# StarNav - Geolocation using Stars

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Overview and Goals

- Provide the warfighter with a geolocation method that avoids detection by adversaries when systems like GPS are unavailable, which can happen via jamming.
- Determine the viability of a celestial navigation app that uses visual data of celestial objects to determine the user's world location.
- Avoid the use of wireless signals, which give away soldier positions.
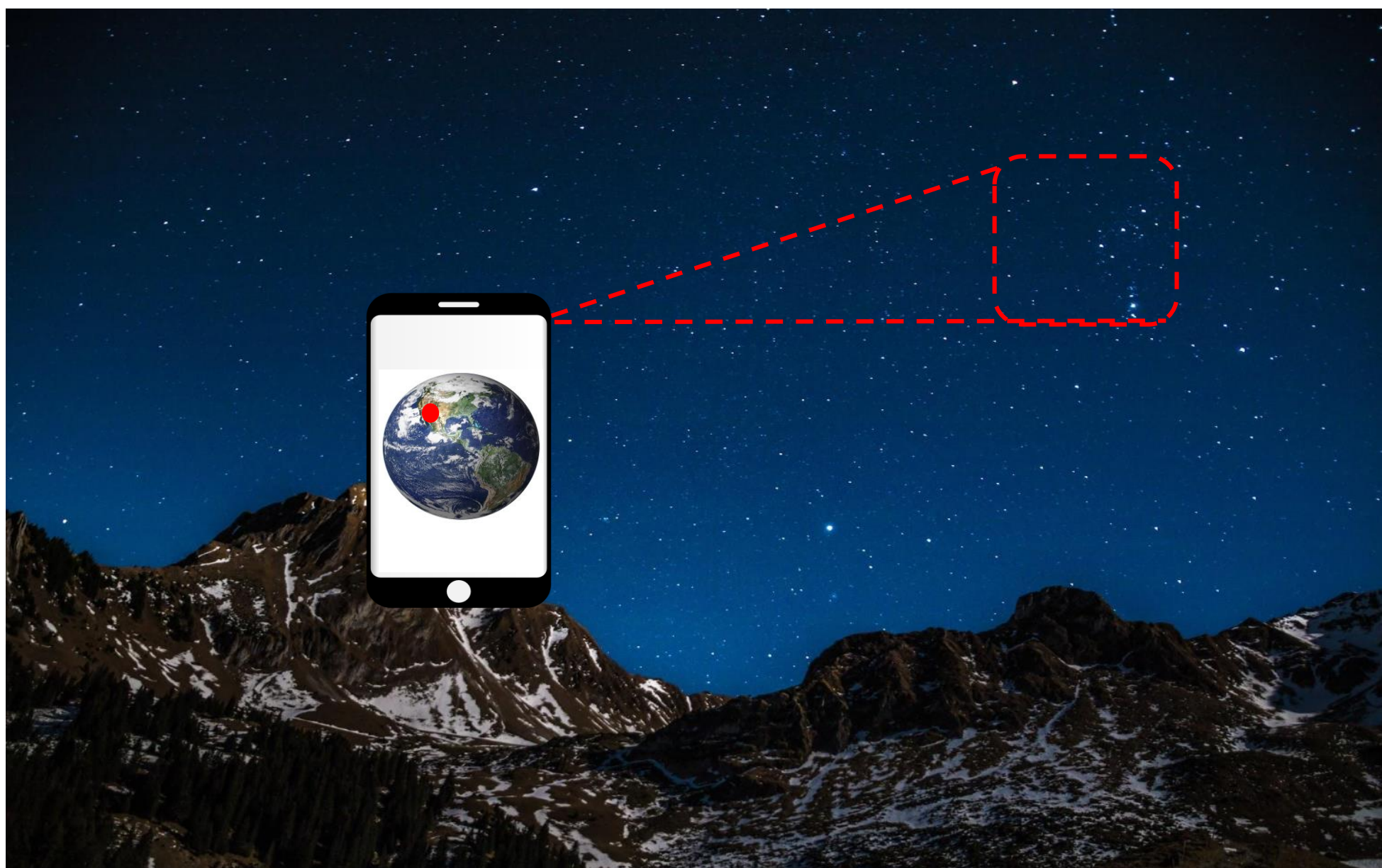
Project Requirements

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| M1: The system shall obtain global position information utilizing sky images and mobile phone orientation. |
| E1.2: The system shall use star image data to produce position data. |
| M6: The system should avoid methods that could disclose the user's position to adversaries. |
| E6.2: The system shall not use cellular data. |
| E6.4: All data used in simulations must be stored locally to avoid needing to reference any cloud databases. |
| M7: The system shall utilize a mobile device application. |
| E7.2: The system must run as an application on a Pixel 9 Pro mobile phone. |

System Design
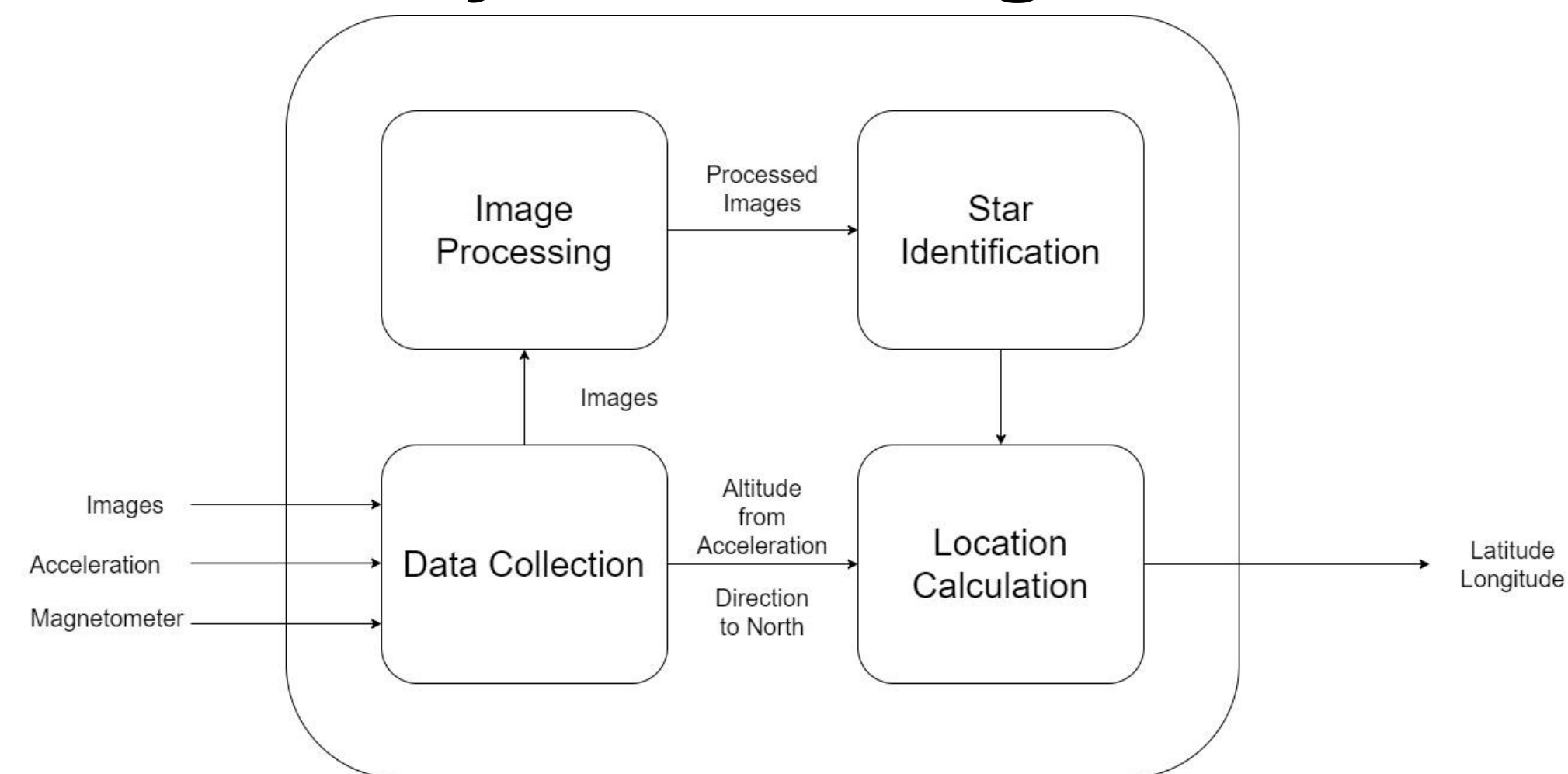
- An android phone will be used to take pictures of the stars and receive external sensor data (accelerometer, barometer, and magnetometer).
- The image will be processed, stars in the image will be identified, and celestial coordinates and sensor data will be combined to produce latitude and longitude.

Results

- Small measurement errors (<1°) cause major discrepancies as demonstrated by the data in the figure to the right.
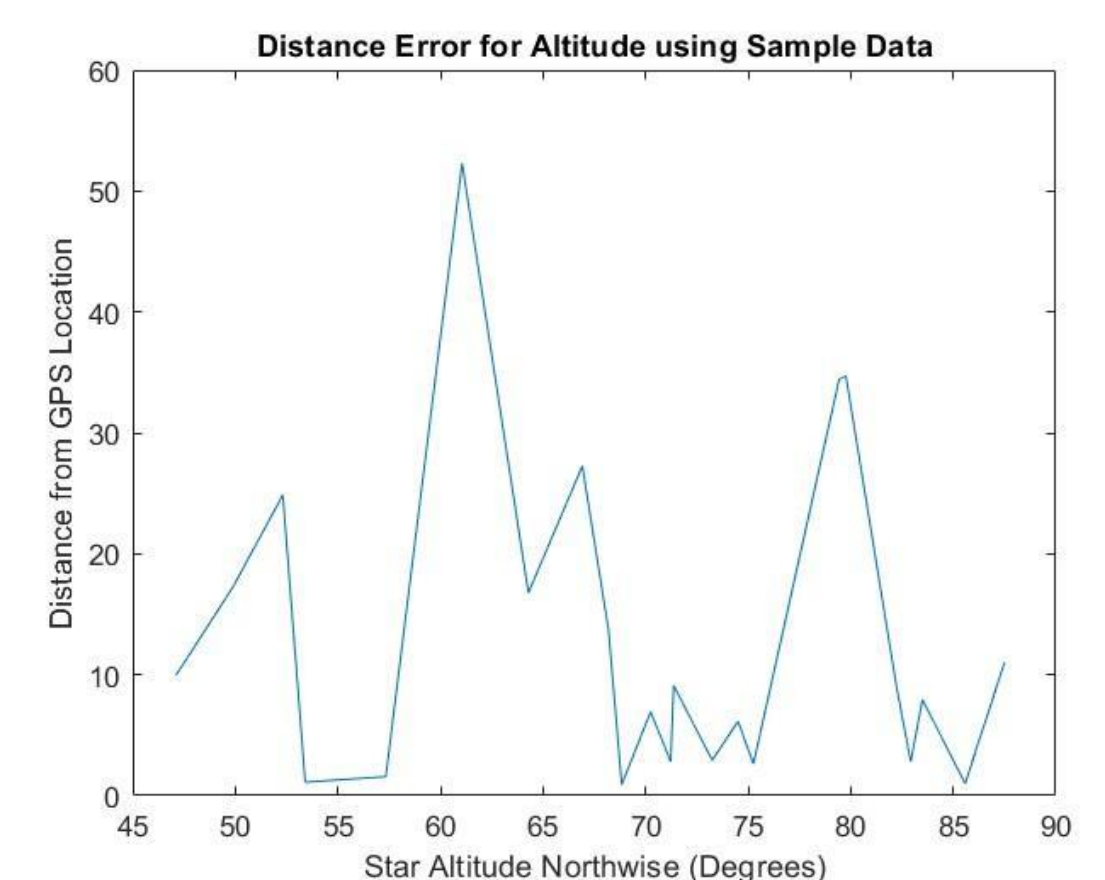
- The star identification algorithm, which utilizes the solve field method, enables StarNav to find the celestial coordinates of any position in the sky. This enables StarNav to use more points along the user's meridian for geolocation.

Conclusion

StarNav can offer a geolocation method that is wireless and discrete. It offers an alternative when GPS cannot be relied upon. By using celestial navigation techniques, it ensures secure and reliable positioning without revealing the user's location to adversaries.

Acknowledgements and References

Phone and Supporting Hardware: University of Alabama in Huntsville
Sample Data from: https://www.timeanddate.com/astronomy/night/
Star Identification Software from: https://astrometry.net