ITSIS Concept Design Paper

1. Communication Approaches

Scenario 1: Acquiring Transit Service Information (TSI)

Information Carrier	Transit Bus	Passing Intersections	Backhaul	Passenger Service Server	Transit Dispatch Center
Location	Moving	El Camino Real		PATH	VTA
Hardware(s)	DSRC OBE	DSRC RSU	3G Cell Network	Server	Server
	ARADA	SAVARI			
Content of Info.	Bus ID; location (facility availability ?)				
Comm. mode	Broadcasting				
Content of Info.		Bus ID; location			"Real Time Map" Bus Info; ETA
Comm. mode		Event triggered pushing			Fix-time pushing? On request?
Content of Info.				(A number of Next?) Bus Info. and Arrival Prediction	`
Comm. mode				Fixed-time pushing to registered intersections	
Information Carrier	Bus Stop	Registered Intersection(s)			
Content of Info.		Approaching Bus Info. and ETA			
Comm. mode		Fix-time pushing			
Content of Info.	Approaching Bus Info. and ETA				
Comm. mode	HMI output				

Scenario 2: Acquiring Transit Trip Information (TTI)

Information Carrier	Passenger	Bus Stop	Nearby Intersection	Passenger Service Server	Transit Disp. Center
Location	Arriving bus stop	ECR Downstream of Palo Alto	El Camino Real	PATH	VTA
Hardware(s)	Station Inter. Hub;	DSRC RSU	DSRC RSU	Server	Server
Device Type or Manfct.	Touch Screen	SAVARI	SAVARI		
Content of Info.	Trip Destination				
Comm. Mode	HMI input 1: select a down-stream stop	HMI input 2: touch a point on map			
Content of Info.	Local feedback	From & To in Geo-coordinate			
Comm. Mode	HMI output: …	Event triggered pushing			
Content of Info.			From & To in Geo-coordinate		
Comm. Mode			Event triggered pushing		On request?
Content of Info.				Candidate route(s) and transfer station; ETA and PTA at transfer stations; Real time connection info. (*)	
Implementation Scheme				Trip planning engine options • Integrated with IDTO; • Request to VTA server	
Content of Info.			(*)		
Comm. Mode			Event triggered		
Content of Info.		(*)			
Comm. Mode		Event triggered			
Content of Info.	(*)				
Comm. Mode	HMI output …				

Scenario 3: On-Demand Transit Station Operation (ODO)

Information Carrier	Passenger	Bus Stop	Nearby Intersection	Passenger Service Server	Transit Dispatch Center
Location	Arriving bus stop	ECR Downstream of Palo Alto	El Camino Real	PATH	VTA
Hardware(s)	Station Inter. Hub;	DSRC RSU	DSRC RSU	Server	Server
Device Type or Manfct.	Touch Screen	SAVARI	SAVARI		
Content of Info.	Waiting call				
Comm. Mode	HMI input: Select a route				
Content of Info.		Waiting call			
Comm. Mode		Event triggered pushing			
Content of Info.			Waiting call		
Comm. Mode			Event triggered pushing		
Content of Info.				Waiting call for the bus approaching this stop (**)	
Comm. Mode				Event triggered pushing	
Information Carrier		Bus(es) "in Range" †	Intersection "in Range" †		
Content of Info.			(**)		Archiving
Comm. Mode			Event triggered		Receiving
Content of Info.		(**)			
Comm. Mode		Event triggered			

† Which intersection(s) and bus(es) are assigned to receive the instantaneous waiting call will be calculated based on the locations of on-road buses and their geometry relation with the bus stop sending the call and all the DSRC equipped intersections.

2. ITSIS User Interface Design

2.1 Information Needs

Scenario 1 – Acquiring Transit Service Information (TSI)

(a) Passengers use the Station Interactive Hub (SIH) to inquire information below — Info Index

- Regular Route
  - route maps — TS-RR1
  - schedules — TS-RR2
- Connecting Route
  - transfer lines and their route maps at each downstream stop — TS-CR1
  - walking distance between two connected stops/stations — TS-CR2
  - transfer route schedules if available — TS-CR3
- Arriving Bus(es) (1~3)
  - the route (e.g. line 22 or 522) — TS-AB1
  - transit vehicle's ID (bus # -- this may not be necessary for passengers) — TS-AB2
  - ETA (estimated time of arrival) at the current station (mm:ss) — TS-AB3
  - ETAs at all downstream stations — TS-AB4
  - bike rack availability (to be investigated) — TS-AB5

(b) When approaching a station, the mobile device carried by a passenger inquires will display same information as in (a)

Scenario 2 – Acquiring Transit Trip Information (TTI)

The acquiring information under this scenario can be summarized into three categories, which will be indexed respectively:

i) The same as Transit Service Information; (TS-xxx)
ii) A part of TS information specified by a planned trip; (TS-xxx-T)
iii) Real time information not included in TS. (TT-xxx)

(a) Under this scenario, passengers provide their destination by either selecting a transit station/stop using the interactive interface or inputting an address within Bay Area (pointing at Google Map). The trip itinerary is returned and presented together with the info below.

- Arriving Bus
    - the route — TS-AB1
    - transit vehicle's ID (bus # -- this may not be necessary for passengers) — TS-AB2
    - ETA (estimated time of arrival) at the current station (mm:ss) — TS-AB3
    - ETA at a destination or transfer station — TS-AB4-T
    - bike rack availability (to be investigated) — TS-AB5
- Connecting Bus (if requested)
    - The transfer station name (e.g., Pagemill) — TS-CR1-T
    - The route (e.g. bus 101) — TS-CR1-T
    - Walking distance between transfer stations/stops — TS-CR2-T
    - transit vehicle's ID (bus # this may not be necessary for passengers) — TT-CB2
    - ETA at the transfer station — TT-CB3
    - Estimated arrival time at the final destination station/stop. — TT-CB4

(b) Using the mobile app, passengers are provided trip information similar to scenario 2(a), with additional information about the trip segment between the origin to the first transit station.

Scenario 3: On-Demand Transit Station Operation (ODO)

Scenario 3 aims to enhance transit operations by providing bus operators with real-time 'passenger waiting' information.

(a) Passenger request transit service using SIH
- Requesting feature: 'I'm waiting for route X' button on the interactive interface (after Scenario 1) or by confirming a planned trip (after Scenario 2) — OD-WC
- On bus display will show 'passengers waiting at Y stop' — OD-WD
- SIH displays the waiting call response and the pickup bus information (by highlighting among the arriving buses in Scenario 1 or 2) — OD-WR, TS-AB1~5

(b) Request transit service through a mobile phone. Passenger made and confirmed a trip plan before arriving the bus stop, the trip information is kept in the app. When approaching a station (judged by GPS location), the carried mobile device automatically communicates 'passengers waiting' and destination information through (the OBEs) to transit vehicles and presented to the bus operator via an on-board driver vehicle interface (DVI).

2.2 User Interface Design Requirements

1) Objectives:
   a) To demonstrate DSRC and other communication means can enable ITSIS functions
   b) To evaluate how ITSIS information is useful for transit travelers

2) Assumptions
   a) Scope of the testing system:
      i) The test system only include VTA route 522 and route 22 and the VTA routes that connect with route 522 and route 2.
      ii) Similar to rail system, the destination selection only include the stations destinations.
   b) Interface requirements
      i) Legible by people who have visual capabilities (currently not designed for full ADA compliance)
      ii) The display shall work under outdoor environment
      iii) Information seeking by passengers should not require more than 15 seconds per action

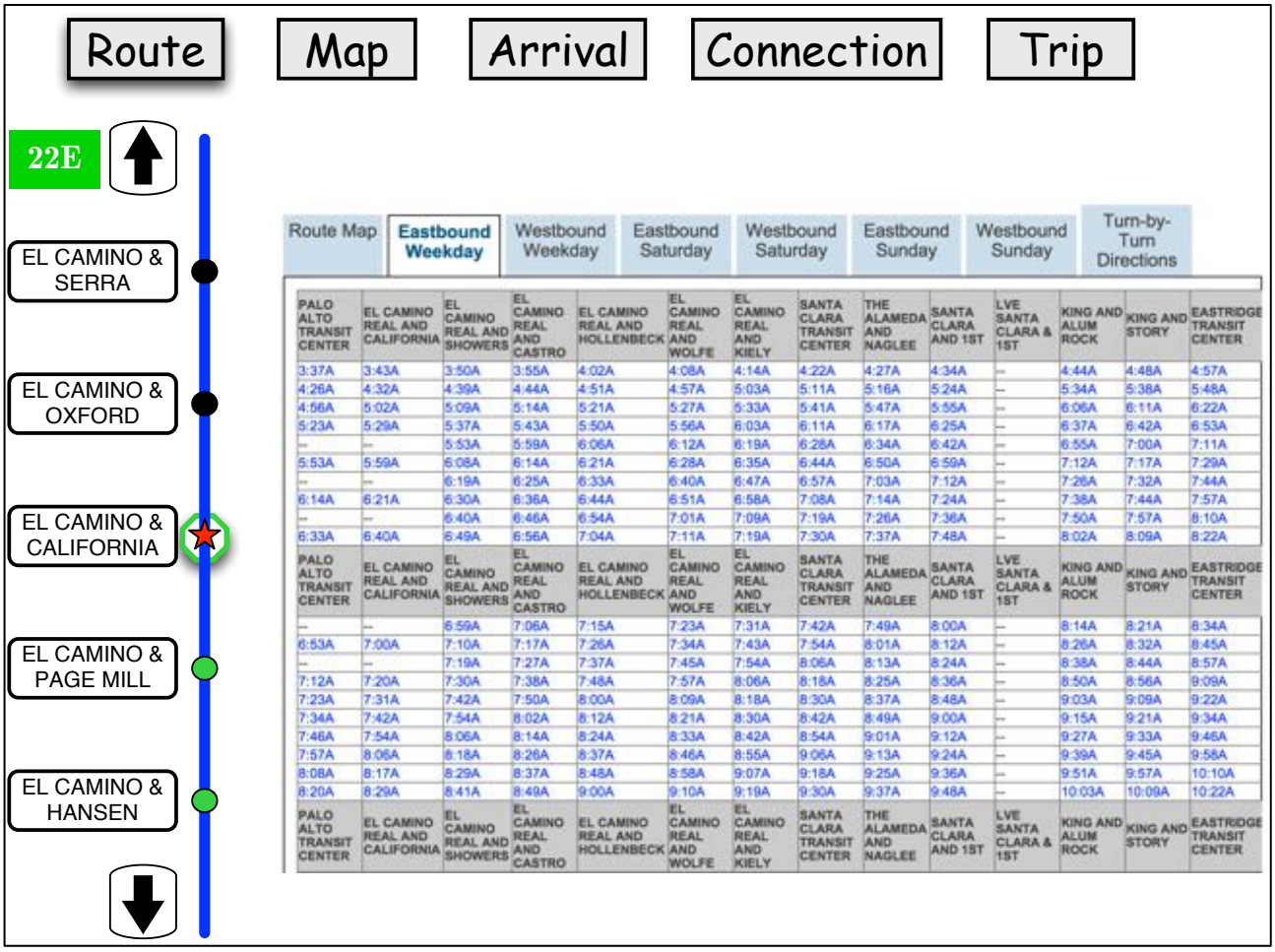
3) Designs
   a) Information seeking shall only involve selection using buttons or icons, should not require inputting letters for search
   b) May include a Google map for general information seeking purpose.

2.3 User Interface Design

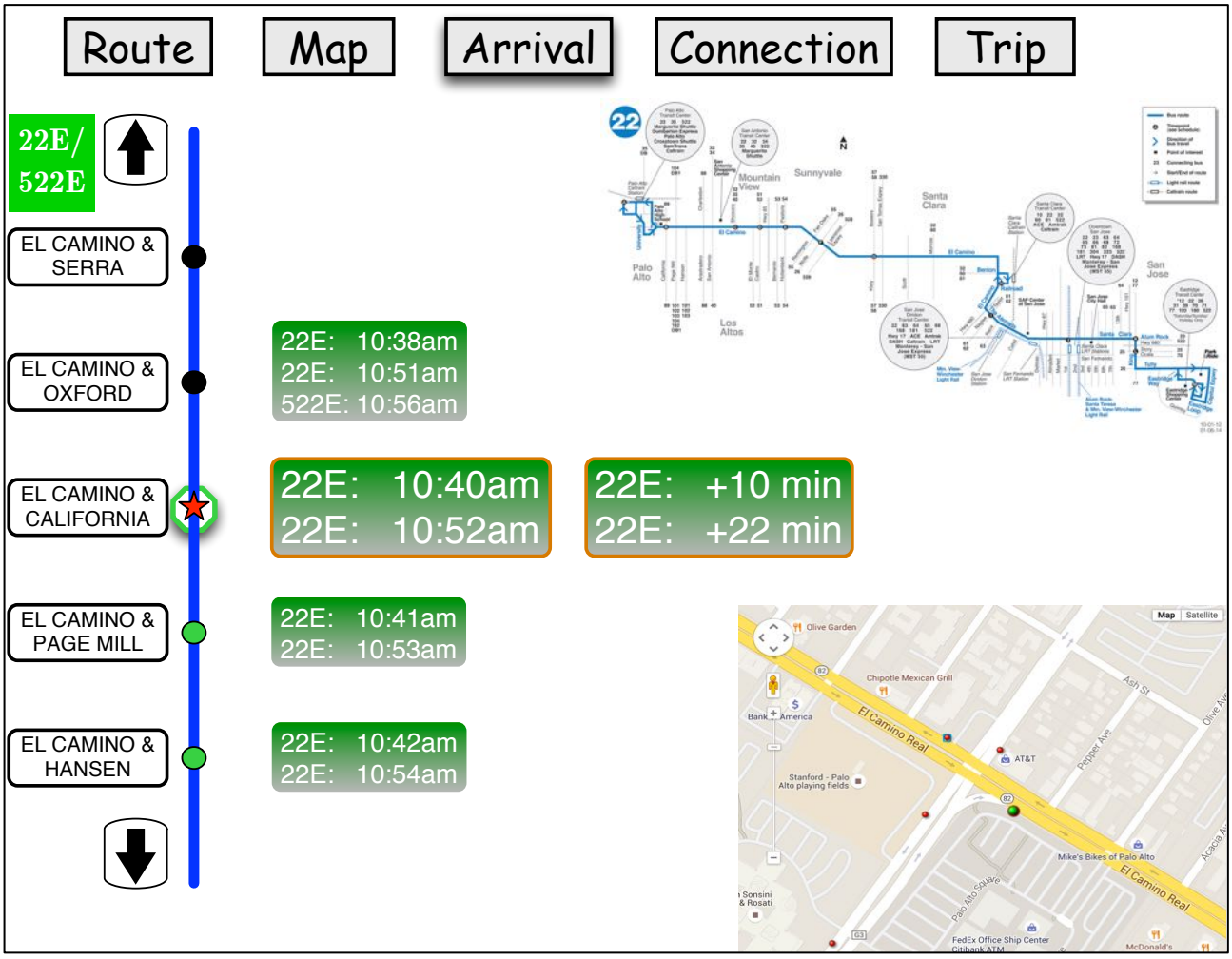
This preliminary design illuminates how a passenger accesses the ITSIS system and obtains the inquiring information. The interface items and icons are assembled to a conceptual figure, which are not necessarily the design of implementation.

Approach 1. Viewing entire system map

Approach 2. Viewing a route and its schedules

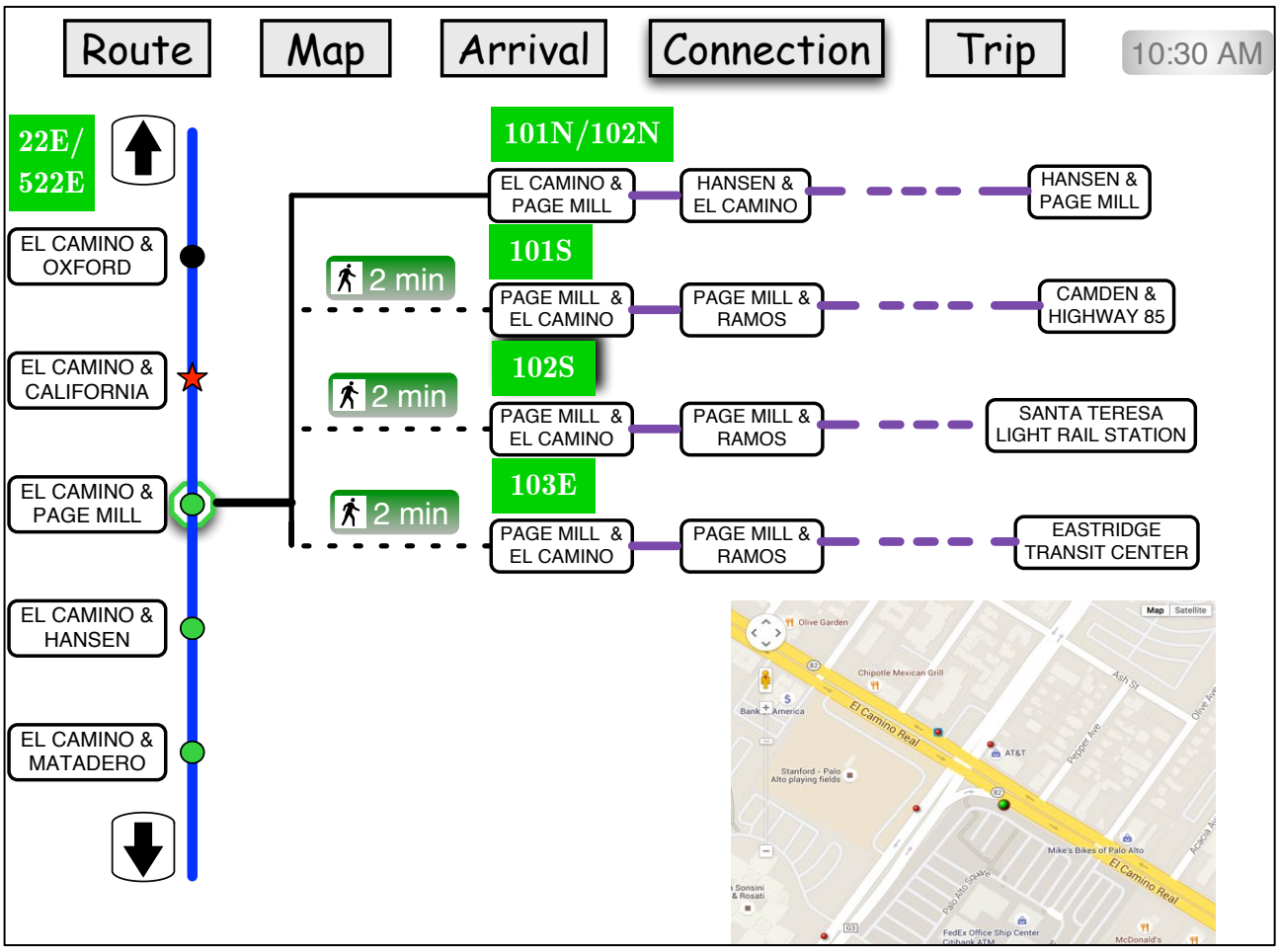


Approach 3. Viewing Estimated Arrival Times of all available stops

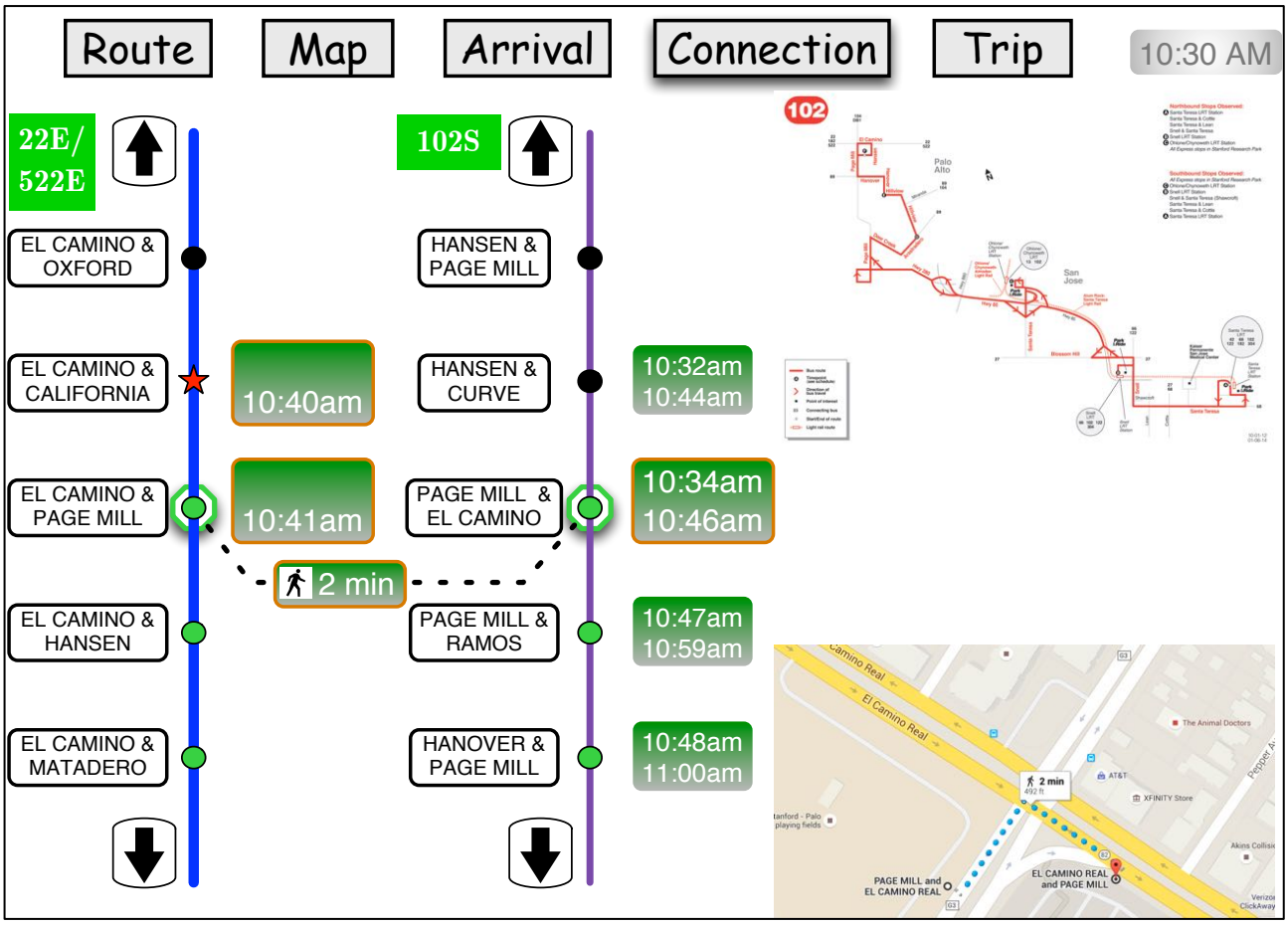


Approach 4. Acquiring information of connecting routes

Step 4-1: Choose a transfer stop, list all possible connecting routes.

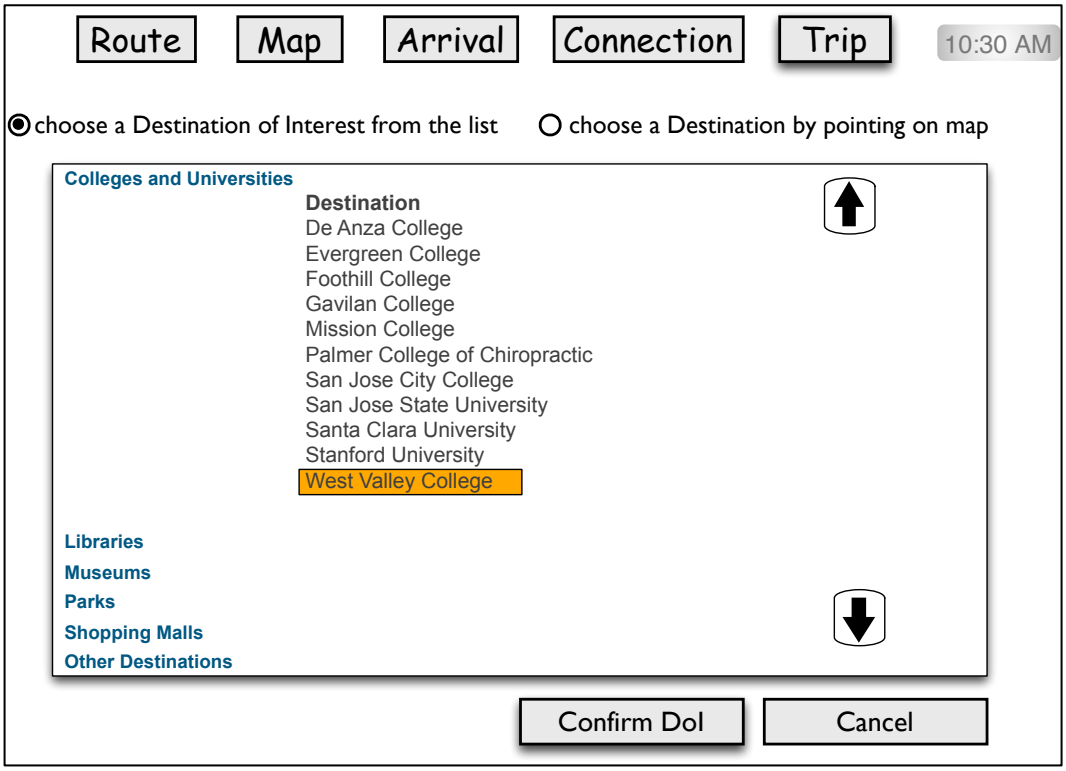


Step 4-2: Choose a connecting route, get real-time connecting information.

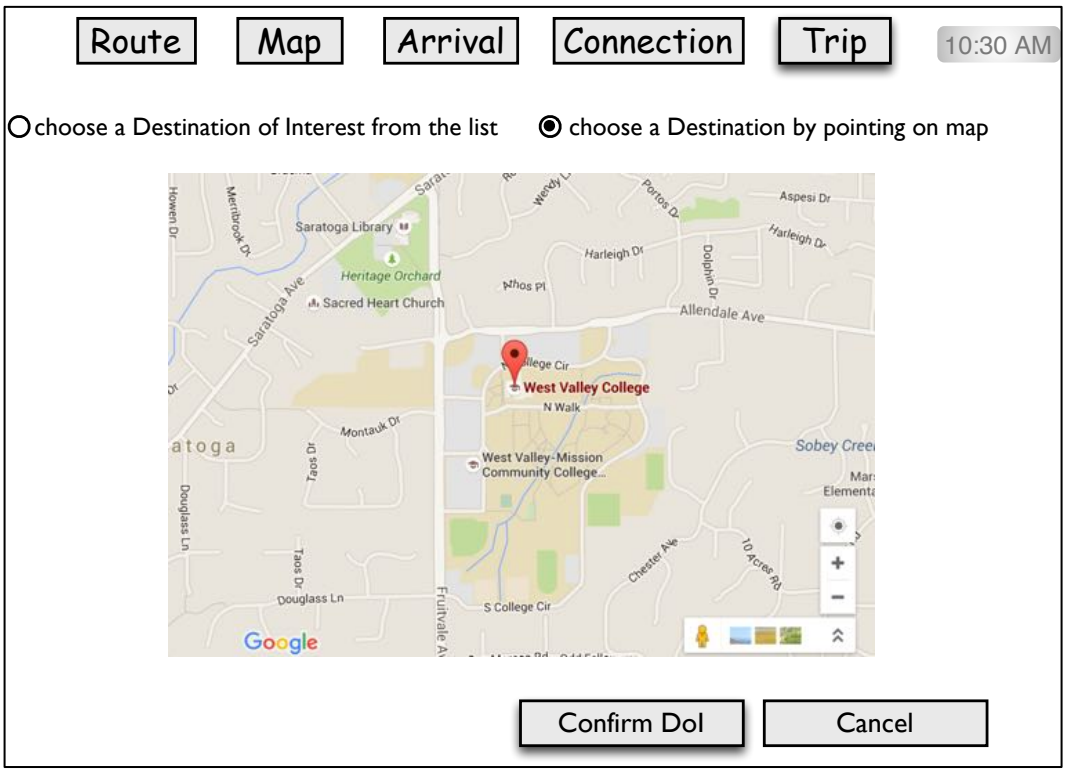


Approach 5. Acquiring real-time information of a planned trip

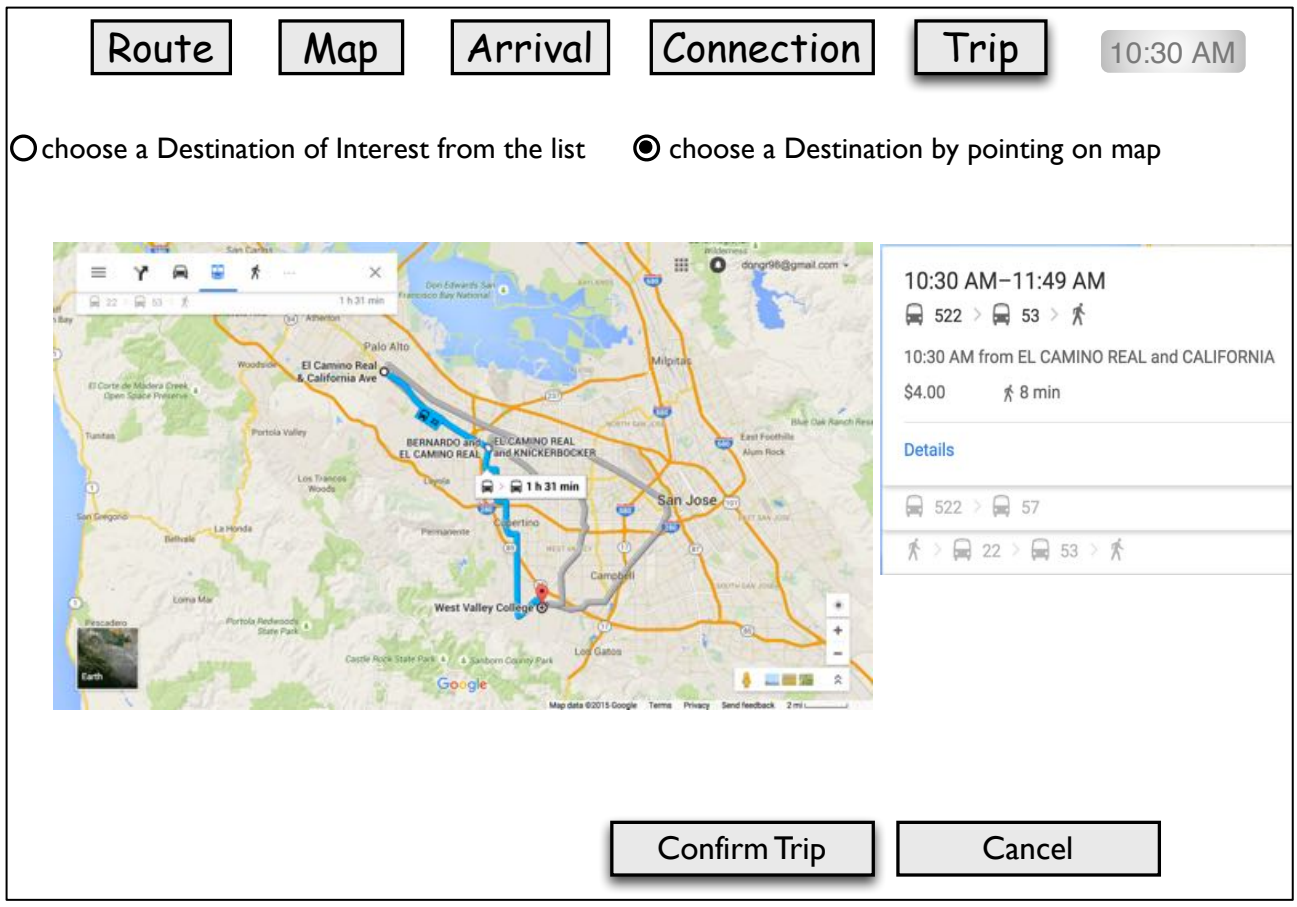
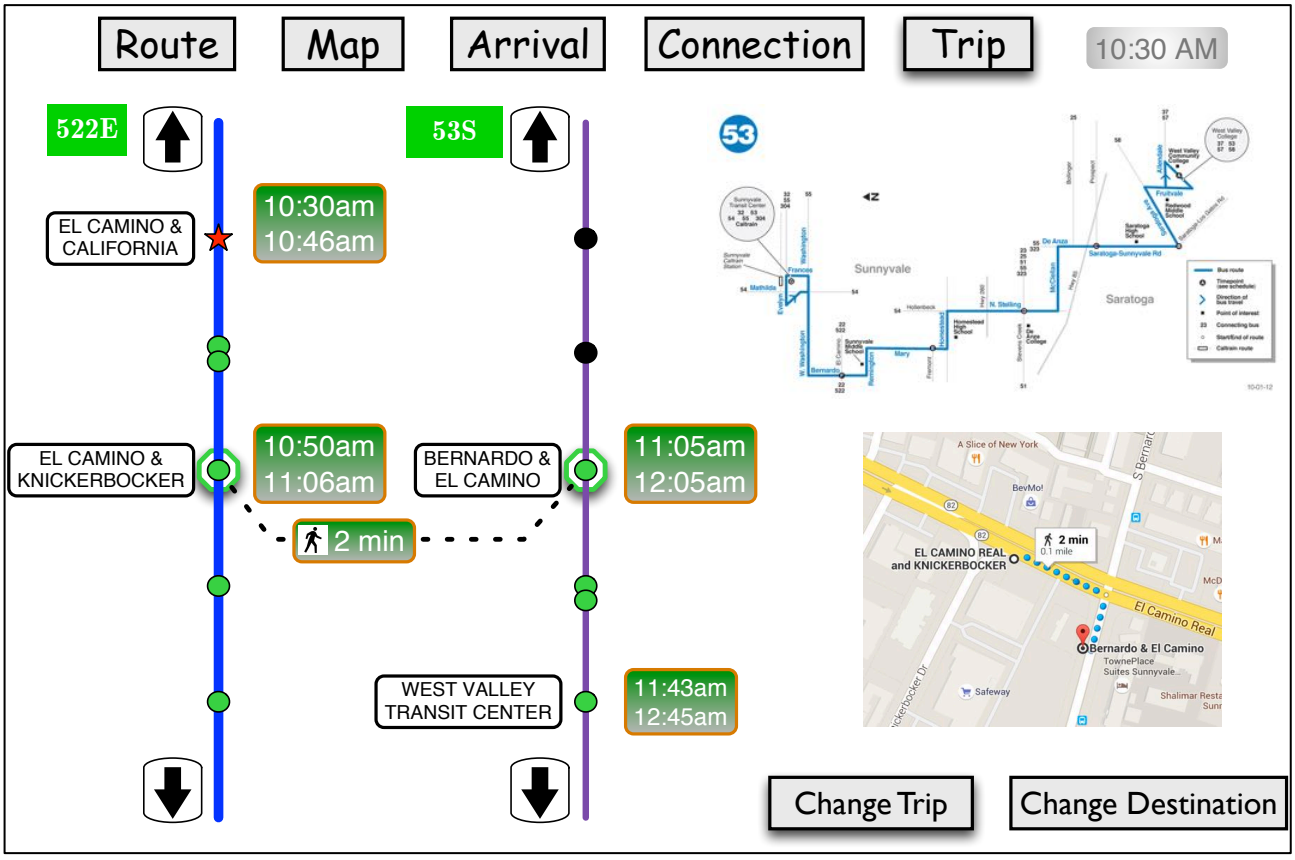
Step 5-1a: Choose a "Destination of Interest" from the list



Step 5-1b: or Choose a destination by pointing on map (may only be available on mobile app)



Step 5-2: Confirm a trip from the candidate planned trips



Step 5-3: Acquiring real time information of this specified trip (within VTA network)