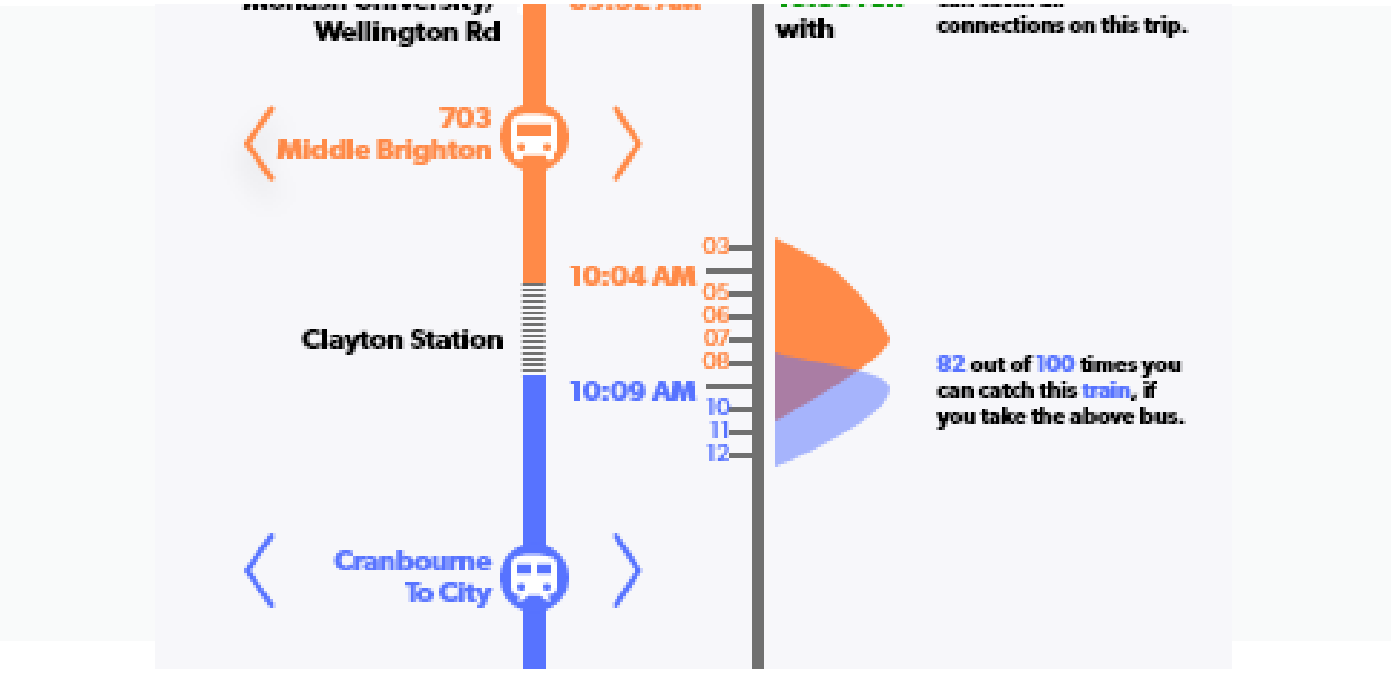

See figure 1.

Amit Jena[1] (amit.jena@monash.edu)
[1] IITB-Monash Research Academy

COMMUNICATING UNCERTAINTY IN PUBLIC TRANSPORT: MELBOURNE AND MUMBAI

Keywords: Uncertainty visualisation; Public transport; User centered design;

1. INTRODUCTION

Public transport is critical to the sustainability of any city. But often the arrival and departure schedules of public transport comes with uncertainty. We are exploring the possibility of communicating the associated uncertainty with any means of public transport to the commuters. This we believe may help commuters make an informed decision while using the public transport. For this purpose, we are designing a mobile app interface and plan to conduct user study in two thriving cities of the world: Melbourne and Mumbai. The choice of city is guided by the author's familiarity with the two cities. In Melbourne, the public transport of victoria (PTV) has the real time data of bus, train and tram available with them, where as in Mumbai the public transport does not have real time information available. After conducting the study at Melbourne, we plan to conduct a qualitative study at Mumbai. From the two studies, one qualitative at Melbourne and other qualitative study at Mumbai, we aim to gain insights as how to design solutions for communicating uncertainty information to non-experts.

The public transport in Melbourne consists of Train, Bus and Tram to move around 5 million [1] people living in Melbourne, where as Mumbai's public transport consists of Suburban Railway, Metro, Monorail and Ferry to support 23 million [2] people of Mumbai. The public transport

system in both the cities vary in terms of infrastructure, expansion plans, use of technology, demography and the commuter's perception towards it.

2. DESIGN CHALLENGE AND PROTOTYPE

We are facing two key challenges

- **Communicating Uncertainty to non-experts:** The associated uncertainty is modelled as probability density function and it will be essential to see how non-experts (commuters) perceive the shown visualisations. We are exploring what extra information we need to provide with the shown visualisations to help commuters understand the visualisation.

- **Visualising on a mobile screen:** Small screen size of the mobile devices impose design restrictions to the visualisation.

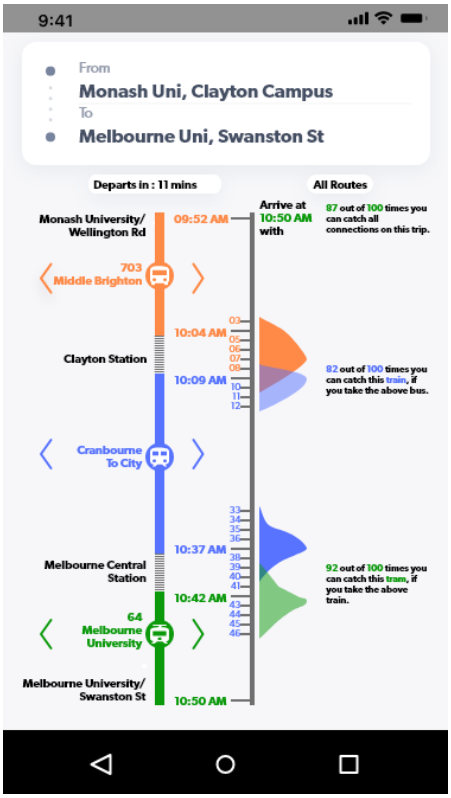

Figure 1: Using Density plot and Natural Frequency

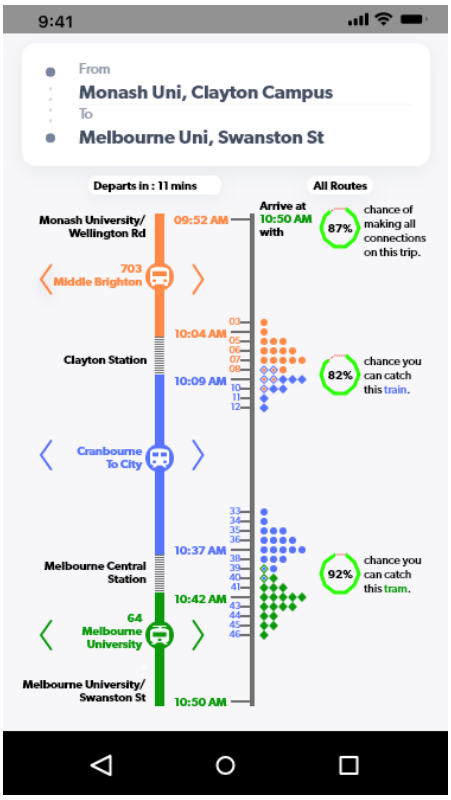

Figure 2: Using Quantile Dot plot and Probability in Percentage

In our prototype we have included two visualisation designs: density plots and quantile dot plots [3] and three ways of communicating probability: percentage, natural frequency and standardised word expression. We mined the arrival and departure times of bus, train and tram from the API of Public Transport of Victoria (PTV) for 30 days and generated the probability density functions and the likelihood probability.
People reported that often they make transfers among various public transports in order to reach their destination. Hence, the uncertainty information becomes significant. Our design communicates the overall uncertainty information and also the uncertainty associated with the individual options.

We conducted a pilot study of our high fidelity prototype to gather feedback on the design. But the pilot was restrictive in the sense that the participants reported to have familiarity with statistics and visualisation. We conducted a follow up study with 49 participants by simulating the real time public transport catching scenario, who are every day commuters of public transport. With each participant the user study session lasted on an average 1 hour. We also plan to conduct a longitudinal study over a period of 30 days using a android application.

2. DISCUSSION

For Melbourne, the time table information is available in GTFS format and the PTV (Public Transport of Victoria) has a dedicated mobile app. The prototype at this stage is designed for public transport in Melbourne. We are about to start large scale user testing at Melbourne. We will be starting the requirement gathering for Mumbai to understand the data available for various modes of public transport and how people currently use any mobile app for public transport.

3. CONCLUSION

It will be interesting to see how non-experts use this uncertainty information for making transit decisions. We hope to gain insights on the design process to be adopted while developing solutions for communicating uncertainty to non-experts. It will also be interesting to see the impact of demography on the design of the mobile app while we develop it for two very distinct cities: Melbourne (Australia) and Mumbai (India).

REFERENCES

[1] P. Australia. Melbourne population. http://www.population.net.au/melbourne-population/, 2019.

[2] indianonlinepages.com. Population of mumbai. http://www.indiaonlinepages.com/population/mumbai-population.html, 2019.

[3] M. Kay, T. Kola, J. Hullman, and S. Munson. When (ish) is my bus? usercentered visualizations of uncertainty in everyday, mobile predictive systems. In Proceedings of the 34th Annual ACM Conference on Human Factors in Computing Systems, CHI '16, 2016.