**Publication: Channel News Asia Online**
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# Commentary: Shortening the waiting time for your cab with a driver guidance system

There is a solution that can help match taxi demand and supply better – and it isn't surge pricing, says one Singapore Management University professor.

File picture of taxis in Singapore. (Photo: TODAY)

SINGAPORE: The taxi industry around the world has suffered huge losses since the emergence of ride-hailing apps.

In New York, taxi medallion prices collapsed from over US$1 million in 2013 to less than US$200,000 last year, putting many taxi drivers in debt.

A permit to drive a taxi in the US used to be seen as a great investment to many taxi drivers as the value of a medallion, a license issued by authorities to drive a cab, used to double every few years.

But when ride-hailing cars saturated the market, it led to an exodus of drivers from taxis and killed medallion values, leaving taxi drivers losing hundreds of thousands of dollars in equity and many bankrupt.

In Singapore, the total taxi population has fallen since the arrival of these ride-hailing companies from its 2014 peak of 28,800, to around 20,900 as of November 2018 - a decline of almost 28 per cent.

The good news is the taxi industry in Singapore, is still holding up relatively well compared to other cities. Taxi fleets, consolidated to only a handful of companies, gives them the benefit of scale.

The top four taxi companies combined own more than 96 per cent of all taxis. Market leader ComfortDelGro has 60 per cent of the total taxi market.

Singapore taxis have also been investing in technologies early on, providing reliable and efficient booking services even before the entry of Uber and Grab.

Trips from street hails and taxi queues, which can only be served by taxis, still account for around 70 per cent of all taxi trips, providing a good baseline protection for taxi drivers.

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A taxi driver.

However, as ride-hailing apps evolve at neck-breaking speed, Singapore's taxi industry needs to up its game to stay competitive.

**BALANCING TAXI SUPPLY AND DEMAND**

The challenges brought about by disruptive ride-hailing companies are two-fold. On one hand, large numbers of private cars are flooding the market in a short time, creating supply surplus.

For example, in Singapore, the number of private cars registered for chauffeur service has grown from only 614 in 2013 to over 46,000 in 2017.

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On the other hand, most ride-hailing companies utilise innovative approaches such as dynamic pricing mechanism, and surge pricing in particular, to improve demand and supply matching in a bid to lower the waiting time for a ride for passengers.

But dynamic pricing is not the only way to balance demand and supply.

Our study at the Singapore Management University found that in most hours of the day, vacant taxis are not roaming in the areas where they are needed most. For example, even during rush hour, there is still roughly 20 per cent of taxis available around the city; they are just not positioned at the right place to pick up passengers.

We also found that providing all drivers with real-time updates on "demand heatmaps" could solve the issue, but only to some degree.

For example, in Singapore, both ComfortDelGro and Grab already provide their drivers with demand heat maps. Unfortunately, these real-time updates, although informative, suffer from the Matthew effect, which results in demand being under-served.

This happens because areas which have high passenger demand naturally attract more drivers, as all drivers are represented with the same information and likely gravitate towards the same places with super high demand. If a sufficient number of drivers react to this information in a similar fashion, they might even overcrowd high-demand areas while leaving low-demand areas under-served.

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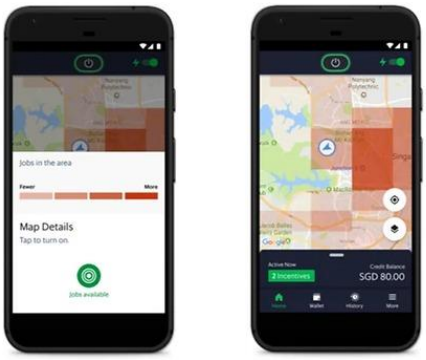

Screenshot of a demand heat map seen by drivers on Grab. The darker the area, the greater passenger demand in the shaded box is. (Photo: Grab)

For example, let's say 4,000 drivers have demand levels for two regions revealed to them: Region A has 1,500 passenger trip requests while region B has 500 trip requests. If drivers are not anticipating what other drivers might do, upon seeing this information, all drivers would choose to go to Region A, leading to 4,000 drivers crowding in region A and none in region B.

The end result would be lose-lose for both drivers and passengers, as drivers in region A have only a 37.5 per cent chance of scoring a trip, and all 500 passengers in region B would go unserved.

The best-case scenario for this example would be to divide drivers into two groups: 3,000 drivers to serve region A and 1,000 drivers to serve region B. In this case, all passengers will be served, and the likelihood of getting passengers in both regions are equalised at 50 per cent.

**EXPERIMENTING WITH A DRIVER GUIDANCE SYSTEM**

So how do we achieve this? Drivers make decisions independently and cannot arrive at this service plan by themselves. A central coordinator equipped with required real-time information and computational power will need to process the data to coordinate drivers.

To realise this idea, the research team at the Fujitsu-SMU Urban Computing and Engineering Corp Lab (UNiCEN) has been working on the research and development of a Driver Guidance System (DGS) for taxi drivers for the past 3 years.

The DGS platform can estimate current taxi supply and demand (for both street-hail and bookings), and predict future taxi supply and demand for the next 30 minutes around Singapore. A sophisticated computational engine then incorporates these predictions to produce recommendations for individual drivers, with the objective of minimising their vacant roaming times.

DGS is different from the demand heat maps in that we compute the best "personalised recommendation" for each participating driver, without showing the same demand heat map to all of them. To incorporate the latest information, recommendations are re-computed every minute.

The DGS App is designed to be hands-free, requiring no user interaction, and pans and zooms automatically based on the driver's current location. This would suit drivers busy juggling between multiple apps for booking and routing.

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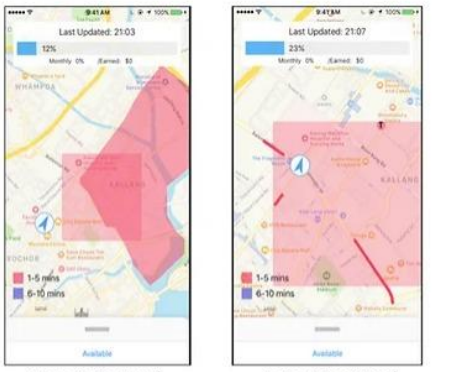
The driver is shown a recommended area (1km by 1km) with high demand in red and receives more detailed guidance on which streets to roam or which taxi stands to check when he enters the recommended area.

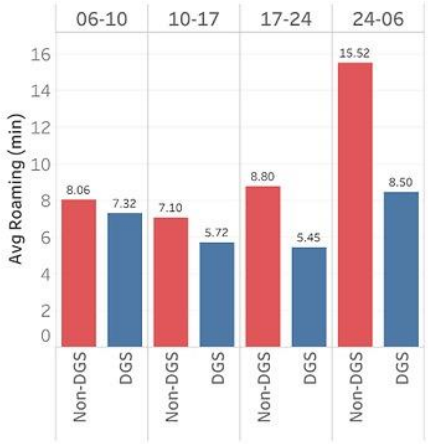



The DGS App Interface (Photo: Shih-Fen Cheng)

If the driver does not like his recommendation, he can keep driving and the app will generate new suggestions.

Almost 500 taxi drivers, with the help from the National Taxi Association in Singapore, were recruited to install and test the DGS app since September 2017. After more than one year of field trials, we have found that drivers using the DGS have reduced their empty roaming time by almost 27 per cent.

Based on our observations, drivers experience lower empty roaming time throughout the day and in all areas. However, the DGS is particularly effective when demand is sparser and more unpredictable during off-peak hours and late nights in less dense neighbourhoods, compared to periods of abundant demand, where drivers can easily find passengers even in neighbourhoods with fewer people.




A breakdown of a driver's empty roaming time following and not following DGS recommendations, during four periods (6-10am, 10am-5pm, 5pm-12am, 12am-6am). The higher the bar, the longer a driver's roaming time. (Graph: Shih-Fen Cheng)

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**USING TECHNOLOGY TO IMPROVE EFFICIENCY**

Our field trial of the DGS platform demonstrates that modern data analytics and AI technology can work hand in hand to enable taxis to be more efficient and thus more competitive, even in the face of intense competition from ride-hailing apps and without the use of dynamic pricing.

We believe that we have provided a feasible model for other cities to follow if they are looking for solutions to upgrade their embattled taxi industry.

In an age of disruption, doing nothing is not an option. Relying on regulations to protect the taxi industry is also a passive strategy.

As commuters are already used to the hyper-efficiency of hailing rides, the only way forward for the incumbent taxi industry is to harness technology to launch a fierce offensive. Offering taxi drivers some smart guidance can be a start.

*Shih-Fen Cheng is associate professor of Information Systems, and deputy director (Research) at Fujitsu-SMU Urban Computing and Engineering Corp Lab in Singapore Management University.*

Source: CNA/nr