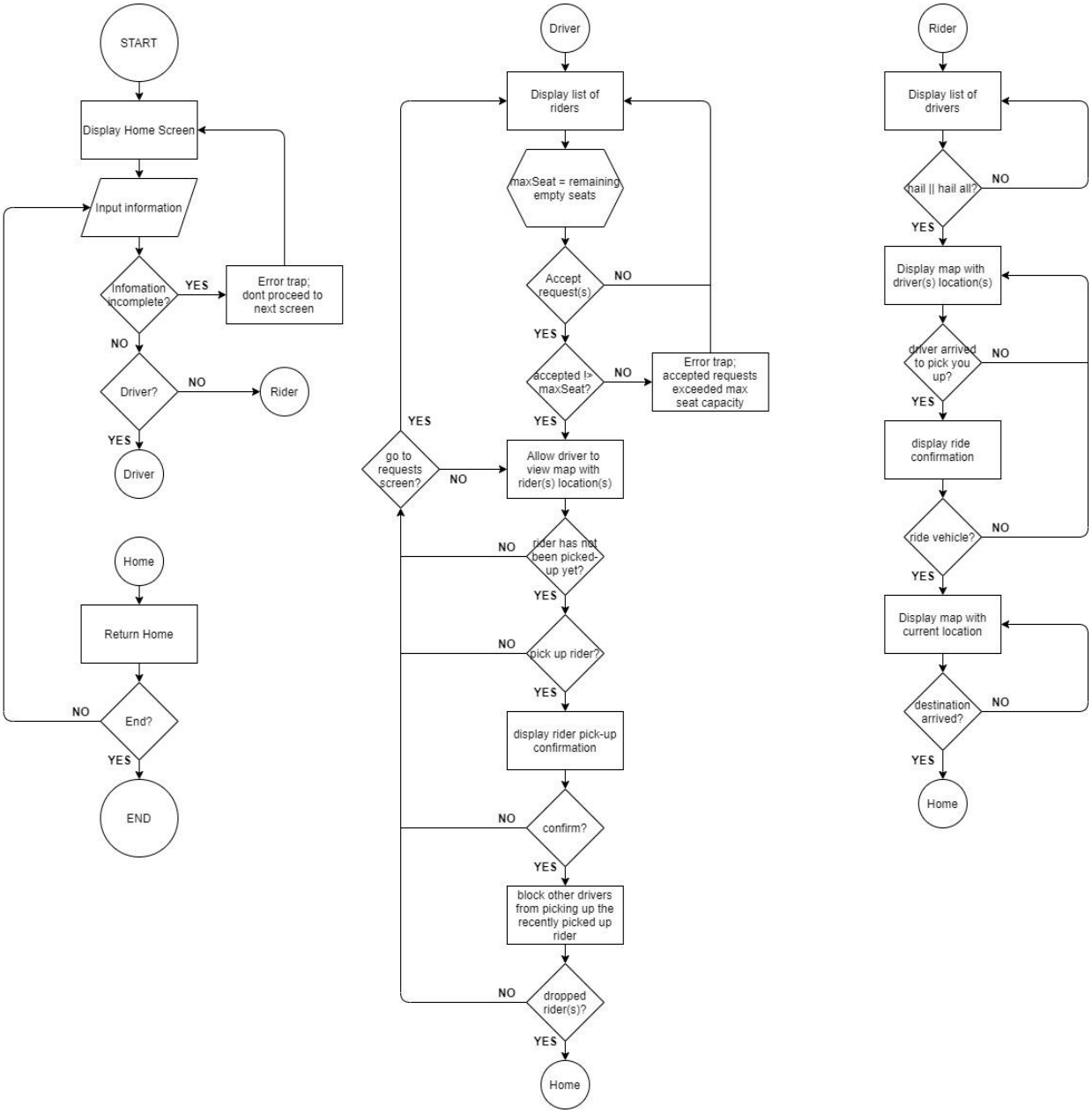
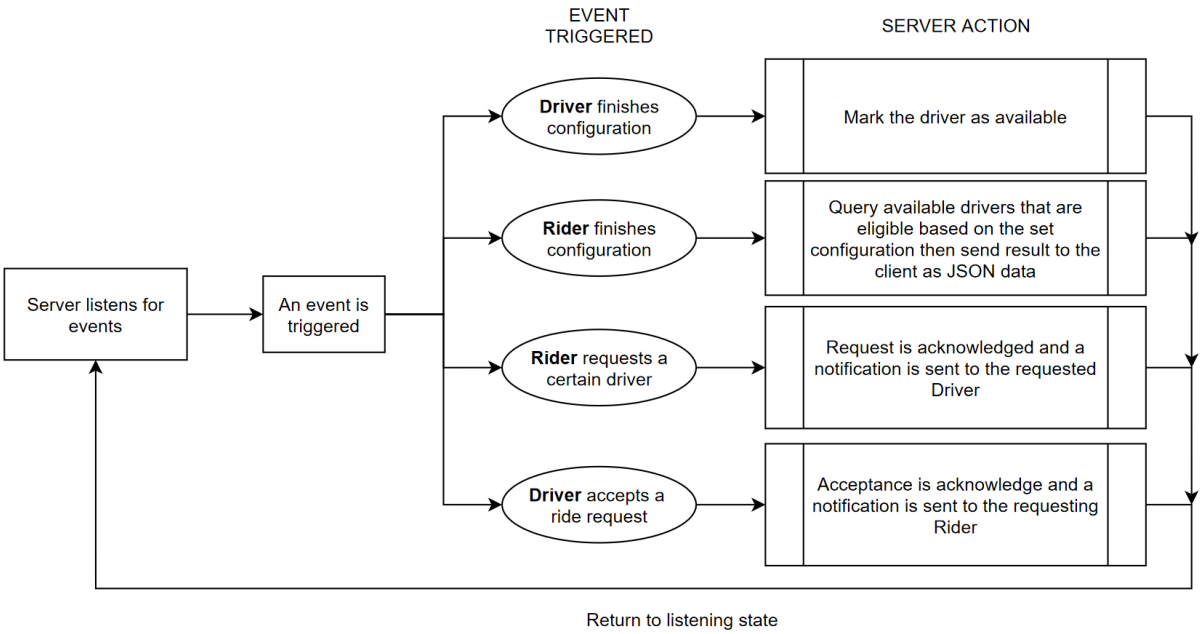
Appendix 1: General UI Flow



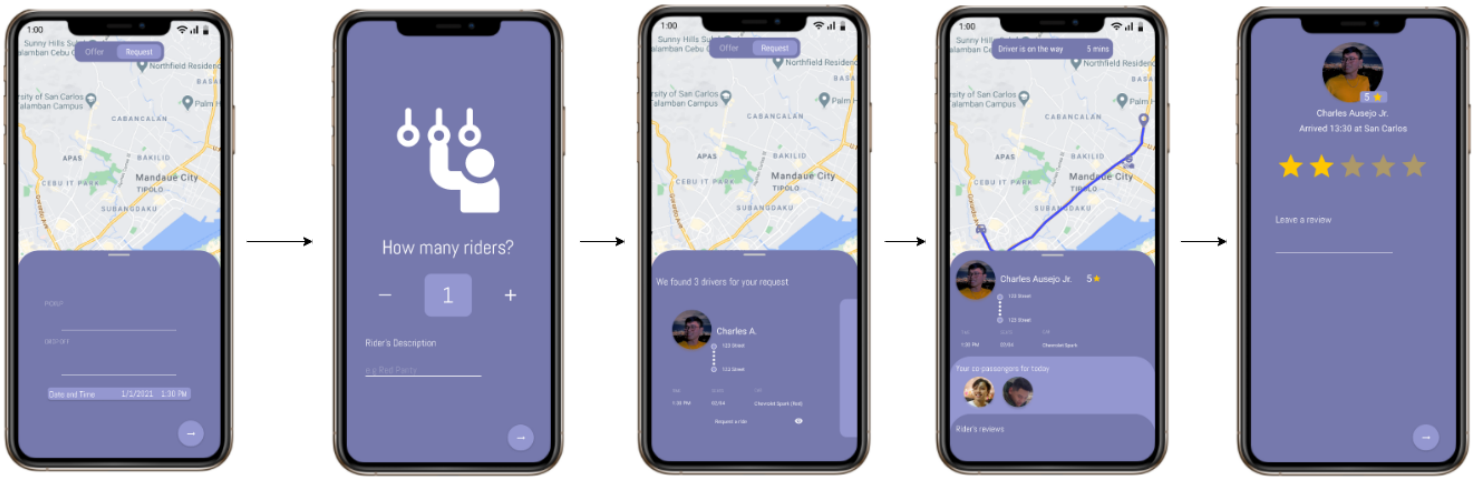
Appendix 2: Server Events and Actions



When an event is triggered, a corresponding server action is run by the server app as shown above. After that, the server app returns to its listening state, ready for the next event. In most cases, the server action will involve modifying and controlling the real-time database, Firestore.

Appendix 3: Mock-up GUIs

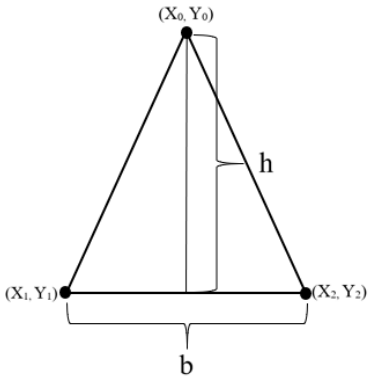
GUI for Riders



GUI for Drivers

Appendix 4: Derivation of Eq. (3)

Given a triangle of the form:



Area of a triangle using Coordinate Geometry

$$A = \frac{1}{2} \left| \det \begin{pmatrix} X_0 & X_1 & X_2 \\ X_0 & X_1 & X_2 \\ 1 & 1 & 1 \end{pmatrix} \right|$$

$$A = \frac{1}{2} \left| X_0Y_1 - X_1Y_2 + X_1Y_2 - X_1Y_0 + X_2Y_0 - X_2Y_1 \right|$$

$$A = \frac{1}{2} \left| (X_0 - X_2)(Y_1 - Y_0) - (X_0 - X_1)(Y_2 - Y_0) \right|$$

Solving for base b

$$b = distance\ ((X_1, Y_1), (X_2, Y_2))$$

$$b = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2}$$

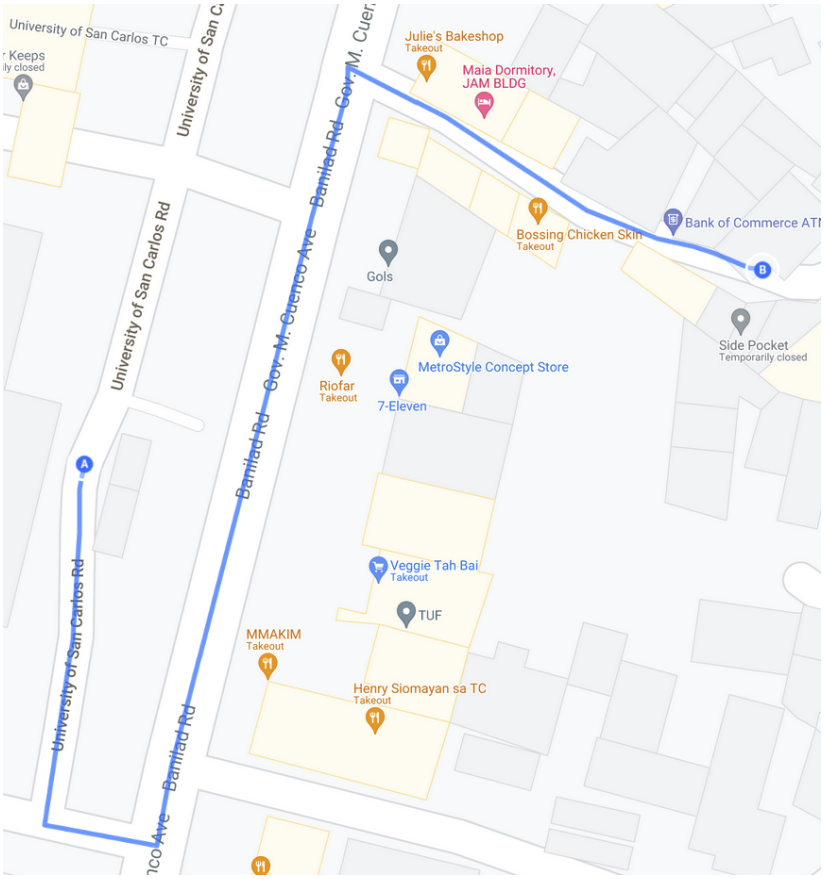
Putting it all together

$$A = \frac{1}{2} bh$$

$$h = \frac{2A}{b}$$

$$h = \frac{|(X_0 - X_2)(Y_1 - Y_0) - (X_0 - X_1)(Y_2 - Y_0)|}{\sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2}}$$

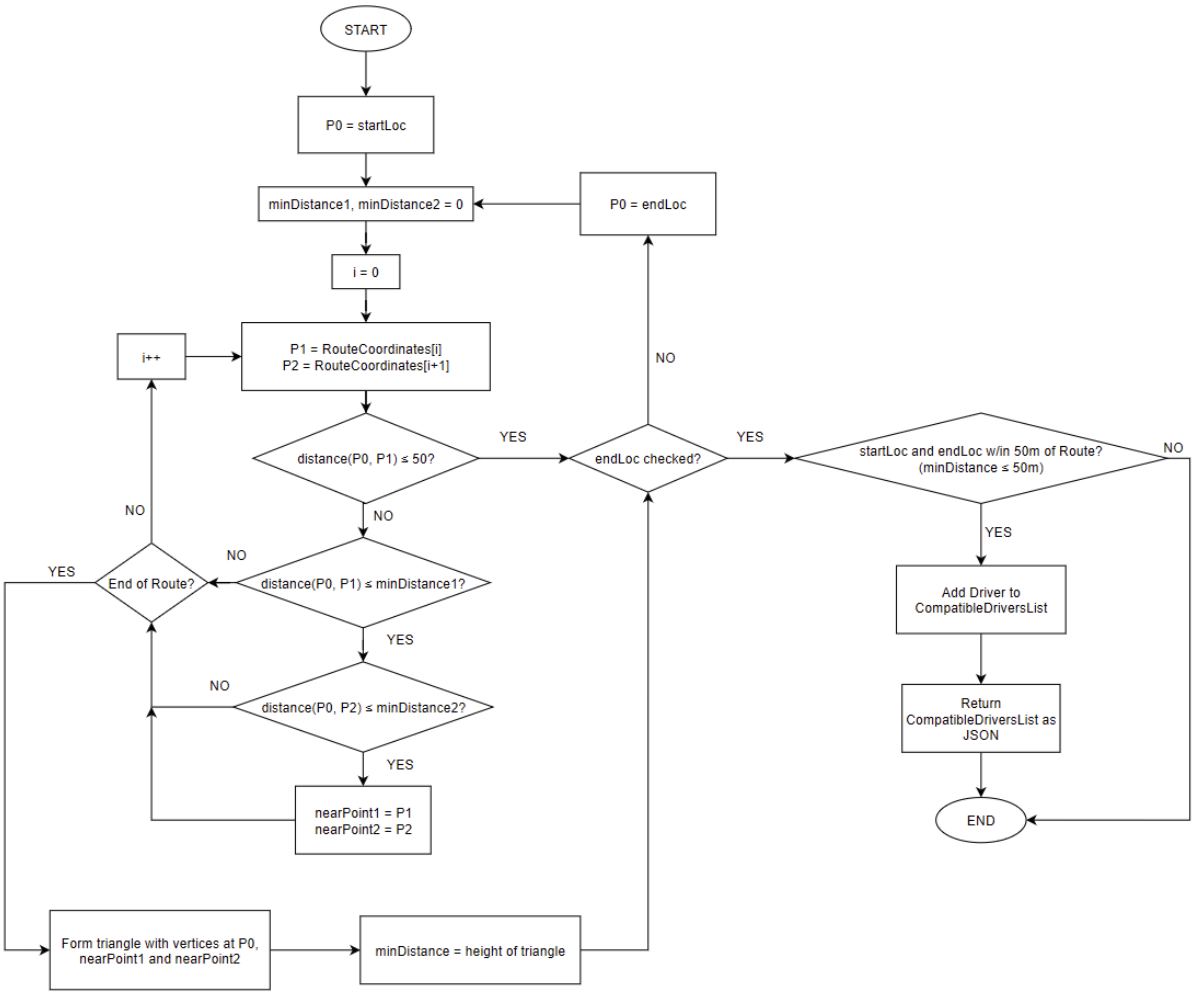
Appendix 5: Real-world route example (USC to Side Pocket)



Ordered list of coordinates for this route:

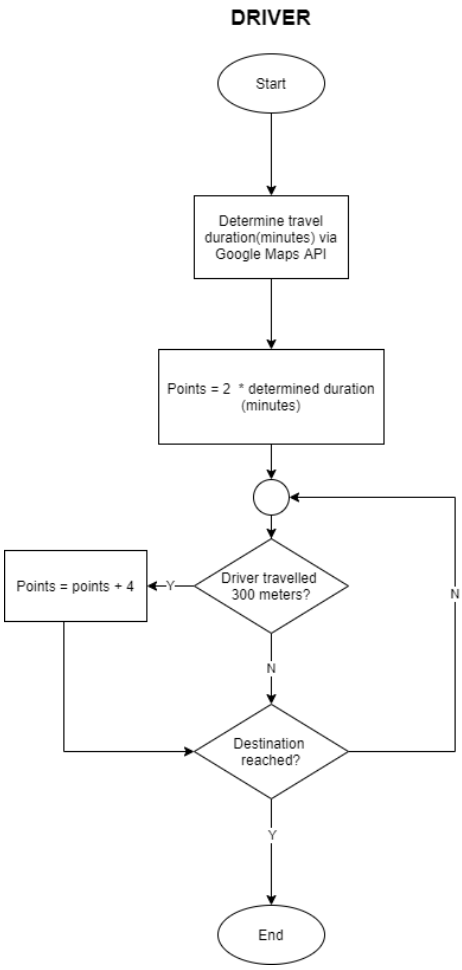
123.91364,10.352 (A: USC)
123.91363,10.35197,
123.91363,10.35191,
123.91362,10.35176,
123.9136,10.35163,
123.91358,10.3515,
123.91374,10.35147,
123.91376,10.35158,
123.91396,10.35235,
123.91401,10.35253,
123.91401,10.35254,
123.91401,10.35256,
123.91415,10.35249,
123.91435,10.35236,
123.91445,10.35232,
123.9145,10.35231,
123.91453,10.3523,
123.91458,10.35228,
123.9146,10.35228 (B: Side Pocket)

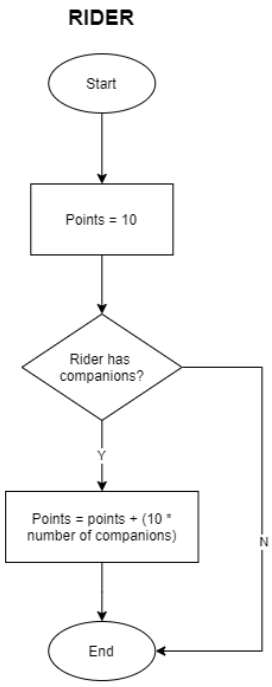
Appendix 6: Driver-Pairing Algorithm Flowchart



The algorithm above describes the function that the server app runs for **a single Driver**. One of the very powerful features of Firestore (Firebase database) is that it queries in parallel. Therefore, the function above is run on all currently available Drivers in the database at the same time.

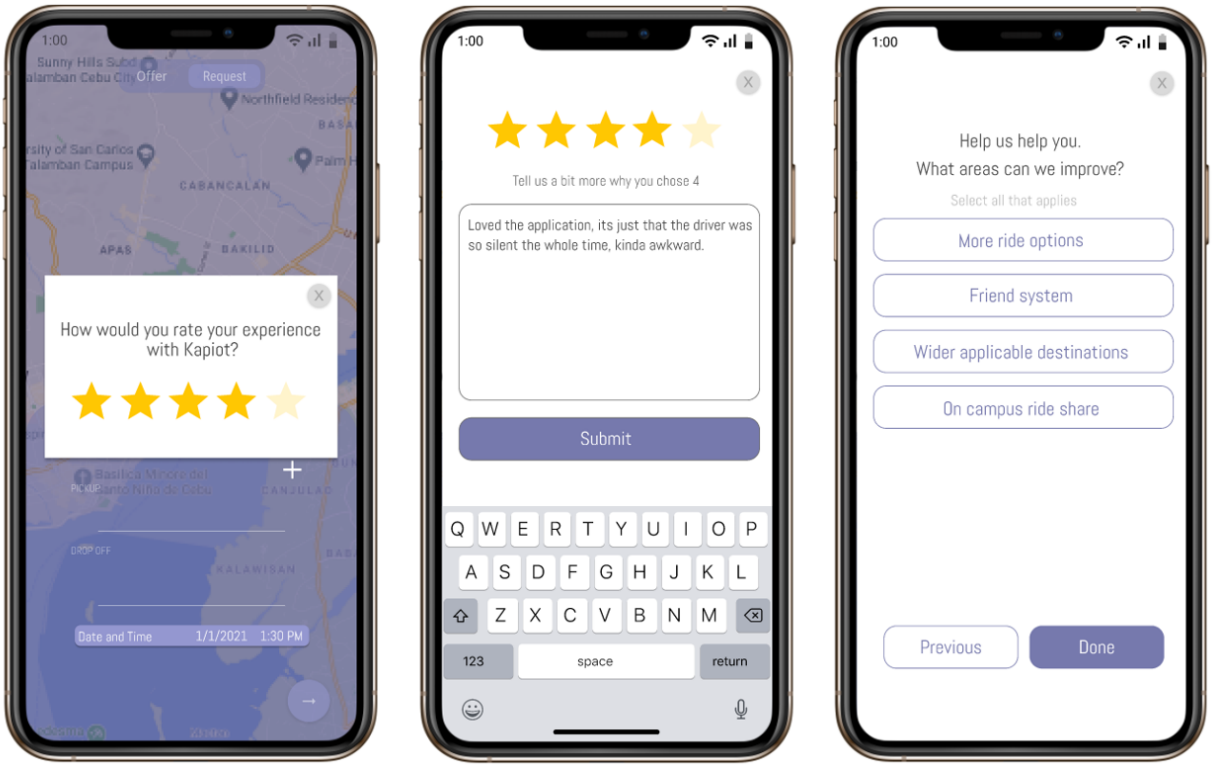
Appendix 7: Point System Flowchart





Appendix 8: Mock In-App Feedback System

GUI for Mobile Application Survey



2.0