THE SEARCH FOR THE RIGHT PATH

WEB AND MOBILE JOURNEY PLANNERS ARE REAL BOONS TO MODERN TRAVELLERS, BUT CAN THEY BE IMPROVED? SERGEY MARKOV AND ANNA NOVGORODOVA SURVEYED PASSENGERS AND ANALYSED 35 SYSTEMS FROM AROUND THE WORLD TO FIND OUT WHAT JOURNEY PLANNERS ARE DOING RIGHT – AND WHAT THEY COULD DO BETTER IN FUTURE

Many municipalities nowadays have to deal with an increasingly large number of cars causing pollution and traffic jams, making urban navigation complicated. Inhabitants of large cities regularly face the challenge of finding the best route from point A to point B. It is easy to get lost in a large network of routes and modes of transport, and finding the fastest, cheapest or most convenient route is rarely simple.

To make travellers' journeys easier, a diverse variety of journey planning applications is available today. Journey planning engines have been used for about 40 years. The first were developed for booking and route planning high value transport, such as trains and aeroplanes, and these are still in use. Now PCs, mobile devices and the internet mean journey planners have become available for public use and other transport types.

Dijkstra's algorithm and graph theory form the basis of route calculations for most journey planners. A route-planning engine calculates a journey in a network based on its nodes and edges, which represent transport access points (stops) and connecting journey options respectively. The edges are given various weights or costs that represent real-world attributes, such as distance and fare. The algorithm selects the shortest possible cost-distance between two selected nodes.

Journey planners initially derived possible routes for travelling that did not take into account transport timetables. Nowadays, transit routes are often combined with transport schedule information in such a way that a different route may be created between the same points at different times. One recent development is the embedding of real-time schedule information in route planning.

Our test

To evaluate what has been done in the past, Intetics analysed the core functions of 35 web-based journey planners. The analysis consisted of planning a journey in each engine and marking the availability of pre-defined

features, as well as noting extra features that are rarely present in similar engines. A list of pre-defined 'standard' features was extracted during the initial research phase and was later used for a wider range of applications.

We also conducted a survey to evaluate passenger opinion of some commonly used functions of route planning engines. The respondents had to define which functions are necessary for route planning and which are redundant. They evaluated journey planner features, ranking them as 'essential', 'useful' or 'not necessary'. 212 people took part in the survey although only 170 replies were valid for further analysis. The survey was set up online and posted on various social networks and GIS/geography-related forums and groups.

87% of the respondents were aged 21-35, and 60% used public transport every day. However, 45% of all respondents had never used a journey planner for public transport routing.

The results

There are several features that many of the planners have in common. Most engines have a map of the area they are serving. This can be implemented in several ways: the map can be used for initial start/end location input, or the services provide text input and the map is only shown with the output route results. Several engines on our list do not have a map in their interface at all.

The majority of applications support choosing the mode of transport for route calculations. Apart from some that only have one type of transport to choose from (for example, buses), certain services do not support a choice of transport mode, although routes can be calculated using several modes of transport.

The next most frequent features are total journey time and total walking distance calculations. These are indeed useful for anyone planning a trip, especially when comparing possible routes and choosing the optimal one.

Another common feature that most engines provide is an embedded timetable of the connections. It should be noted that total journey time calculation ranking second in our rating seems incomplete without an actual timetable.

Another very useful feature of planning a journey is setting default preferences for route search, such as always searching for the fastest/cheapest/least number of connections or little walking routes, but this feature is only present in about half the cases examined.

Lowest in our frequency ratings are some 'advanced' options, such as real-time transport location or delay information. These are rare features but common in more advanced applications.

Survey results

Although a large number of functions received high scores with 50%-80% positive responses, some still stand out as more important. These were mainly features connected to route configuration and the output of final results. The features voted for the most were:

- The ability to choose the start and end of a journey from a map.
- The ability to input and address, point of interest or area name as the start/end of a journey.
- The ability to choose a mode of transport.
- The display of the total journey time.
- The marking of stops on a map
- The display of a transport route scheme on map.

It is interesting that some features not widely used in journey planning applications proved to be desirable. These are: an option to travel via a particular stop, using the current device's GPS location as the start and information on passenger quantity at given time.

Only two features were rated notably much higher by the people that use journey planners: engine customisation, saving travel options to favourites and real-time transport location and delay information.

Overall, all features listed in the survey were voted quite high by the respondents. A threshold of 70% was used as the cut-off for the most popular functions, which narrows down the preferences to nine features.
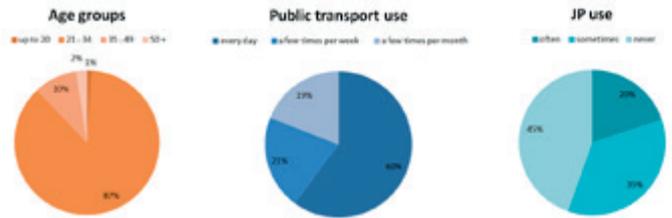

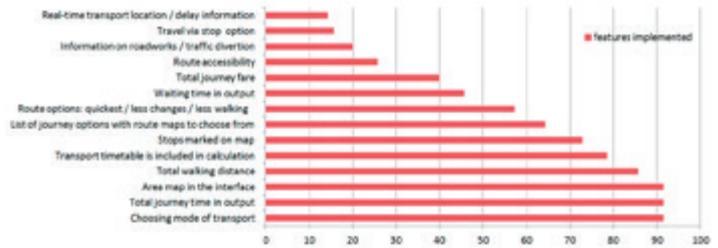
Chart 1 Respondent statistics

Chart 2 Percentage feature implementation for tested services

Chart 3 Generic user rating for different features in per cent. The score was calculated using the following grading system: essential – 1, useful – 0.5, unnecessary – 0

Chart 4 Respondents' evaluation of features

Chart 5 Passenger rating by frequent journey planner users and those who have never used journey planners

Chart 6 Passenger demand for specific features versus the frequency of implementation of these features
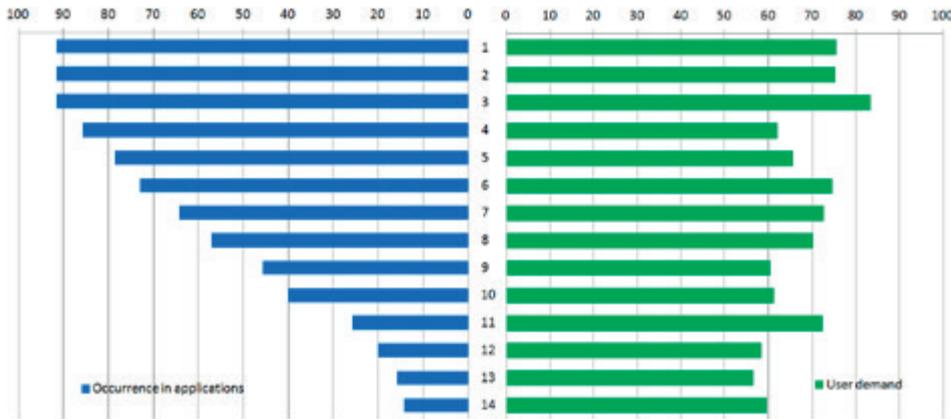
1 Choosing mode of transport
2 Total journey time in output
3 Area map in the interface
4 Total walking distance
5 Transport timetable is included in calculation
6 Stops marked on map
7 List of journey options with route maps to choose from
8 Route options: quickest/less changes/less walking/cheapest
9 Waiting time in output
10 Total journey fare
11 Route accessibility
12 Information on road works/diverted traffic/road incidents
13 'Travel via stop' option
14 Real-time transport location/delay information

■ Occurrence in applications   ■ User demand

Peculiar features

Often the features and style of a journey planner are closely linked to the location (city/country) and of course the users. Often, the peculiar needs of the passengers can be seen from some interesting functions that are present in a journey planner, as the developers try to make their service more suitable and attractive.

In areas where public transport seems chaotic and poorly organised, the journey planners available are similar. Sometimes, it even seems that when the planner has no timetable, it is because the transport itself does not have a fixed schedule.

On the other hand, areas with more developed transport infrastructure with thousands of people moving around every day need a good management system and a good way of communicating with passengers for successful operation. These areas tend to have more evolved journey planners.

Improving journey planners

It's clear that not all the needs of the travellers are being satisfied with the current solutions. However, our research has allowed to envision an improved service that would offer the maximum benefits to users:

Choosing the start and destination of a journey

A potential user can start by typing a known address, point of interest or landmark name, station or stop, or GPS coordinates. A context search feature is available to help the user by providing possible input options. For mobile device users, a choice to use the current GPS location is included as an option for the journey starting point. Alternatively, an option to pin points of travel directly onto the map simplifies the input of the start and end points.

It is also possible to add a stopover to a journey with the specified duration of stay and to exclude specific areas (or routes) from planning.

The option to use the same start/end points in reverse order

Apart from the usual information, the map also contains optional add-on layers for transport routes and stops. Individual stop information is accessible so that a user can click on the stop to access information about other routes passing through it. For tourists and city visitors, default journeys can be pre-set to landmark locations, airport, railway stations and so on.

Customisation

While exploring travel options, the user can use customised settings and create personal default preferences. They can customise options such as choice of transport mode, time and date of journey, route options, route accessibility, or opt for a longer walking distance if it means an easier connection. These preferences can be saved as default user settings.

Alternatively, strictly walking, cycling or driving routes may also be calculated and combined with public transport.

Traffic information can be pictured on the map to avoid congestions. Information on average passenger flow is also available. These two options can be calculated either statistically using time of day and day of the week information together with pre-defined coefficients, or using real-time data obtained from various sources.

Output

The user has enough options to choose from, though the quantity of options is limited to avoid excess of information. Since the journey outputs have common characteristics such as length, total time, price, number of connections and waiting time, the number of necessary options can be easily limited. Every route can be seen on a map as a whole or as detailed representations of each route segment. A comparison table can be created to help evaluate pros and cons of each optional journey. The application can also report road works and accident information.

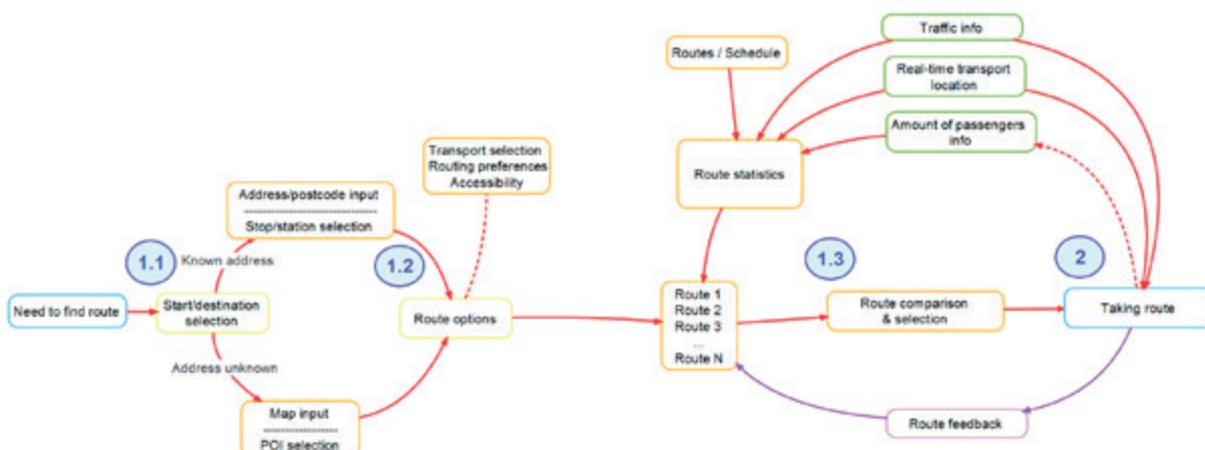Additionally, mobile app users can give feedback about quantity of

Chart 7 Simplified graph of the journey planning process

California's 511 planner allows you to specify stopping off points in journeys

passengers on the route, delays, and so on.

A final route choice can be saved as the default, printed, sent to a friend or shared using a social network. It is also possible to place a widget on other websites, giving the clients information on how to reach a specific business location.

Live timetable information

While taking the route, the passenger can obtain live timetable information about vehicle and connecting vehicle timetables. After completing their commutes, users can give feedback about the whole journey, its specific segments or the mode of transportation. Mailing lists for transport alerts and new options on various routes/stops can further be used to get regular updates.

Conclusion

Without doubt, various locations have their own unique features, so the conclusions made above are very general and may not correspond to the needs and requirements of all passengers. However, an effort was made to include as many of the most common features as possible.

It is likely that public transport will continue to be as important if not more important in the future, especially because of increasing gas prices and growing traffic congestion. Accordingly, journey planning applications will become more important and more adapted to their specific environment. It is important that the complexity and functionality of these services reflects the complexity of the systems they represent, as well as the needs of the people using them.

There is no doubt that expanding and improving the features of a journey planner would make it more useful and user-friendly, and as a result make it more competitive in a fast-paced widgets and apps market. Unfortunately, there is no single recipe for success – different areas and countries will have their own specifics and unique requirements.

In this article, however, we have tried to point out the most commonly required features. The main lesson to remember is no application, no matter how extraordinary and peculiar its features may be, can
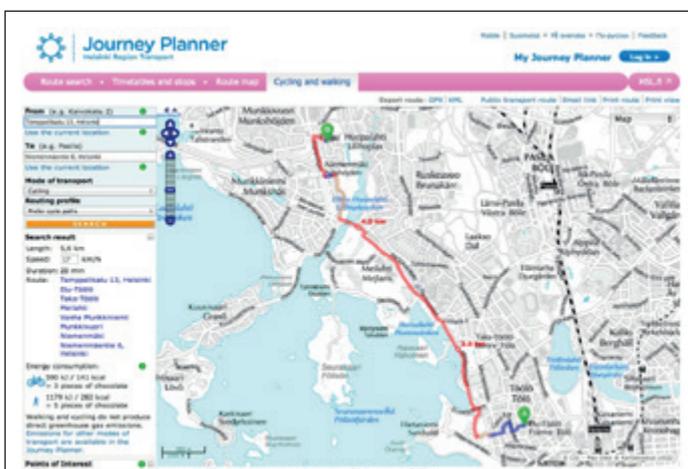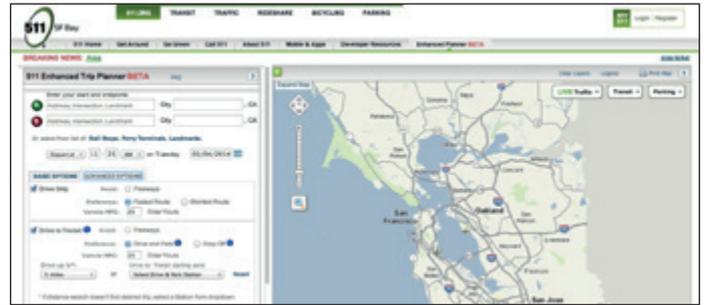
function successfully without the users and without respecting their needs. Only applications that are built around constant communication and interaction with the end-user will provide the most up-to-date information and features and will ultimately succeed in our ever-changing technological world.

ONLY APPLICATIONS THAT ARE BUILT AROUND CONSTANT COMMUNICATION AND INTERACTION WITH THE END-USER WILL ULTIMATELY SUCCEED

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UNIQUE FEATURES FROM AROUND THE WORLD

transit.511.org
The enhanced trip planner includes a combined driving and transit option that allows users to compare a trip of driving to transit facilities, parking or dropping off transit riders there, and continuing their trip using transit, including information (where available) about rates at adjacent major parking facilities.

www.reittiopas.fi
This planner offers an alternative cycling/walking route, including altitude changes of the route and the potential calories burnt.

www.transitlink.com.sg
Allows users to plan a route that only includes vehicles with either card or cash payment options on board.

rusavtobus.ru
Users are able to give a name to a searched route and send it to someone as a present. All users that would search for the same route later can see its name and who it belongs to.

www.plymgo.com, www.stib.be, www.hsl.fi
These journey planners calculate the CO_2 emissions per person of a journey and provide a comparison between different means of transport.

www.atm-mi.it
Provides safety advice for different transport modes.

transport.orgp.spb.ru
Lets you search for a vehicle by its number plate, checking the route it goes on, and where it has been on a given day.

www.transportdirect.info
As well for being one of the first journey planners and still the best one available, this service has some more advanced options, including real-time transport information, detailed directions and statistics for a large number of journeys.

Some journey planners offer alternative information, such as how many calories a cycle journey will be burn