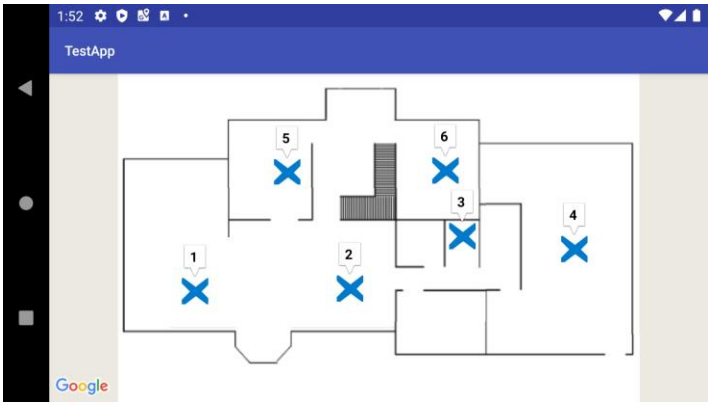
Results

Six locations were used to test the precision and accuracy of the application as more Access Points become available. The initial control test was with 1 Google Wifi Router and 2 additional points, as this was the minimum setup to cover the testing area, which was 4100 sqft. For each test, one additional point was added in areas to maximize the usefulness the point would provide for testing.



(Fig. 1) The location of the markers used for testing.

For this experiment, six points were used in each trial in order to compare the accuracy and precision gained or lost from each additional router. The markers were labeled from 1-6, as shown in Figure 1. The marker locations would remain constant, which would allow a much better comparison between the trials, as the phone would always be placed on top of the same markers.

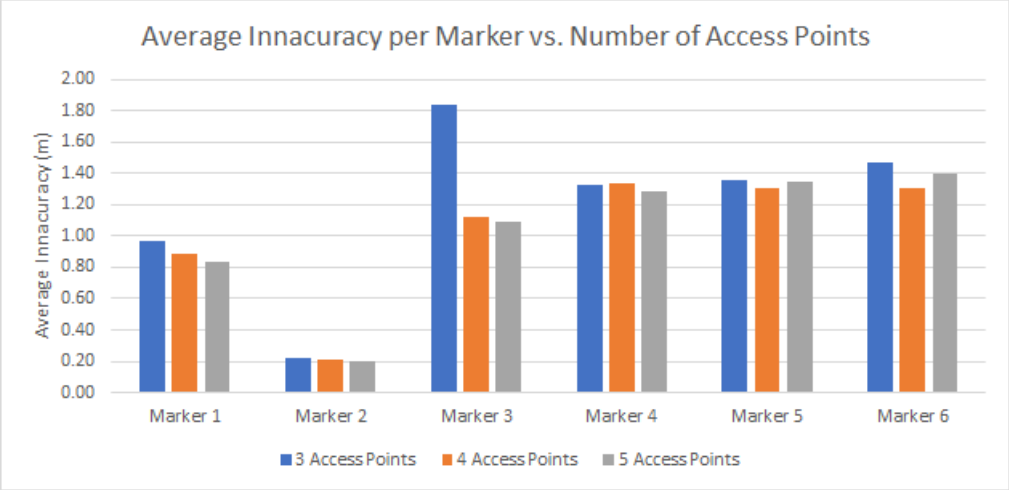
Results

	Average Inaccuracy	Accuracy Difference	%RSD
Access Points:	(m)	(%)	of Davg
3 (1 Router 2 Points)	1.228	N/A	8.796
4 (1 Router 3 Points)	1.028	16.744	5.223
5 (1 Router 4 Points)	1.025	0.266	4.331

(Table 1) The number of access points compared to the average distance off from theoretical and the accuracy difference between adding an additional access point.

From Table 1, there is a major increase in accuracy between 1 Router and 2 Points to 1 Router and 3 Points, with is being around a 17% increase in accuracy, while a minor increase in accuracy between 1 Router and 3 Points to 1 Router and 4 Points, with only around a 0.3% increase in the accuracy of the location. This shows that the addition of the first router is a significant increase in the accuracy, while the addition of any more routers does not improve the accuracy significantly.

Also from Table 1, the Relative Standard Deviation (%RSD) shows that the addition of points did increase the precision of the points. The use of 3 access points gives the user a moderate to low accuracy as it had a %RSD of around 9%, while additional routers give a moderate to high accuracy of 5% with 4 access points and 4% with 5 access points.



(Fig. 2) The average accuracy of each marker compared to the number of access points

Figure 2 displays the change in accuracy that occurred for each individual marker. Markers 2 and 4 stayed relatively the same, as they were markers that were close to access points. Notably, Marker 2 consistently had the least inaccuracy, possibly due to it being close to the main router. Marker 1 shows an increase in accuracy from the addition of extra routers, while

5 and 6 show minimal increases in accuracy. Marker 3 displays the greatest increase in accuracy. This was most likely because Marker 3 was in a room with thick, concrete walls, and the addition of a router inside the room made the application more accurate.