**Requirements:**

1. A scanner needs to be installed at one device location, but one device location can have multiple scanners installed.
2. Device locations can belong to tram, bus or stop stations. (Only tram and bus will have scanners in the vehicle; the rest of the scanners should be at the stop stations)

**一張含有 文字, 圖表, 方案, 地圖 的圖片

AI 產生的內容可能不正確。**

**Assumptions & Justifications:**

1. All vehicles require a touch-on and off (the current tram system doesn’t require a touch-off):

**Changes**:

* + This assumption will change the mechanism only deducts when “touching off.”
  + The forgot-to-touch-off rule remains the same. If passengers forget to touch off, the system will deduct the “Zone1+2 2 hours” fee.

**Benefits**:

* + Uniforming the myki-using behaviour. For passengers, it is more intuitive and friendly to memorise the rules. For PTV, we can gain more trip data from users for tram usage.
  + The company will have the flexibility to adjust the payment mechanism from zone-based pricing to distance-based pricing.

1. So far, we only discuss the Metropolitan tram, train and bus in this design.
2. We consider top-up machines to be a type of scanner as well. We don’t focus on the top-up mechanism here
3. We can see online transactions (top-up or buying myki pass) as happened at DeviceLocation -> location\_type = ‘online’
4. Every vehicle is equipped with a GPS and will send a real-time log (VehicleRealTimeLog) every few seconds.
5. VehicleStopLog is generated from VehicleRealTimeLog. The system determines whether a vehicle is entering or leaving a stop based on its latitude and longitude: if the vehicle is within 50 meters of a station, it is considered “entering” the stop; otherwise, it is considered “leaving.”

**Pricing rule:**

* Apply to tram, train and bus travel
* If you travel only within Zone 1/2 boundary overlap and Zone 2, the system will charge you only the Zone 2 price.
* The rest will be charged to you Zone 1+2 2-hour fare

**Entities:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Description** | **Attributes** | **Note** |
| **CustomerAccount** | * Represents registered customer accounts * May hold 0 or more MykiCards | * customer\_id (PK) * full\_name * email * phone\_num * address * dob * register\_date * account\_status * password\_hash | * Optional: card may be anonymous |
| **MykiCard** | * Identify users and deduct objects * Can be anonymous (no link to customer account needed) * Used to initiate trips and hold value | * card\_id (PK) * balance * customer\_id (nullable FK) * card\_type * myki\_pass | * Linked to lookup table CardType contained:   Full-fare  Concession  Child  Senior |
| **Trip** | * Represents a single **transport journey** (from touch on to touch off) * Every touch-on action will have a corresponding trip record * A trip may or may not involve an actual fare charge | * trip\_id (PK) * card\_id (FK) * touch\_on\_time * touch\_on\_scanner\_id * touch\_on\_stop\_station\_id * touch\_off\_time (nullable) * touch\_off\_scanner\_id (nullable) * touch\_off\_stop\_station\_id (nullable) * fare\_charged * fare\_type * fare\_calc\_method | * Fare-related value can be derived and updated later when detected touch-off action |
| **Transaction** | * Represents a **monetary action** (deduction, top-up or buying a pass) on the card. * A trip may generate **zero or one** fare-related transaction. (May within 2 hours free period) | * transaction\_id (PK) * card\_id (FK) * trip\_id (nullable FK) * scanner\_id (FK) * amount * type * timestamp | * Types may include like 'TopUp', 'FareDeduction', and ‘Mykipass’ |
| **Scanner** | * Make the record once a myki card touches * Physical or virtual(online) scanning device used for touch-on/off or any interaction regarding Myki card | * scanner\_id (PK) * device\_location (FK) | * Online transactions will be seen as one type of scanner that device\_location is ‘online’ * Connected to either vehicle or stop station via DeviceLocation |
| **DeviceLocation** | * Abstracts the physical context where a scanner is installed | * device\_location\_id (PK) * vehicle\_id (nullable FK) * stop\_station\_id (nullable FK) * location\_type | * Location\_type can include vehicle, stop station, online |
| **StopStation** | * Represents a physical transport stop or station | * stop\_station\_id (PK) * name * zone\_id * geo\_point | * geo\_point used for GPS-based arrival inference that record longitude and latitude * zone\_id will be either ‘Zone1’, ‘overlap’, or ‘Zone2’ |
| **Route** | * Represents a public transport route | * route\_id (PK) * route\_name * route\_type * start\_time\_of\_day * last\_run\_time | * One route consists of multiple RouteStops |
| **RouteStop** | * Defines the sequence of stops along a route | * route\_id (PK) * stop\_station\_id (PK) * direction (PK) * scheduled\_arrival\_time | * Composite PK defines stop identity within route direction |
| **Vehicle** | * Represents a physical transport vehicle | * vehicle\_id (PK) * vehicle\_type | * Values include metropolitan\_bus, metropolitan\_tram, etc. |
| **VehicleRun** | * A single operational instance of a vehicle on a route | * run\_id (PK) * vehicle\_id (FK) * route\_id (FK) * direction * start\_time | * Used to track daily or scheduled trips of a vehicle |
| **VehicleStopLog** | * System-inferred record when a vehicle stops at a station | * stop\_log\_id (PK) * vehicle\_id (FK) * run\_id (FK) * stop\_station\_id (FK) * actual\_arrival\_time * actual\_departure\_time | * Derived from real-time logs |
| **VehicleRealTimeLog** | * Records GPS position of a vehicle at a given time | * live\_log\_id (PK) * vehicle\_id (FK) * stop\_station\_id (nullable FK) * vehicle\_lat * vehicle\_long * timestamp | * Used to infer actual stops and arrival |

**Actions:**

**TouchOn()**

**Trip → scanner\_id → device\_location → vehicle\_id → find current run\_id → lookup VehicleStopLog or VehicleRealTimeLog → infer StopStation → derive Zone → calculate fare**

References:

Myki Interstate travel: <https://www.ptv.vic.gov.au/more/travelling-on-the-network/interstate-travel/>

Myki pricing: <https://www.ptv.vic.gov.au/tickets/fares/metropolitan-fares/#defaultfares>

Stop Station data: <https://discover.data.vic.gov.au/dataset/annual-regional-train-station-patronage-station-entries/resource/f93a819a-351e-4242-a6f3-74d92cd682dc>