.1%), swimming (10.1%), and boating (10.1%) activities were the most common activities resulting in fatalities.

Conclusions.—Without the presence of NPS personnel responding to SAR incidents, 1 in 5 (20%) of those requesting SAR assistance would be a fatality. Future research and the development of any prevention efforts should focus on the 5 NPS units where 50% of all SAR incidents are occurring.

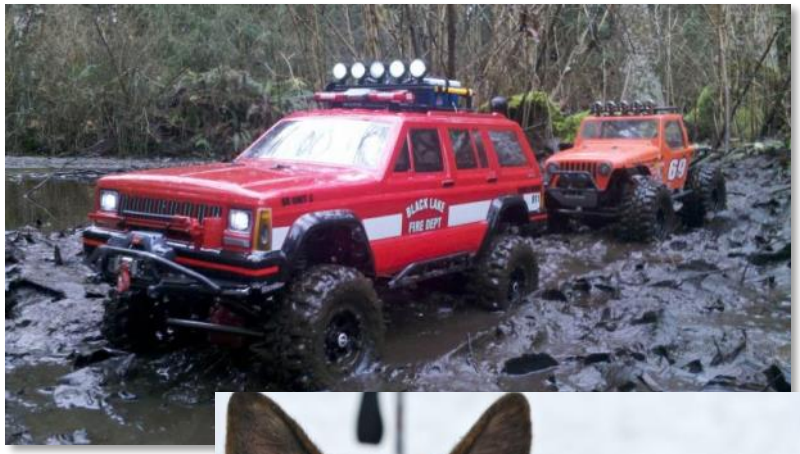
Key words: search, rescue, national park, fatality, injury, illness

Highest incidents - Hiking

Table 2. Most common activities requiring search and rescue (SAR) assistance in National Park Service units, 2005

Activity	*No. of incidents*	*% of SAR*	*Fatalities*	*Illness/injury*
Hiking	1167	48%	34	730
Day hiking (870)				
Overnight hiking (297)				
Boating	506	21%	15	116
Motorized (338)				
Nonmotor (168)				
Swimming	153	6%	15	29
Climbing	127	5%	13	84
Scrambling (39)				
Technical roped (76)				
Technical unroped (12)				
Vehicle/driving	73	3%	9	35
Canyoneering	57	2%	3	39
Mountaineering	52	2%	14	37
Roped (30)				

Current Methods



Ground Based

Limitations

- Terrain
- Manpower

Aerial Based

EXPENSIVE!

Hobbyist UAV

Affordable

Easy to fly

- iPad or Android
- Autopilot

Easy to deploy

Current Aerial Approach

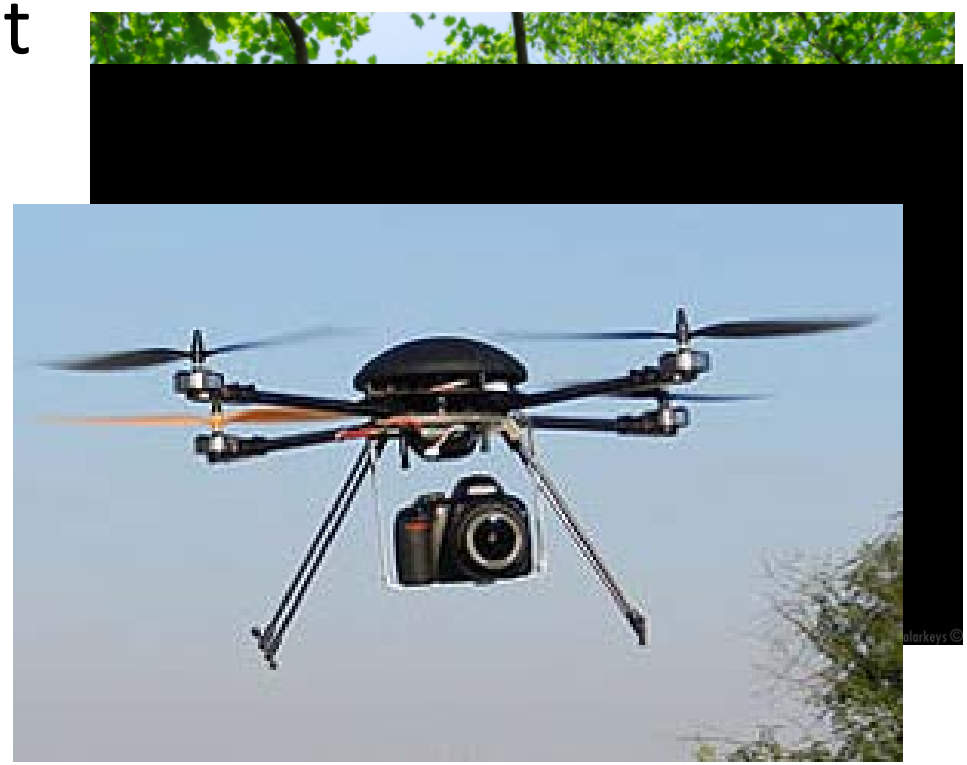
Cameras

Real Time Image Processing

P. Rudol and P. Doherty. Human body detection and geolocalization for UAV search and rescue missions using color and thermal imagery.

Drawbacks

- Requires Line-of-Sight
- Requires daylight
- Heavy payload
  - Optics
  - On-board CPU



Key Idea


Eye-Fi
Pro X2
8GB
+Wi-Fi


Wi Fi


12:45
Samsung GALAXY S4 zoom


Canon
SELPHY


SONY
APS-C

Is it Feasible?

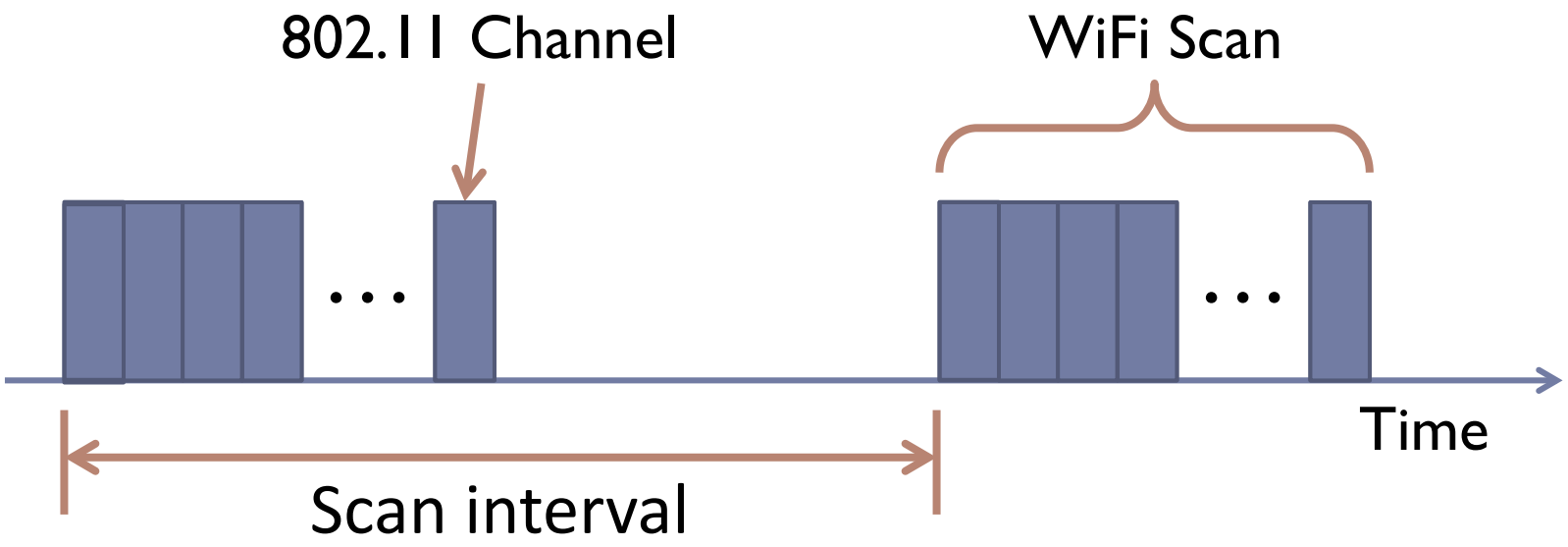
Signals from a phone?

Battery life?

Range of detection?

WiFi Scan/Probe

WiFi Scan

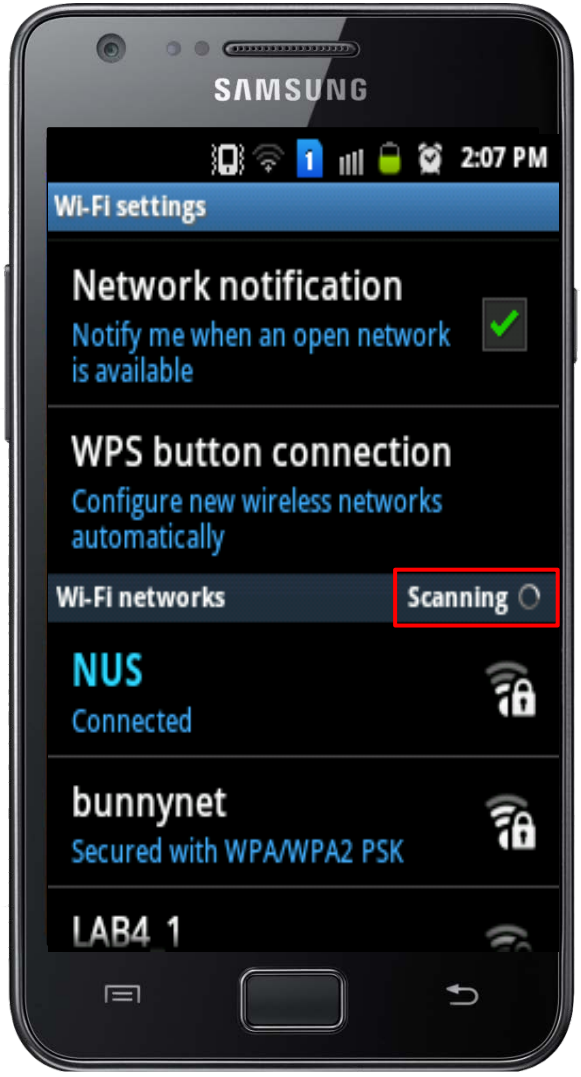


Different Scenarios

Different Devices

Different Intervals

Different Scenarios



	Scan Frequency
Settings Screen	High
Home Screen	Moderate
Display Off	Low

Different Devices

HTC Desire

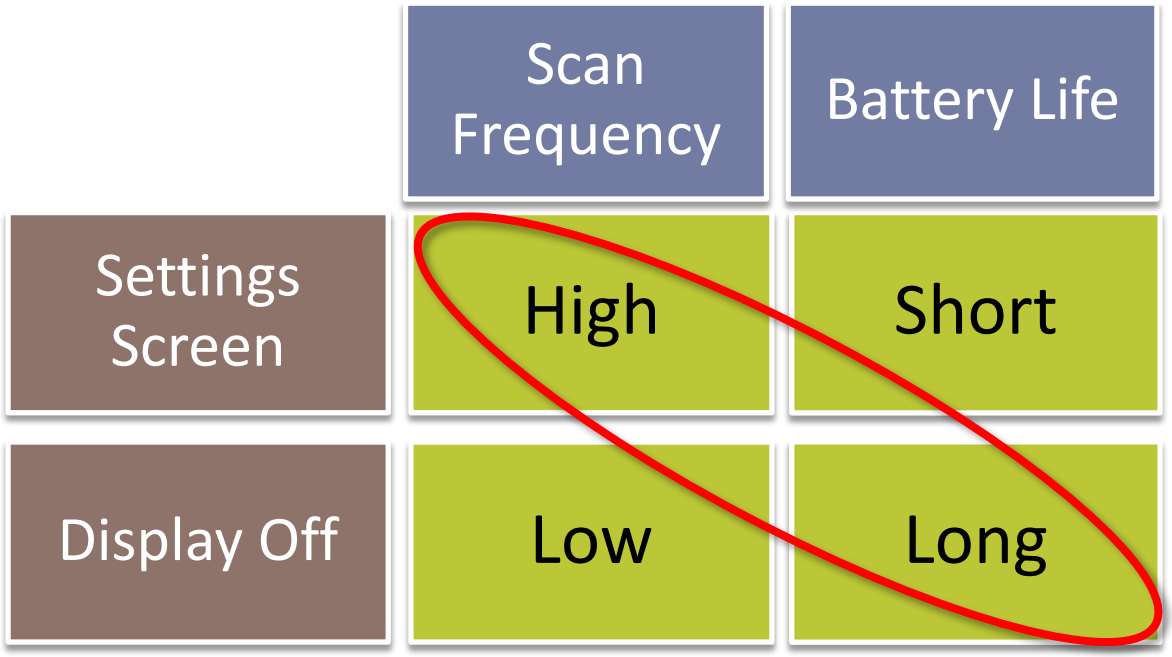
Settings Screen	Every 6 s
Home Screen	Every 15 s
Display Off	Does not scan

iPhone 5

Settings	
Screen	{31, 31, 62, 62} repeat
Display Off	3, 7, 12, 17, 62, 62, 62, …

More results in the paper (Table 1)

Battery Life



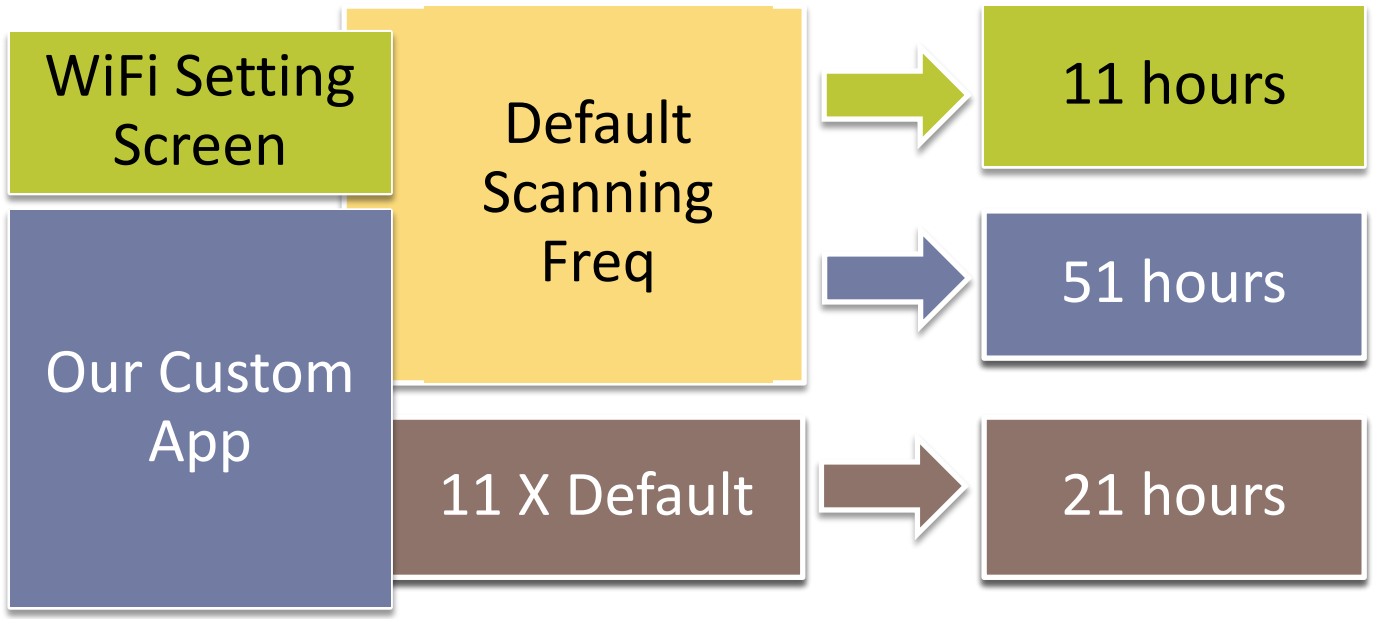
Custom Android App

- Android WiFiManager API
- **Increase scan frequency** with **display off**

Monsoon Power Monitor

Sample Result of Battery Life

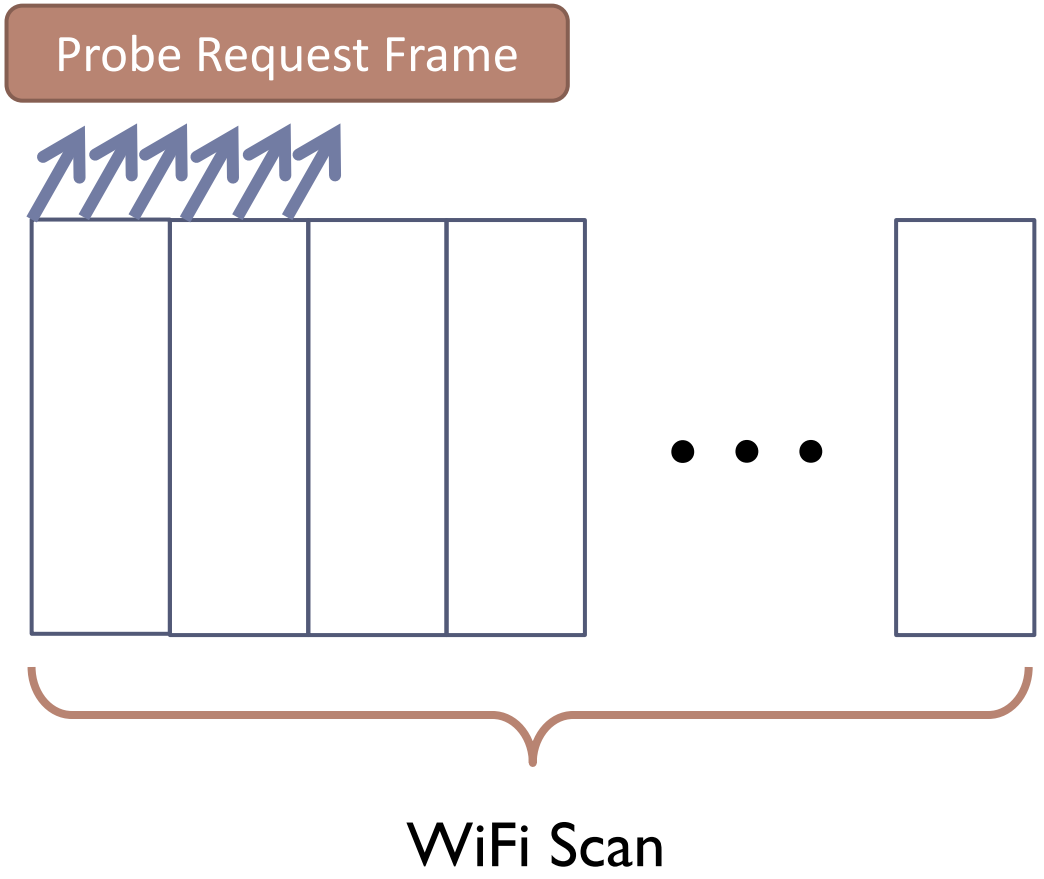
- Motorola Electrify



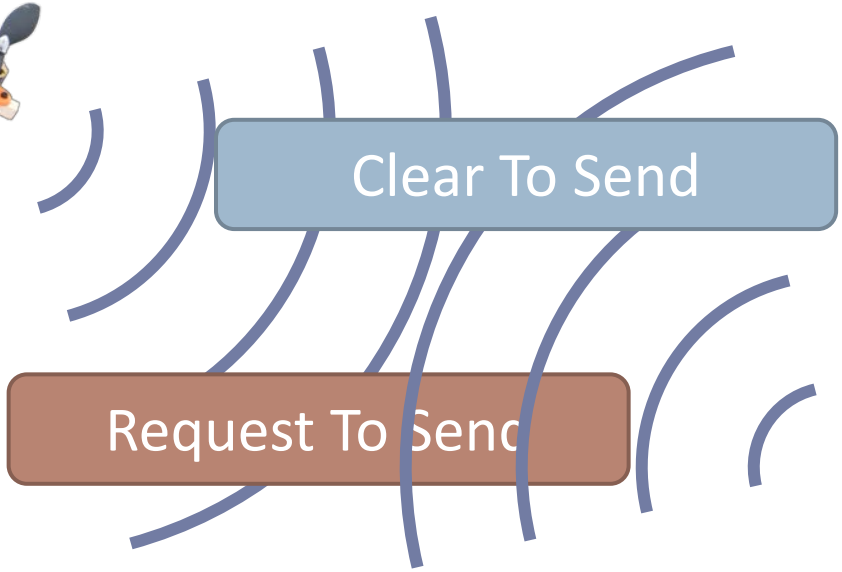
More results in the paper (Table 2)

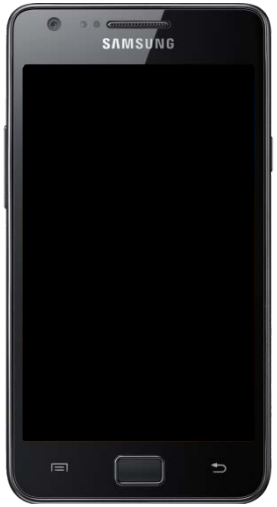
Passive Detection

- 4 to 5 Probe Request Frames



Active Probing





Is it Feasible?

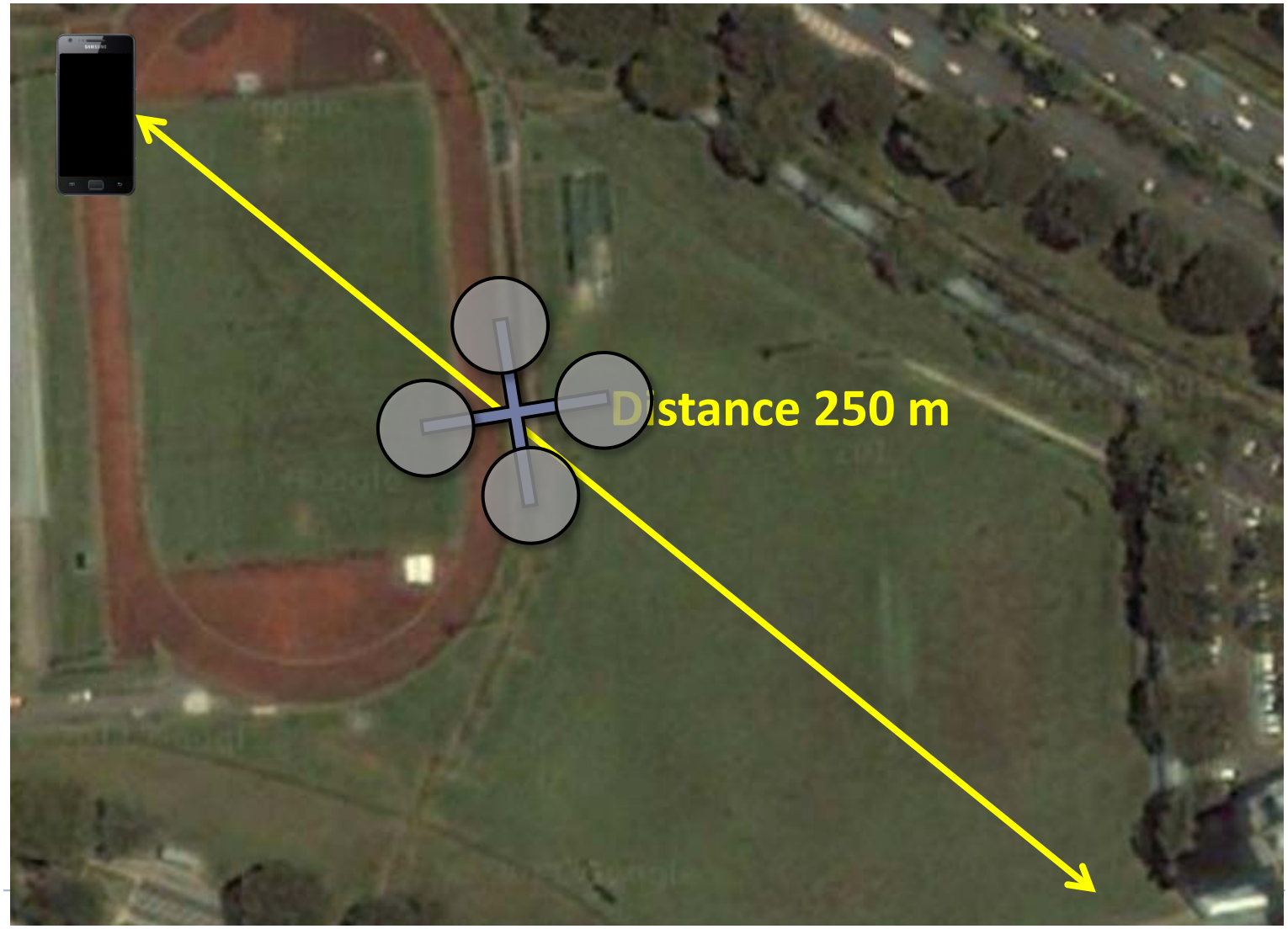
Signals from a phone?

Battery life?

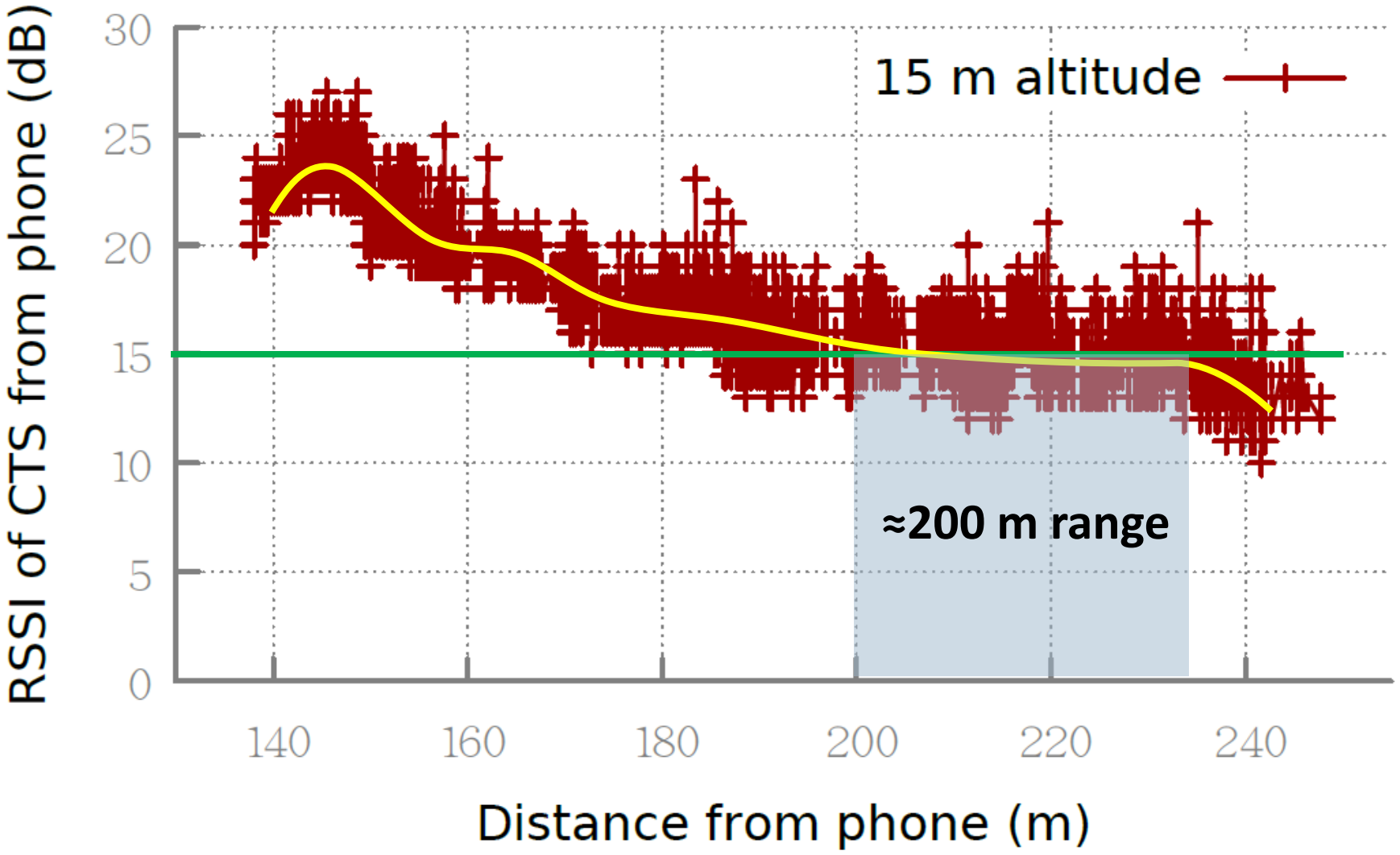
Range of detection?

DIY Quadrotor

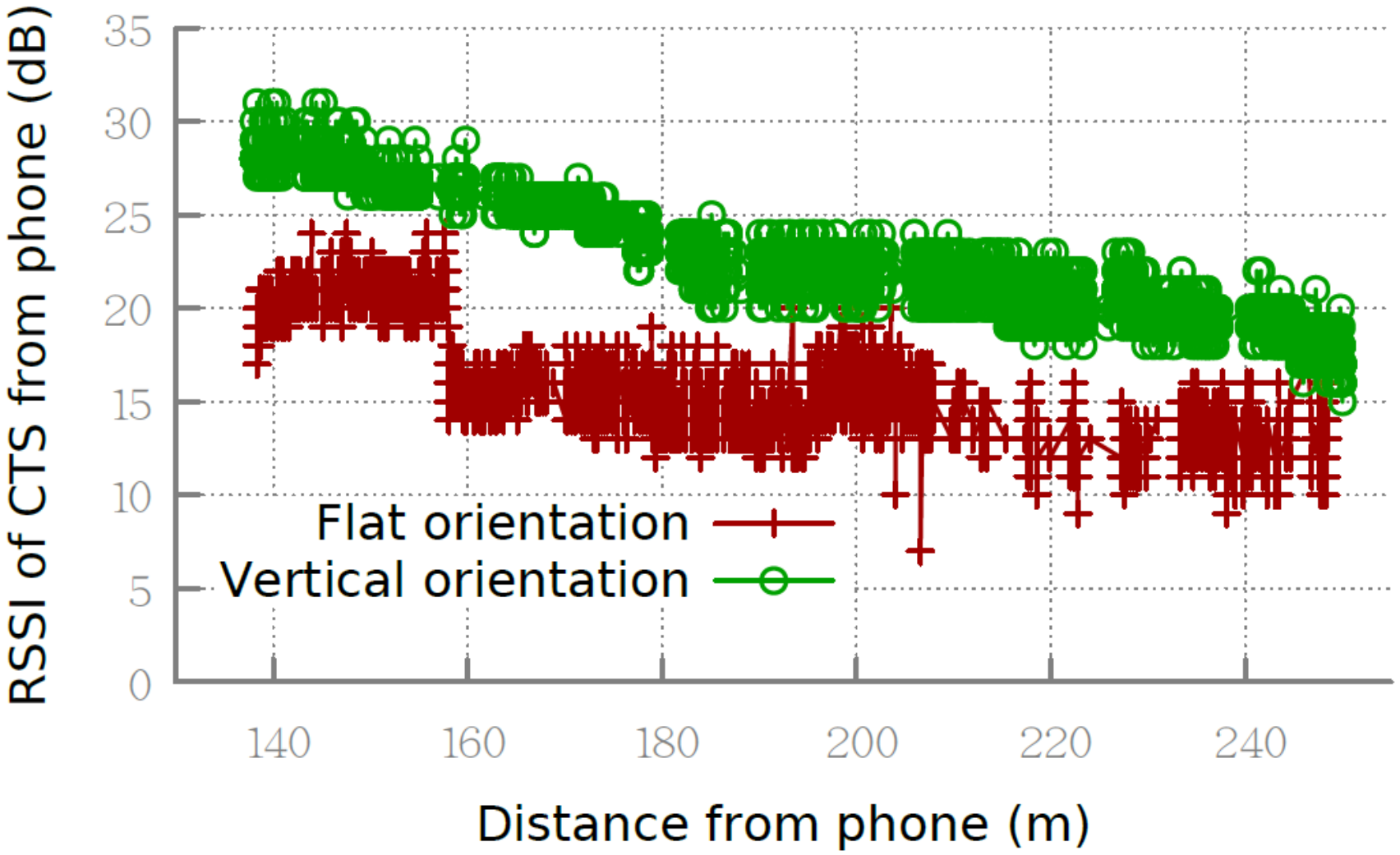
Detection Range



Effective Range



Effect of Phone Orientation

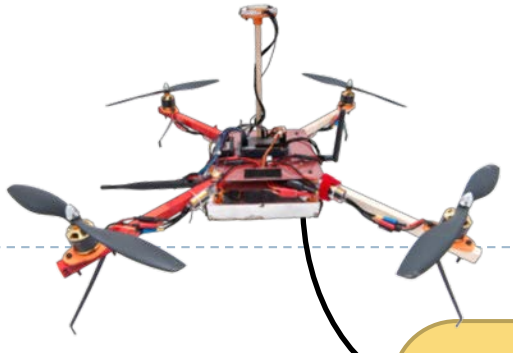


Conclusion

Phone WiFi signal

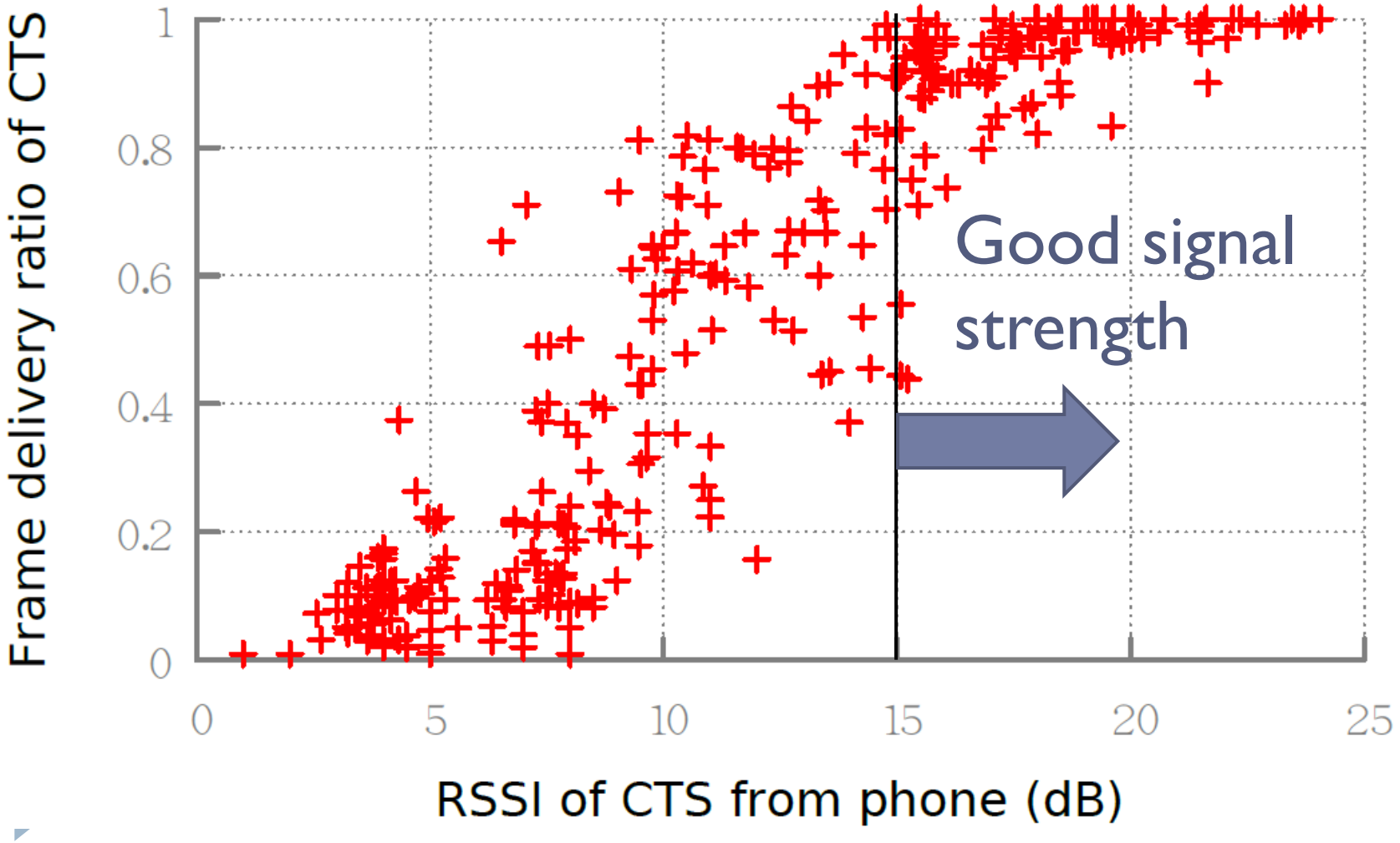
Battery life: 2 days

Range: 200 to 230 m

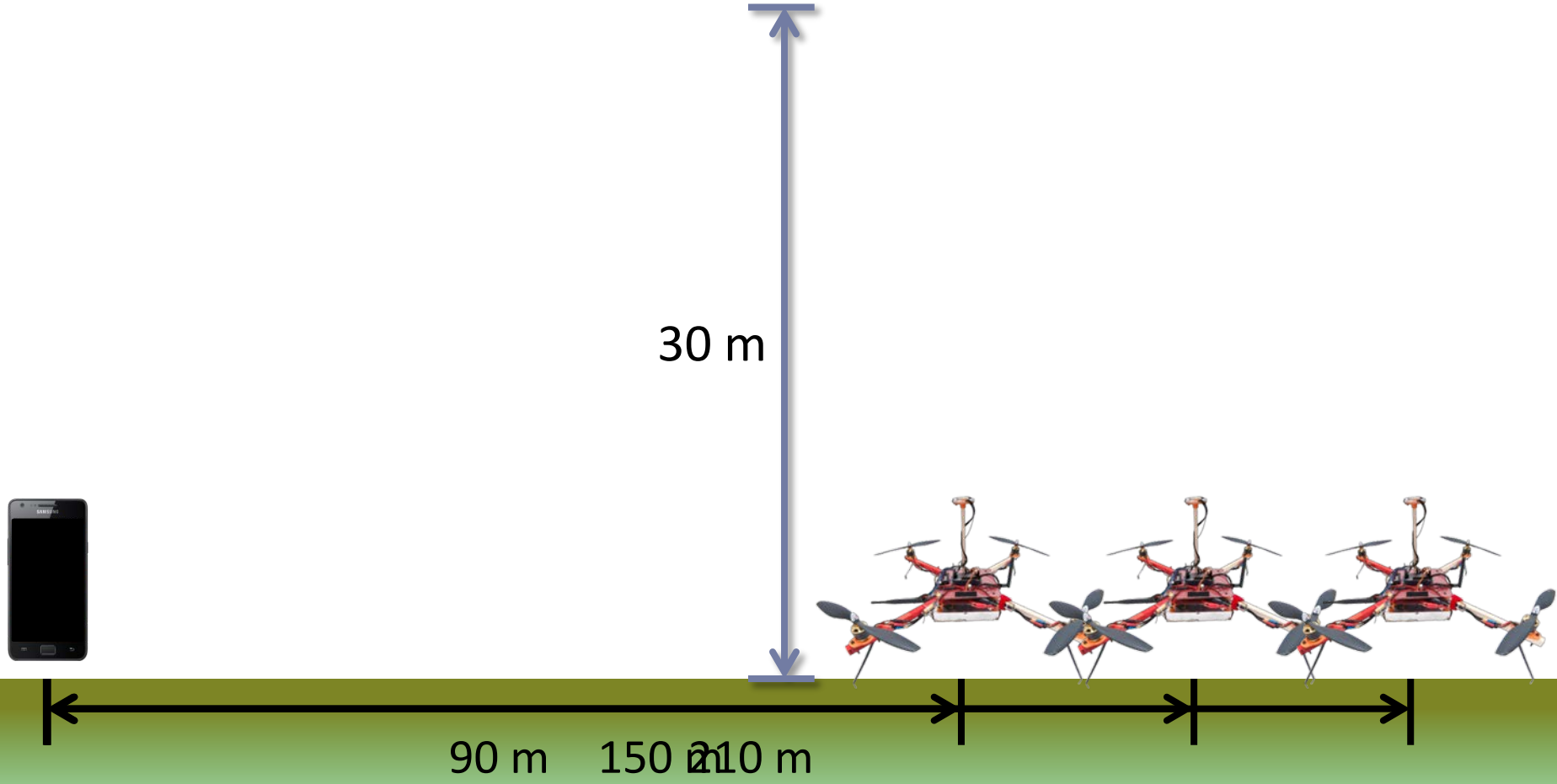


Backup Slides

RSSI Threshold



Effect of Altitude



Effect of Altitude