Case Study 2: A university campus public transport

**CMU Public Transport Organizing System**

**using Deep Learning and IoT Sensor**

In Chiang Mai University, there is a transportation service known as Purple Bus which available for students and people who living in a service area. However, passengers who use the university campus public transport have problems using the service. Sometimes It takes a long time to wait for the bus. The allocation bus is not enough to meet the need of passengers with an actual number of passengers in real-time. Therefore, improve the efficiency of bus routes by using sensors to count the number of passengers to train a model and using an algorithm to calculate the number of passengers to reduce the over demand in the same route.

We believe that the main source of the bus shortage problem came from bad transportation schedule management in each route which doesn’t relate to passenger demand in the specific period rather than the lack of number of available buses. For example, the number of students who desire to use the bus in the morning is usually higher than evening due to the study schedule.

To handle the problem mentioned above, Deep Learning Technique and IoT sensor will be implemented to collect the number of passengers that use the bus in each period of time then estimate and assign the appropriate number of the transportation vehicle for each period.

The collection of data will be done by setting up the GPS sensor and attach the LIDAR which is a distance measuring sensor onto the bus, one above an entrance door and another one above an exit door. Once the passenger gets on the bus using the entrance, the LIDAR will be triggered and counting the number of passengers who get on. As well as the LIDAR at the exit door, the system will count the number of passengers who get off the bus. The number of passengers is interpreted by the pulse of the measured distance when the passenger gets on or gets off the bus while each station will be determined by a GPS sensor. These sensors are controlled by a microcontroller and transmit the data to the database via wifi signal.

The collected data will be processed by using a deep learning technique in order to estimate the passenger density in each station and determine the compatible ratio of buses assigned in each route.

The experimental results from the LIDAR sensor will show an outcome as an increasing amount of data for Model training in order to improve the accuracy of the data and the The data processing by using a deep learning technique will show an outcome as most suitable for the number of buses in each bus route in order to decrease passenger density in each station.

We can develop it to display the solution in an application in the future for both bus drivers and passengers and can be subdivided by many different criteria, such as season or shorter time.

**Problem Analysis**

A university campus public transport

Problem : Some of the passenger are waiting for too long (10-15 minutes)

Activities / Outputs / Outcomes :

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| Activity | Output | Outcomes |
| Install a distance measurement sensor and gps sensor on the bus | Number of passenger who using public transport service in each period of time | Increase amount of data for Model training in order to improve the accuracy |
| Use deep learning to estimate the passenger density in each period of time | Number of bus that should be assigned in the specific period of time | The bus is assigned appropriately.  The passenger don’t need to wait for too long |

Indicators: A density of passenger in each station decrease faster overtime

Stakeholder: Passenger

Data Source: IoT sensor

DM technique: Data Clustering / Data prediction

Data as data production (solution) : CMU public transport route management system

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