BUS PASSENGER TRACKER DATABASE
(Revised)

Initially submitted

as partial fulfillment of the requirements for the subject

Database Systems

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INTRODUCTION

Bus transportation is a common option for travelers or commuters. In Panay Island in the Philippines at least, people ride buses to travel over long distances such as going from one province to another (e.g. Aklan to Iloilo), or to going to work daily (e.g. within Iloilo City). Due to the insurgence COVID-19 in 2020, bus stations or operators needed to impose strict transportation policies and monitor passengers and employees for contact tracing when necessary.

Transportation restrictions have already been lifted but the threat of COVID-19 remains. Moreover, re-emergence of harmful viral pathogens is inevitable (Smith, 2021) which could pose risk to quality of human lives. A comprehensive and easy-to-use tracking system of passengers can mitigate the spread of such viruses by speeding up the process of contact tracing.

Bus Passenger Tracker Database (BPTD) is a prototype database designed to store relevant and necessary data of bus trips and passengers. It is a relational database (currently written in MySQL) that provides an organized collection of data for efficient access of information. It was designed with scalability---in terms of locale scope---in mind. The designers hope it can minimize the propagation of COVID-19-like transmissions in the future.

APPLICATION DOMAIN

1. A person has a corresponding id to uniquely identify them, a name, a home address, date of birth, age, and multiple contact numbers.
2. A person may or may not have taken a vaccine. A vaccine can be taken by many persons or none at all.
3. For each person, their vaccination status must be indicated. If they are vaccinated, the number of doses and the most recent date of dosage should be indicated.
4. Each vaccine has a brand name, a manufacturer, and a corresponding id.
5. A person can either be an employee or passenger (or both for special cases, e.g. an employed driver taking a bus as a passenger).
6. Each employee has a designation. An employee is either a driver or a conductor.
7. A driver drives a bus and is accompanied by a conductor. Together, they operate one or many trips.
8. Each bus has a control number, a plate number, and passenger capacity.
9. Each trip is primarily identified by the date, place of origin and destination, departure time, arrival time, and with a corresponding id.
10. A bus is necessary for a single trip.
11. A passenger may pay for one or more trips and a trip can have many passengers. In a trip, each passenger has their own origin and destination, and paid fare.
12. A bus travels from one station to another. A station is defined by a unique ID, a name, and its location or address.
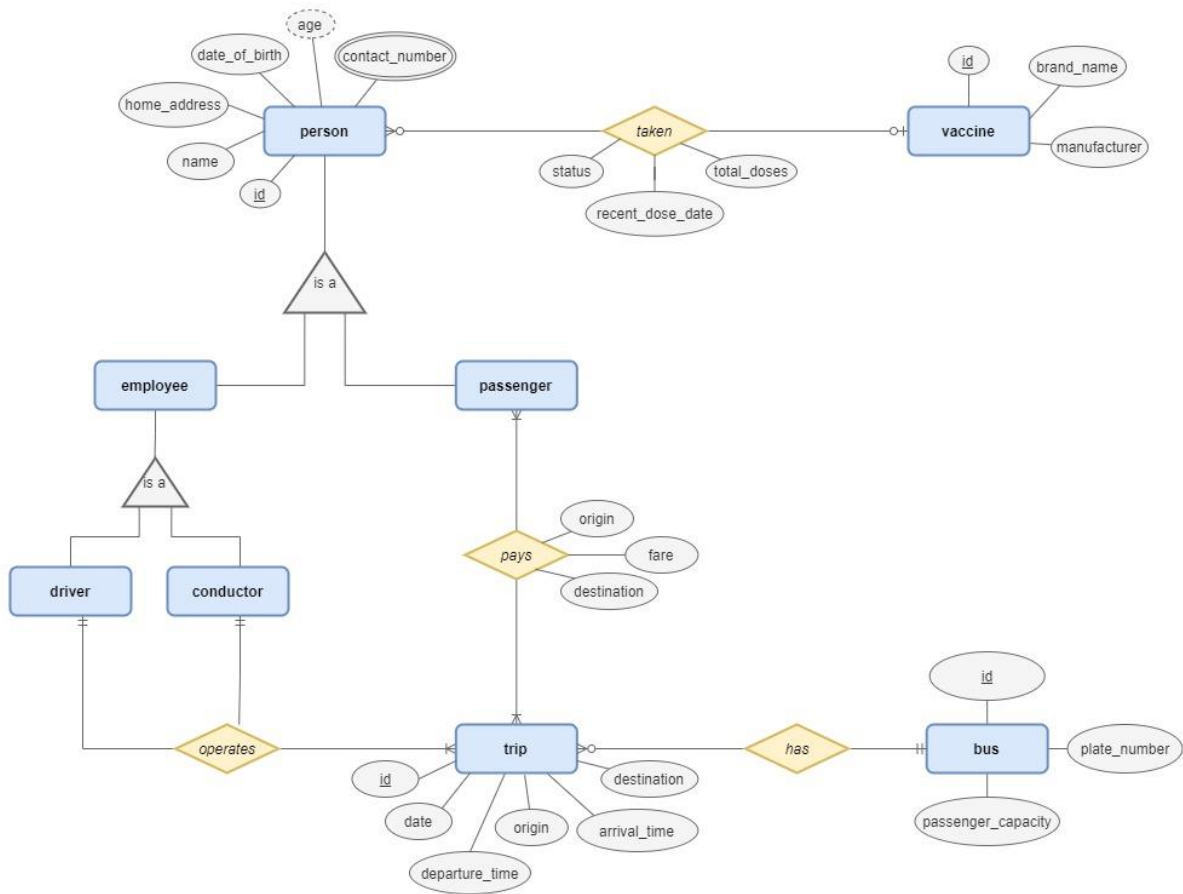
ENTITY-RELATIONSHIP DIAGRAM

Table columns and sample data based on specifications of application domain:

person

id	name	home_address	date_of_birth	age	contact_numbers
1	John Watson	Miagao, Iloilo	01-01-2001	23	0912-123-4567
2	Mary Jane Watson	Miagao, Iloilo	06-01-2002	22	0917-123-4567, 0918-987-6543
3	Mary Jane Watson	Roxas City, Capiz	06-01-2002	22	0917-123-4567, 0918-987-6543

Note and/or issue(s):
- A person may have two (2) addresses they want to register.
- A person may have two (2) contact numbers.
- Age can be derived.

vaccine

id	brand_name	manufacturer
1	Drug_A	Manufacturer_A
2	Drug_B	Manufacturer_B
3	Drug_C	Manufacturer_C

person_taken_vaccine

person_id	is_vaccinated	vaccine_id	total_doses	recent_dose_date
1	yes	2	1	12-01-2020
2	no	NULL	NULL	NULL

Note and/or issue(s):
- is_vaccinated should be of BOOLEAN datatype. 0 – no; 1 – yes.
- Some column values can be NULL if a person is not vaccinated with a COVID-19 vaccine.

employee

employee_id	name	home_address	date_of_birth	age	contact_number	employee_type

| 1 | John Crick | Miagao, Iloilo | 01-01-1990 | 34 | 0912-123-4567 | Driver |
| 2 | Mary Jane Crick | Miagao, Iloilo | 06-01-1995 | 28 | 0917-123-4567 | Conductor |

Note and/or issue(s):
- Almost same columns with person table.

passenger

id	*name*	*home_address*	*date_of_birth*	*age*	*contact_number*
1	John Watson	Miagao, Iloilo	01-01-2001	23	0912-123-4567
2	Mary Jane Watson	Miagao, Iloilo	06-01-2002	22	0917-123-4569

Note and/or issue(s):
- Same columns with person table.

passenger_pays_trip

passenger_id	*trip_id*	*passenger_origin*	*passenger_destination*	*fare_amount*
1	1234	Aguinaldo St., Roxas City, Capiz	Tagbak, Jaro, Iloilo	50.00
2	5678	Mabini St., Roxas City, Capiz	Tagbak, Jaro, Iloilo	60.00

Note and/or issue(s):
- passenger_origin and passenger_destination can be decomposed into simpler data: specific place of origin, city, and province.

trip

bus_id	*date*	*o_station_id*	*d_destination_id*	*departure_datetime*	*arrival_datetime*	*driver_id*	*conductor_id*
1	01-01-2021	1	2	08:00:00 01-01-2021	12:00:00 01-01-2021	987	321
2	01-02-2021	2	1	08:00:00 01-01-2021	12:00:00 01-01-2021	654	322

Note and/or issue(s):
- date can be derived departure_time if DATETIME datatype is used.

bus

bus_id	plate_number	capacity
1	TCG-1234	45
2	INV-1234	50

station

station_id	station_name	station_location
1	Pueblo Terminal	Roxas City, Capiz
2	Tagbak Terminal	Tagbak, Jaro, Iloilo

Note and/or issue(s):
- station_location be decomposed into simpler data: specific place of origin, city, and province.

NORMALIZATION
(1NF, 2NF, 3NF)[i]

1NF

- Created a separate table for home addresses and contact numbers.
- Decomposed *home_address* and other address-like attributes into specific components: specific address, city/municipality, province.
- Since column values of *employee* and *passenger* tables are similar to *person* table, and only the **designation** column persists in both table, we remove *employee* and *passenger* tables and add **designation** to person table. Since this column identifies the type of person, **designation** column was renamed to **person_type** to easily distinguish the data's purpose.

person *

id	*first_name*	*middle_name*	*last_name*	*date_of_birth*	*person_type*
1	John	Jonas	Watson	01-01-2001	passenger

home_address +

person_id	*specific_address*	*municipality*	*province*
1	Door 2, San Jose Apartment, Tiza	Roxas City	Capiz

contact_number +

person_id	*contact_number*
1	09123456789

vaccine

id	*brand_name*	*manufacturer*
1	Drug_A	Manufacturer_A
2	Drug_B	Manufacturer_B
3	Drug_C	Manufacturer_C

person_taken_vaccine

person_id	is_vaccinated	vaccine_id	total_doses	recent_dose_date
1	yes	2	1	12-01-2020
2	no	NULL	NULL	NULL

passenger_pays_trip -

psngr_id	trip_id	psngr_origin_spec	psngr_origin_municipality	psngr_origin_province	psngr_dest_spec	psngr_dest_city	psngr_dest_province	fare_amount
1	1234	Aguinaldo St.	Roxas City	Capiz	Watson St., Tagbak, Jaro	Iloilo City	Iloilo	50.00
2	5678	Mabini St.	Roxas City	Capiz	Edison St., Tagbak, Jaro	Iloilo City	Iloilo	60.00

trip

bus_id	o_station_id	d_destination_id	departure_datetime	arrival_datetime	driver_id	conductor_id
1	1	2	08:00:00 01-01-2021	12:00:00 01-01-2021	987	321
2	2	1	08:00:00 01-01-2021	12:00:00 01-01-2021	654	322

bus

bus_id	plate_number	capacity
1	TCG-1234	45
2	INV-1234	50

station -

station_id	station_name	station_spec_add	station_municipality	station_province
1	Pueblo Terminal	Pueblo	Roxas City	Capiz
2	Tagbak Terminal	Tagbak, Jaro	Iloilo City	Iloilo

2NF

- Added *id* columns for *home_address*, *contact_number, person_taken_vaccine, passenger_pays_trip,* and *trip* tables.

person

id	first_name	middle_name	last_name	date_of_birth
1	John	Jonas	Watson	01-01-2001
2	Mary Jane	Jonas	Watson	06-01-2002

home_address *

id	person_id	specific_address	municipality	province
1	1	Hollywood Street	Miagao	Iloilo
2	2	Brgy. Tiza	Roxas City	Capiz

contact_number *

id	person_id	contact_number
1	1	0912-354-6789
2	2	0998-765-4321

vaccine

id	brand_name	manufacturer
1	Drug A	Manufacturer A
2	Drug B	Manufacturer B

person_taken_vaccine *

id	person_id	is_vaccinated	vaccine_id	total_doses	recent_dose_date
1	1	yes	2	1	12-01-2020
2	2	no	null	null	null

passenger_pays_trip *

id	psngr _id	trip_id	psngr_or igin_spe c	psngr_o rigin_mu nicipalit y	psngr_origin_ province	psngr_dest_s pec	psngr_dest_ city	psngr_dest_pro vince	fare_amount
1	1	1234	Aguina ldo St.	Roxas City	Capiz	Watson St., Tagbak, Jaro	Iloilo City	Iloilo	50.00
2	2	5678	Mabini St.	Roxas City	Capiz	Edison St., Tagbak, Jaro	Iloilo City	Iloilo	60.00

trip -

id	bus_id	o_station_id	d_destination_id	departure_datetime	arrival_datetime	driver_id	conductor_id
1	1	1	2	08:00:00 01-01-2021	12:00:00 01-01-2021	987	321
2	2	2	1	08:00:00 01-01-2021	12:00:00 01-01-2021	654	322

bus

bus_id	plate_number	capacity
1	TCG-1234	45
2	INV-1234	50

station

station_id	station_name	station_spec_add	station_municipality	station_province
1	Pueblo Terminal	Pueblo	Roxas City	Capiz
2	Tagbak Terminal	Tagbak, Jaro	Iloilo City	Iloilo

- Combine **_person_** and **_person_taken_vaccine_** tables because columns in **_person_taken_vaccine_** are heavily dependent on **person.id** as primary key. This calls for elimination of **person_taken_vaccine** table.
- Add **_role_** column (driver, conductor, passenger) and remove tables for employees and passengers because **_person.id_** may define **_designation_** column.

person *

id	first_name	middle_name	last_name	date_of_birth	is_vaccinated	vaccine_id
1	John	Jonas	Watson	01-01-2001	yes	1
2	Mary Jane	Jonas	Watson	06-01-2002	no	NULL

total_doses	recent_dose_date	person_type
1	12-01-2020	driver
1	12-01-2020	passenger

home_address

id	person_id	specific_address	municipality	province
1	1	Hollywood Street	Miagao	Iloilo
2	2	Brgy. Tiza	Roxas City	Capiz

contact_number

id	person_id	contact_number
1	1	0912-354-6789
2	2	0998-765-4321

vaccine

id	brand_name	manufacturer
1	Drug A	Manufacturer A
2	Drug B	Manufacturer B
3	Drug C	Manufacturer C

person_taken_vaccine *

id	person_id	is_vaccinated	vaccine_id	total_doses	recent_dose_date
1	1	yes	2	1	12-01-2020
2	2	no	null	null	null

passenger_pays_trip

id	psngr_id	trip_id	psngr_origin_spec	psngr_origin_municipality	psngr_origin_province	psngr_dest_spec	psngr_dest_city	psngr_dest_province	fare_amount
1	1	1234	Aguinaldo St.	Roxas City	Capiz	Watson St., Tagbak, Jaro	Iloilo City	Iloilo	50.00
2	2	5678	Mabini St.	Roxas City	Capiz	Edison St., Tagbak, Jaro	Iloilo City	Iloilo	60.00

trip

id	bus_id	o_station_id	d_destination_id	departure_datetime	arrival_datetime	driver_id	conductor_id
1	1	1	2	08:00:00 01-01-2021	12:00:00 01-01-2021	987	321
2	2	2	1	08:00:00 01-01-2021	12:00:00 01-01-2021	654	322

bus

bus_id	plate_number	capacity
1	TCG-1234	45
2	INV-1234	50

station

station_id	station_name	station_spec_add	station_municipality	station_province
1	Pueblo Terminal	Pueblo	Roxas City	Capiz
2	Tagbak Terminal	Tagbak, Jaro	Iloilo City	Iloilo

FINAL SCHEMA
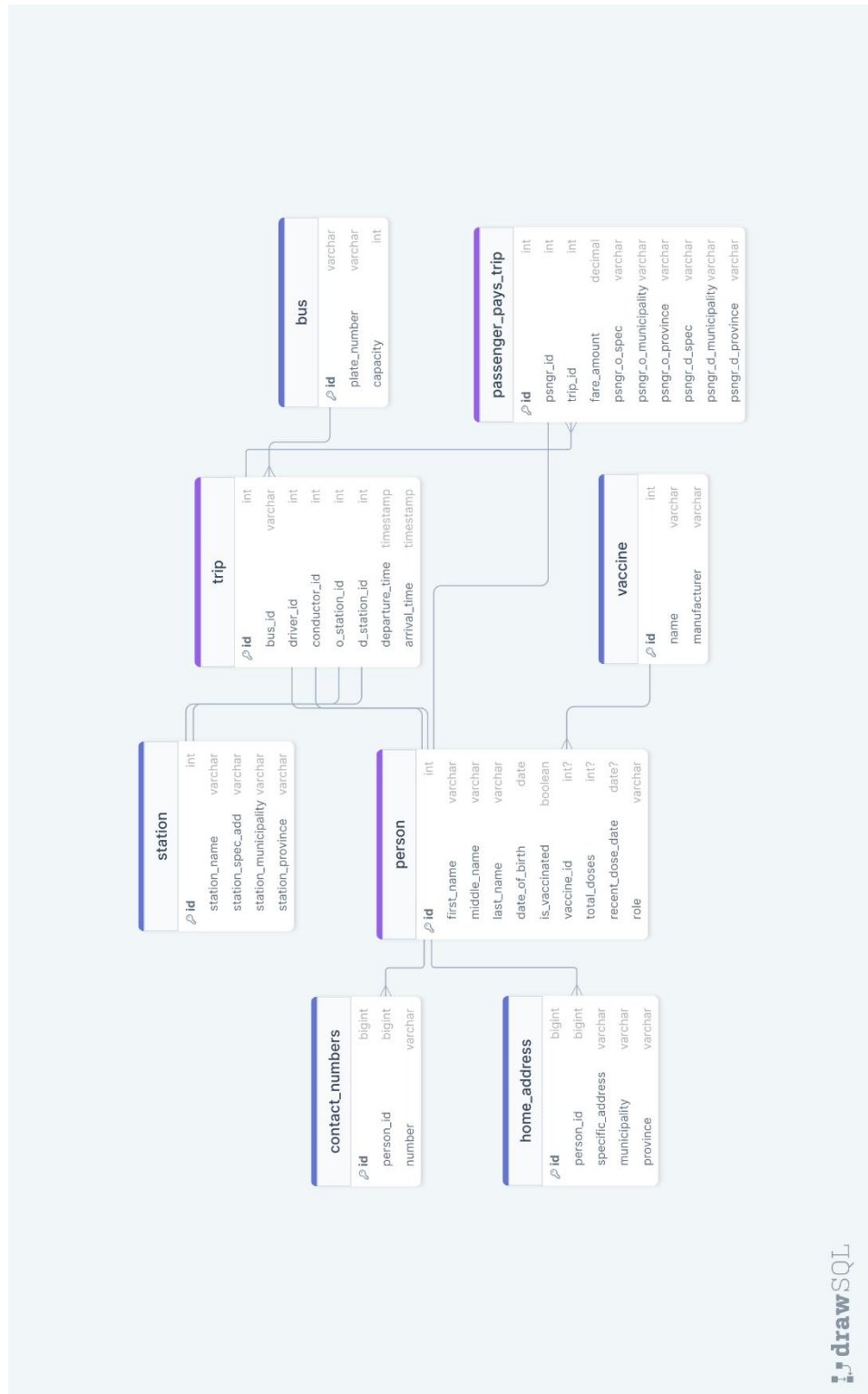
Reference:

Smith, J. (2021, December 16). *Q&A: Future pandemics are inevitable, but we can reduce the risk*. Horizon Magazine. https://projects.research-and-innovation.ec.europa.eu/en/horizon-magazine/qa-future-pandemics-are-inevitable-we-can-reduce-risk

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[i] Legend: ***** - Modified, **+** - New