

Local bus transportation in Joensuu city area

LAMI: Location-aware machine intelligence 3621597

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1. Background information

Essays goal is to give information of public transport applications which can be used in Joensuu area. Also one of these applications is going to be evaluated more specific way. Essay contains also ideas what benefits multi agent transport simulation could give to city of Joensuu and its service producer as well. I didn't have too much substance information of mass transit area, because my house is like 1km away from the Joensuu city center. I usually walk to my work or use own car and I use mass transit services like 1 or 2 times per two months. When I use bus, I have both my children's (which are known also as gremlins) with me. Reason is that they find it is so cool or they are excited that we are in buss like 3 minutes. First thing what I noticed when I started to do this essay were, people who does not understand the substance they make assumptions. Like in this essay, I tried to define mass transit application and created bus stop event, that contained variables and those variables made the bus stop time. I had like 3 pages of text and images of this event and then I took contact to Jani Hietala. He works in Savo-Karjalan Linja Oy as a manager of the local area traffic. One of his tasks is to evaluate and design routes with cooperation with city of Joensuu. We had 3 different conversations with Jani and all those conversations gave more understanding of this subject to me. Conclusions of my first assumptions was, that I removed those 3 pages from this essay. Also I used Radus knowledge via emails and his answers were also there to guide and refine this essays content. As the essays process progressed, we adjusted the skeleton as well.

References are courses papers;

G. Rabbi *"Public transport applications for smartphones"*, 2018

T.C.T. Ho and P. Fränti, *"Multi-Agent Approach Traffic Forecast for Planning Urban Road Infrastructur"*, pp - 1806 IEEE, 2018

1.1 Overview of three mass transit applications

In this section reader get information from available applications. This chapter is overview of these applications. First application is nationwide Digitransit project, that runs on website. Project is funded by ministry of transport and communications. We can get information of Joensuu local area busses on the following webpage <https://joensuu.digitransit.fi> . The first part of the URL is name of the city. User can change the name on that city, which mass transit timetables user want to look at. We will get back to this application later this essay.

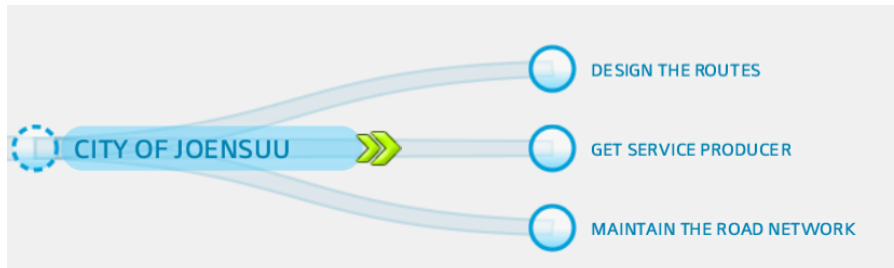
Another application is Moovit which is global application and it can be downloaded via Google play. It contains bus and train timetables and routes. It can be used in different countries and cities. Finnish users has given critique that timetables isn't accurate, which gives idea that time tables isn't updated frequently if some changes on schedules occurs. Application webpage give information that it has over 300 million users. This application is meant to be used in big cities or capitals like in example London or Paris. (<https://play.google.com/store/apps/details?id=com.tranzmate&hl=fi>). Golam Rabbi thesis Public transport applications for smartphones, contained information of Moovit application. He made survey which evaluate the usage of Moovit on scale 0-10. Survey had 18 participants and they evaluate the usage 7.5 and accuracy 6.5.

Third application is Nysse -and it is available on Google play and also in Windows store. Applications works in Helsinki, Joensuu, Jyväskylä, Kuopio, Lahti, Tampere, Turku and Oulu. Application illustrates routes and schedules. In Google plays applications information sites, feedback section includes mainly positive comments but also critique occurs in timetables accuracy. Buss timetables and routes is more accurate than Moovit application. The reason is that Nysse illustrates information only for 8 different cities of Finland and that means. Nysse's Google play page gives an idea that it is developed by Hannu Tapanila. So it seems that is one man's application. If we compare Nysse and Moovit they are meant to different markets. Moovit is global application and Nysse is local application. This means that it is easier to maintain timetables which has only 8 different sources that gives developer the time tables. (<https://play.google.com/store/apps/details?id=io.hannu.nysse>).

Im not aware how these applications collect or what sources they use to get time tables. My conclusions are that reliable timetables are related to number of the sources. Complexity grows as the amount of the cities increase in application. Timetables sources are vital to get accurate information to user. In Finland we need these kinds of nationwide projects to get things almost identical between our cities. When the ministry leads the project, there is hope that cities are involved to project. Because ministry usually has some work group which task is to evaluate how their projects progress. Digitranist work group could have goal like; users all over Finland should have equal opportunity to use this kind of services. I've been involved in past 9 years ministry of justice nationwide work groups as a chairman, member or expert so these comments is reflected to my own experiences.

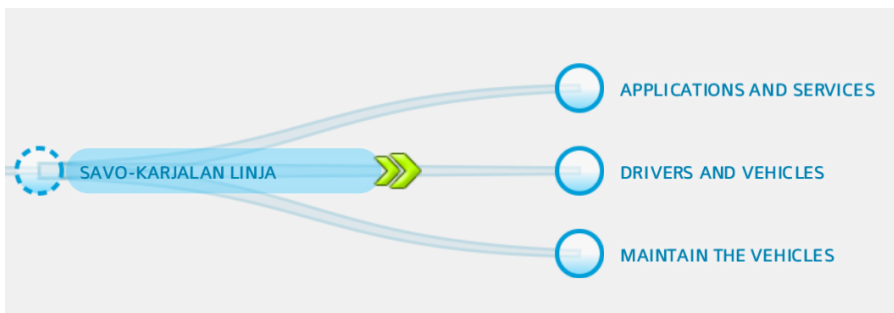
1.2 Identifying the stakeholders and their responsibilities

First part told us what the available applications are, but this section of the essay looks closer to the environment where the applications works. This essays third party members are city of Joensuu and Savo-Karjalan linja, which operates the buss transports in Joensuu city area.



Picture 1. Overview of city's bus transportation responsibilities

Picture one illustrates some of the city's responsibilities, like their task is to organize buss transports to its inhabitants and also tourists. Service provider is selected in every 4-7 years and then the staff of the city ask offer sheets from buss transit service providers. There is some time scale to give offer sheet and when the scale is closed, they evaluate and decide who is the service producer for those years that city and service provider staff have agreed. Savo-Karjalan linja has been service provider since 2014. Stakeholders are vital to recognize, because the customer of these kind of applications is city of Joensuu not their service producer Savo-Karjalan linja.

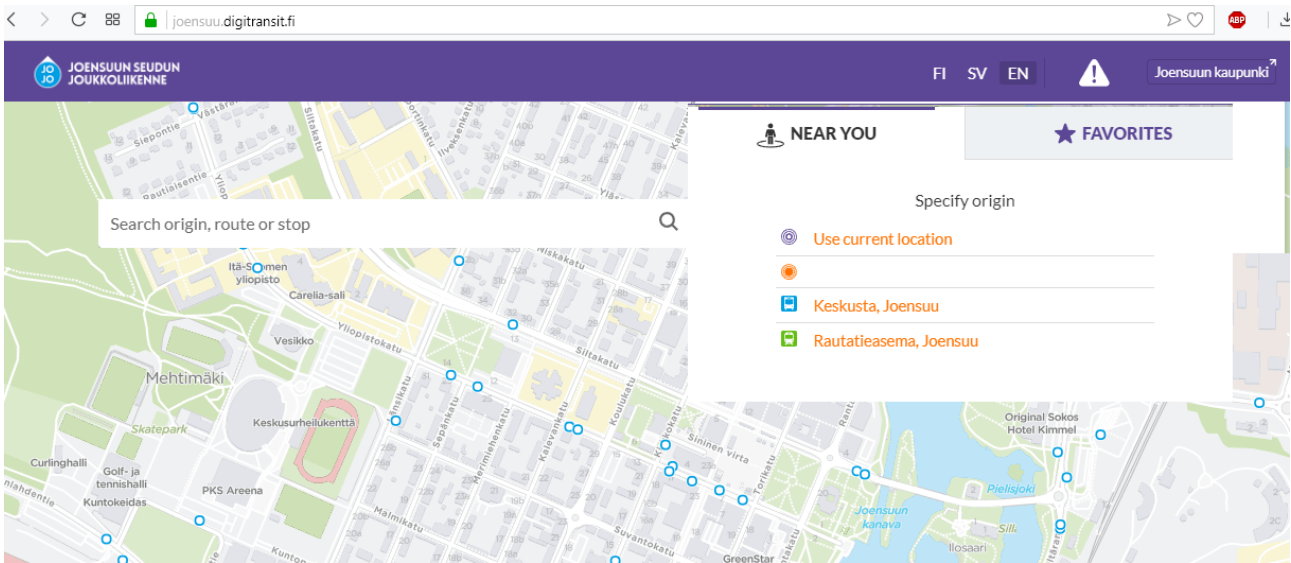


Picture 2. Savo-Karjalan linja's bus transportation responsibilities

Picture 2 shows that responsibilities of service producer are to arrange busses and drivers to routes as they have agreed. City of Joensuu and Savo-Karjalan linjas staff have few meetings per year and they can also be arranged if needed. In these meetings they example evaluate the routes by traffic. Their contracts can contain information of application or devices which should be used in busses, also this kind of things can be agreed in meetings.

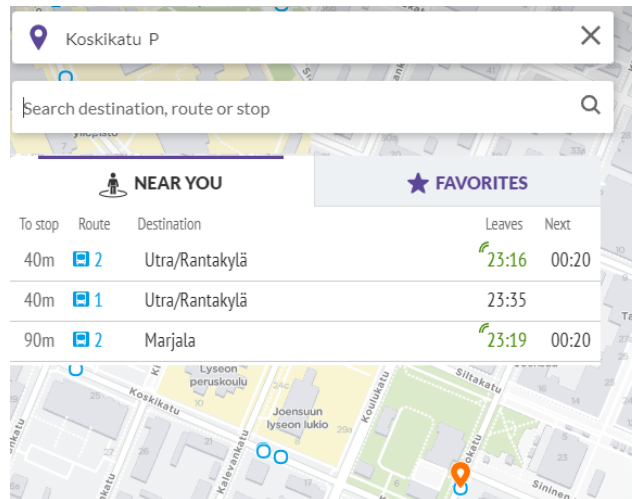
2. Evaluation of digitransit service

Digitransit service is browser-based application which works on computers and smartphones. Service uses OpenStreetMap interface as their 2d-platform. In picture 3 there is a screen capture from the digitransit service. Picture illustrate that the service has option panel where user can choose own location. When user go to the site from computer, application traces user location via ip-address. If user uses smart phone it need gps-signal to detect users location and when user goes to site via smart phone first time the service gives notification to add shortcut to users smartphone. Digitransit service is also open for developers, like Golam Rabbi find out on his thesis and his Mopsi next buss case. He listed three different location providers in his thesis, and they were; GPS provider, network provider and passive provider. He stated that GPS and network providers together gave the best accuracy rate together. Sometimes gps-signal has disruption and that's why there should be also be possibility to use network provider as well.



Picture 3. Screen capture of digitranist service

We can see nodes on picture three and they are bus stops. These nodes are objects and by clicking the node user gets information like when next bus arrives to stop and what route options bus stop has. There is also chance to look just bus stops timetables. Savo-Karjalan linja busses has new devices like tablets and they have possibility to send gps-signal to server and server refines signals to digitranist. On the next page there is picture 4, that shows busses which send the signal has own symbols on column "Leaves".



Picture 4. Gps-device on and off

Worst case scenario is that the value of *Leaves* time is wrong, because it means that customer has to wait next available bus on the bus stop. I made question to Jani, that has there been any feedback from customers because of signal values. They haven't got this kind of feedback from customers. Bus stop node detects the bus from 15-meter range. When user tap on to row where route values are, service shows the whole route on the map and every stop that route has. Jani said that there aren't any more routes which would go on circle, because now days all routes go a to b and back to a. They are like metro or train routes and perhaps they are more user friendly than circles. Because user has two option to enter in bus if it go a to b and back to a. Over all digitranist service seems to be very good application and it gives benefits to user, but it can be used as developers as well.

I also asked the opportunity to have buss icons on live to the map, because busses already send gps-signal. Jani said that there is company which offers this kind of product and its name is Mattersoft Ltd. City of Joensuu uses this kind of service, but Jani said that he isn't aware when this kind of service is available for users. Also Mattersoft offers services that traffic light gets signal from the busses and it priorities busses over the other traffic. Ambulances and polices use this kind of technology. Local Yle news told on January that city of Kuopio uses this kind of technique in their city area busses. Jani said that it would need another device to use this kind of services and now they have decided with cooperation with city of Joensuu that at this point they decline to use this service (<http://en.mattersoft.fi>).

3. Multi agent transport simulation

Researchers Thomas Ho Chee Tat and Pasi Fränti examined possibility to simulate the behavior of traffic in Joensuu. They used multi-agent simulation (MAS) to evaluate, how the new bridge called Sirkkalansilta will affect to traffic behavior. The agents of studies were cars. Each car had own attributes like starting and ending position and time as well. MAS environment were Joensuu region and it used OpenStreetMap as a ground area. Simulations were made on morning and evening time. Pasi and his researcher college made multi agent simulation where they evaluate, how new Sirkkalansilta bridge affected to traffic behavior. Researchers got simulations results which illustrated that new Sirkkalansilta bridge reduces usage of the other three bridges as they were expected. They find out that Suvantosilta had the most traffic and removing it would affect on all other 3 bridges. Researchers were satisfied the results and claimed that MAS is useful planning tool. Researchers conclusion gives idea that MAS could be used also as proactive tool to prevent or evaluate different kind of scenarios before they occur. On below there is some list of what these scenarios might be;

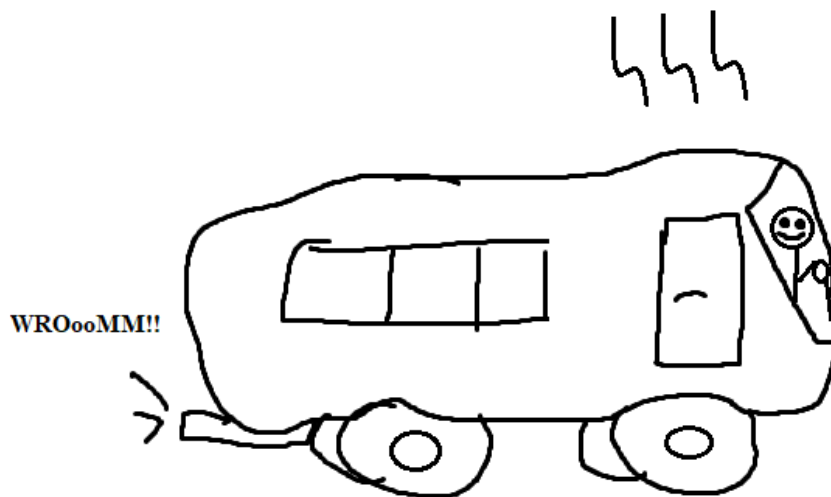
- New bridge (obviously)
- New residential area (how to make road network to new area -> evaluation of the location)
- Road network maintaining like in example construction zones (part of the road is not available)
- Creating plan B for winter season, if snow interrupts the traffic.

Above ideas were from the city of Joensuu perspective. I also asked from Jani, what benefits this kind of simulations would give to their company. He said that they has 150 busses on routes per day, because they are service producer also with municipalities like in example Kontiolahti, Polvijärvi and Outokumpu. Jani said that it is quite impossible to draw these busses to map via pen and evaluate does some of the busses drive same routes like in 15 – 30 minutes scale. They would benefit simulations where the agents were busses and they have attribute average speed. Agents should have own nodes as a route, where they move on. There should be possibility to increase or decrease average time as well. Average time can be recorded in real life route scenarios, like in example 10 route times per month could give one month's average time. By evaluating the months there would be chance to do season average time and simulations as well. There is no need to put other agents than busses on the map in this kind of scenario and busses does not need to do stops in simulation because the stops are already on real life records. So to use real life average time in simulation would be just fine. To get more out of this idea, there is same kind of simulation in

<https://matsim.org/gallery/seoul>. Model was created in 2012 with cooperation of two different university researcher. On videos part 1.32 there is map where agents are on their routes. In this buss scenario there would be same kind of map and routes also in different colours, but only one agent on the route.

3.1 Conclusions

I'm not aware if city of Joensuu already has tools to evaluate the changes and those examples were just my visions how this kind of technique could be used. Savo-Karjalan linja instead would get benefits from defined simulation. Further ideas and this essay main conclusion are that this defined scenario could be a topic of project work or thesis. Jani said that they would have the interest to collaborate with the University to create defined model. So I will leave it to you Radu and also Pasi!



Picture 5. Thank you and see ya!