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Summary of *A Solution to Improve the Performance of Geofence Enabled GNSS Chipset*

There is an increasing amount of interest today in Global positioning systems (GPS), and a byproduct of this is the development of geofencing technology. Geofencing applications consist of four primary parts: determining the user's location, relaying their position about the geofence, identifying movements about the geofence, and reporting those movements. One of the critical components of this technology is the global navigation satellite system (GNSS). The GNSS determines the geographical location of the GNSS chipset within mobile or computer technology by sending a signal. This signal is delivered through two primary methods: the multipath channel and the direct Line-Of-Sight (LOS) method. In the former, the signal is sent and scattered by diffraction and bouncing off surrounding terrain. In the LOS method, there is a direct signal between the satellite and the GNSS chipset. One the various techniques to analyze the performance of a certain method of signal transportation is the Signal to Noise (SNR) technique, which determines signal strength through the SNR and Doppler components associated with these multipath and LOS techniques.

A research team from Bangalore aimed to address the current issue of the incorrect reporting of events by GNSS chipsets by developing a novel program. As it is shown in Figure 1, the program created by the research team obtains the location of the chipset during the initial setup. Following this, the application obtains the GPS coordinates of the GNSS chipset and calculates the distance from the GNSS chipset to the boundaries of the setup geofence. Based on the position relative to the geofence, the application computes the current status. If the current status is the same as the expected status, the current status is reported to the application. Otherwise, the program keeps on running until the status changes during which it will report the change in status. This program also can report multiple changes in status methodically by assigning a value to each of the events which occurred, and reporting them systematically.

The team in Bangalore then ran a performance evaluation on their application as elaborated on in Figure 2. The team, utilizing a smartphone containing the application and charged to 100%, created two geofences with radii of 100 meters and 200 meters. The team then created a table of possible events, illustrated in Figure 3, based on the combinations of the initial status and the current event to predict what the expected outcomes should be for their testing. They then booted up the application which started with a default status of "Unknown," as it had not gotten its position relative to the geofence at this point. As the individual testing the application travels through a pre-designated path of entering the geofence, exiting it, entering it once more, and finally exiting it, the application relays position relative to the fence as well as actions about the fence to the user. The time and the level of accuracy is noted each time.

The results display that the new implementation technique for geofencing is far more accurate in terms of reporting events and reporting events at the correct time. This research has a high level of importance for a multitude of reasons including addressing the issues within the previous system, studying the supporting technology associated with geofencing techniques, and evaluating the accuracy of the current geofencing system in use. Furthermore, this system can be adapted to the entire field of geofencing in the future in contrast to currently just being meant for circular geofences.

Works Cited

Fattepur, M. B., S, S. G., & Huttangoudar, J. B. (2016, June 16). A Solution to Improve the Performance of Geofence Enabled GNSS Chipset. Retrieved September 18, 2017, from http://ieeexplore.ieee.org.ezproxy.wpi.edu/stamp/stamp.jsp?arnumber=7779405

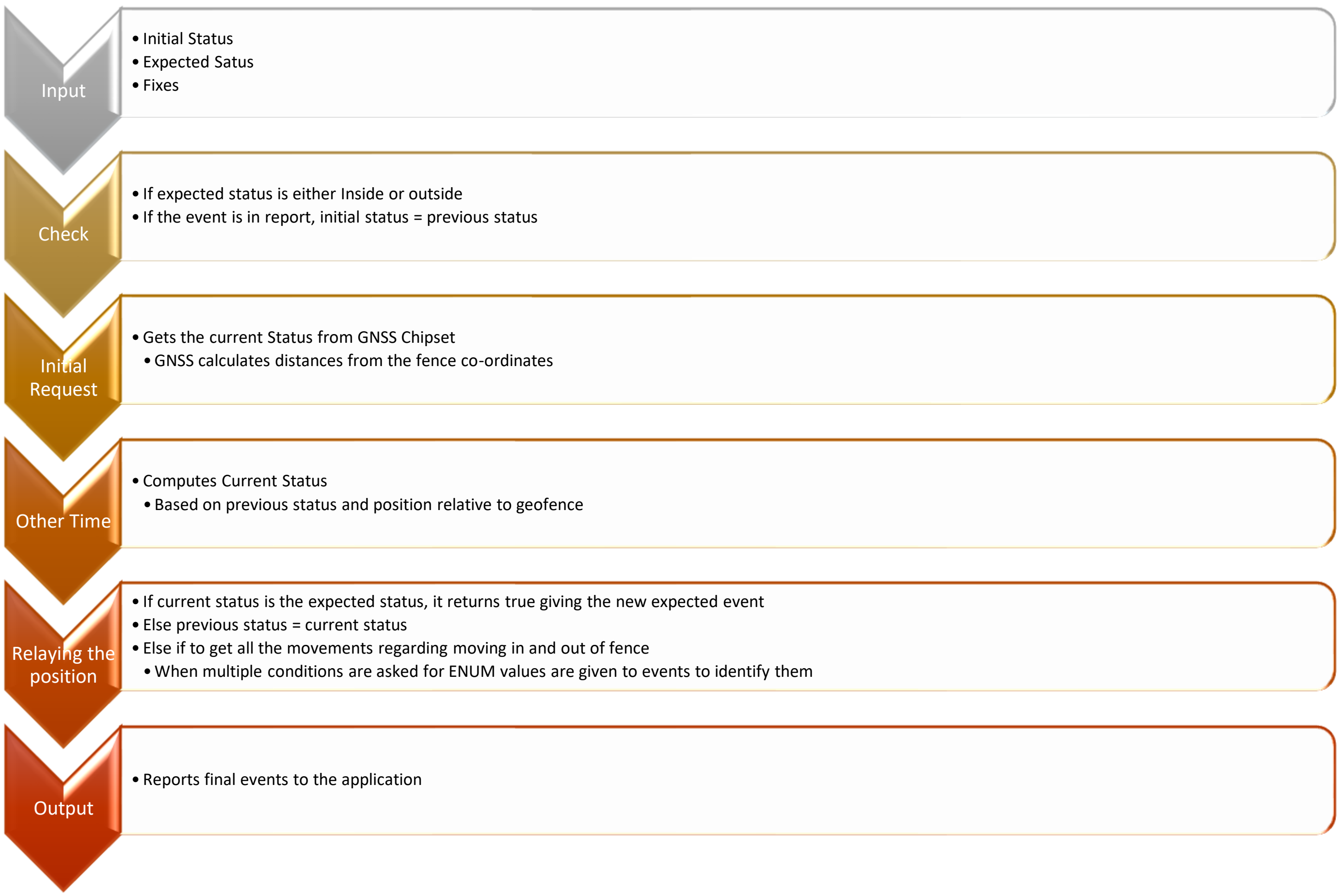

Figure 1: Path of Program

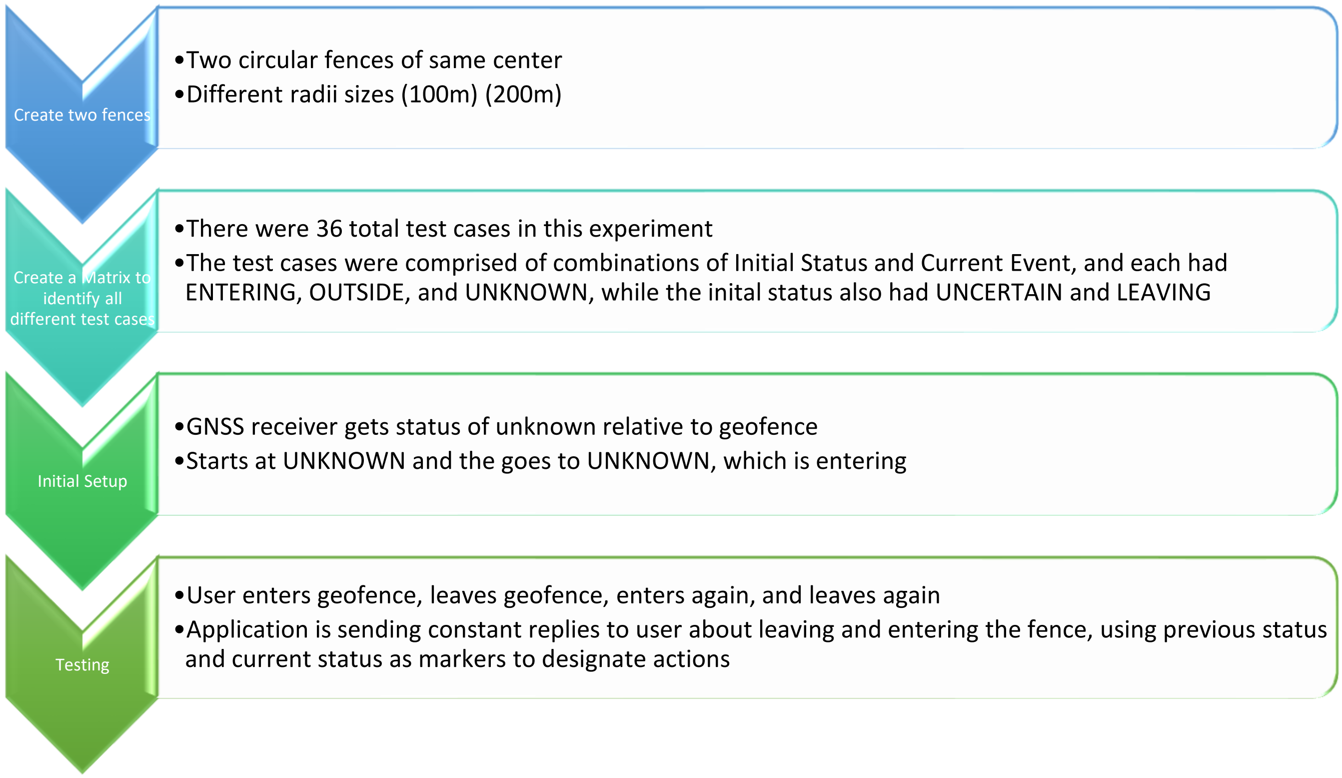

Figure 2: Method of Testing

Current Event	**Entering**	**Unknown**	**Outside**
Initial Status			
Entering	**Entering**	**Unknown**	**Leaving**
Unknown	**Entering**	**Unknown**	**Leaving**
Outside	**Entering**	**Entering**	**Outside**
Leaving	**Entering**	**Unknown**	**Outside**
Uncertain	**Entering**	**Unknown**	**Outside**
Unknown	**Entering**	**Entering**	**Outside**

Figure 3: Matrix of Possible Events

Abbreviations	
Abbreviation	Actual Meaning
GNSS	Global Navigation Satellite System
SNR	Signal to Noise Radio
LOS	Line-Of-Sight
GPS	Global Positioning System