A Mobile Application for Transportation Management and Trip Planning in Rural Sarawak, Malaysia.

Vong Wan-Tze [1,*], Mohamad Yuzrie bin Khalid [1], Valliapan Raman [1], Patrick Hang Hui Then [1]

[1] Faculty of Engineering, Computing and Science, Swinburne University of Technology Sarawak, Malaysia

Abstract. Many rural areas in Sarawak, Malaysia, have limited public transportation systems and poor road networks. Rural residents rely heavily on their own transport and informal transport services such as shared van for their mobility needs. Besides, many rural villages are characterized by limited employment opportunities, causing rural youth to increasingly migrate to cities. There is a lack of a one-stop digital platform to facilitate the connection between rural and urban communities, and to promote the creation of socio-economic values for rural communities. A mobile application is proposed in this article with the intention to: (1) improve the accessibility of information for transportation services and trip planning in rural areas; and (2) empower rural residents to become self-employed transportation service providers of their communities. The ultimate goals of the application are to increase the accessibility of information for transportation and travel-related services in rural areas and to create good-paying employment opportunities for rural workers. A digital inclusion strategy is presented in this article, along with a description of the design and development of the mobile application.

Keywords; digital platform; rural area; socio-economic; transportation; tourism

1. Introduction

Transportation helps rural people to connect with those living in urban areas. A good transportation system also helps facilitate socio-economic activities such as transportation of rural agriculture produces to the market and encouraging travelers to visit rural attractions. However, many rural areas in Sarawak, Malaysia, are characterized by limited public transportation services and poor road networks. Up to 52% of the population in Sarawak lives in rural areas [1]. The rural population is distributed in more than 6000 small villages over a vast geographical region with rugged terrains [2]. Besides, many of the villages are isolated by numerous rivers and dense forest, causing rural residents to rely on their own means of transport (such as pick-up trucks) and informal transport services (such as shared van and boats) to travel from one place to another [3]. Besides, the rural population in Sarawak is made up mainly of indigenous Dayak. Some of them are working as laborers in the mining, oil palm, timber and construction sectors in small towns, while others are faming and selling crops to make a living [4]. A recent national survey reported a higher poverty rate, lower education attainment and lower labor force participation rate in rural areas, as compared to urban areas in Sarawak [5]. Many rural young workers are increasingly migrating to cities for better employment and living standards, leaving behind a disproportionately aged population [6]. The continuous rural-to-urban migration of young workers and the poor rural-urban linkages due to poor transportation systems can widen the socio-economic inequalities faced by those living in rural areas.

Digital inclusion is defined as using technology as a channel to improve skills, to enhance quality of life and to promote economic well-being across all elements of society [7]. Those who remain digitally excluded have been shown to be more likely to experience an increasing level of socio-economic inequalities [8], [9]. In Sarawak, the impact of digital inclusion on the socio-economic condition of rural population has been narrowly studied. Besides, there is a lack of a one-stop digital platform to help visualize the transportation system and improve the accessibility of travel-related information in rural areas. In this project, a digital socio-economic platform is developed to facilitate the process of digital inclusion in rural areas. The platform is intended to strengthen rural-urban linkages by improving the accessibility of travel information for transportation management and trip planning, and to empower rural residents to improve their economic status by working as self-employed transportation service providers of their communities. The strategy is expected to increase the use of mobile technologies by rural communities and facilitate the creation of new values, particularly transportation services and tourism development, for socio-economic development of rural areas. Section II of this paper describes the digital inclusions strategy proposed in this project, followed by the development process, process flow and some key features of the digital platform in Section III. The challenges and future directions of this project is discussed in Section IV.

2. Project Planning and Implementation

A digital inclusion strategy is proposed to bring positive changes to rural communities in Sarawak., as shown in Figure 1. A digital socio-economic platform, which include a mobile application and a web-based management system, will be developed to increase the number of digitally included in rural communities and empower them for socio-economic benefits. The targeted objectives of the platform are three-fold. Firstly, the platform will provide information about public transportation services (such as ferry and express boat terminals, bus operators and the schedule of bus services) and informal transport services (such as pick-up trucks and shared vans). The purpose of these features is to improve the accessibility of public and informal transportation services information in rural areas, in order to ease the finding of transport and strengthen rural-urban linkages for socio-economic activities. Secondly, up-to-date travel-related information such as homestays, cultural activities, tourist attractions and basic community facilities in rural areas will be included in the platform. These features are intended to improve the accessibility of travel-related information, in order to promote eco- and community-tourism in rural areas and to provide an online channel for rural travellers to obtain reliable and accurate information for trip planning. Lastly, the platform will provide a gateway for rural residents to earn extra income by working as self-employed transportation service providers of their communities. These features are intended to be used by rural residents to provide transportation services for travellers and to support the delivery of rural products to the urban markets. In short, the digital socio-economic platform is meant to be useful for rural residents to get involved in transportation services and rural tourism, and for rural travellers to do transportation and trip planning and to gain access to tourist attractions, facilities and services in rural areas.
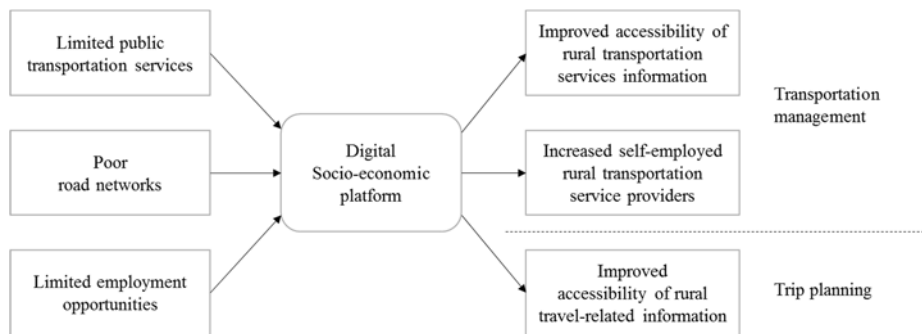

Fig. 1. A digital inclusion strategy for transportation management and trip planning

The implementation plan of the project is divided into three parts. The first part involves the collection of data for the mapping of public and private transport services, and tourist attractions, facilities and services in rural villages for content development. This is to be achieved by recognizing and classifying the patterns of human daily activities such as transportation, eating, entertainment, recreation and farming among the rural villagers. The content development activities have been and will continue to be conducted in rural villages located in three different regions of Sarawak (Padawan, Asajaya and Singai) until the end of 2018. Storyboards will also be developed to share

the concept plans with the stakeholders. The second part focuses on the design and technical development of the digital platform. It is important to note that we are currently in the early stage of developing the platform, which includes a mobile application and a web-based management system. The platform is to be developed using several web and mobile technologies such as HTML 5, JavaScript, clouds, maps APIs and database systems. The design and process flow of the platform is presented in the following section, along with some features that have been developed for the mobile application. The last part of the project, user acceptance testing (UAT) will be performed to ensure that the platform meets the objectives of the project and its features satisfy the needs of users. The platform will also be made available for all users in order to test whether the platform is operating well in a real-world environment. Phase 2 and Phase 3 will be carried out iteratively to test the design, functionality and user-experience of the platform, until it is officially launched.

3. System Design and Features

The platform is a combination of a real-time web application and android application. To ensure the system is highly readable and maintainable for the developers, the java modules are separated to match MVC structures as much as possible. The platform is separated into three parts, two android applications; one for passenger and one for driver; one web application for service provider to act as a moderator to ensure the accuracy of the information provided through this platform. All the data is served from a web application via REST API and Pusher service for real-time interaction. Figure 2 shows the process flow of the system between the user groups.
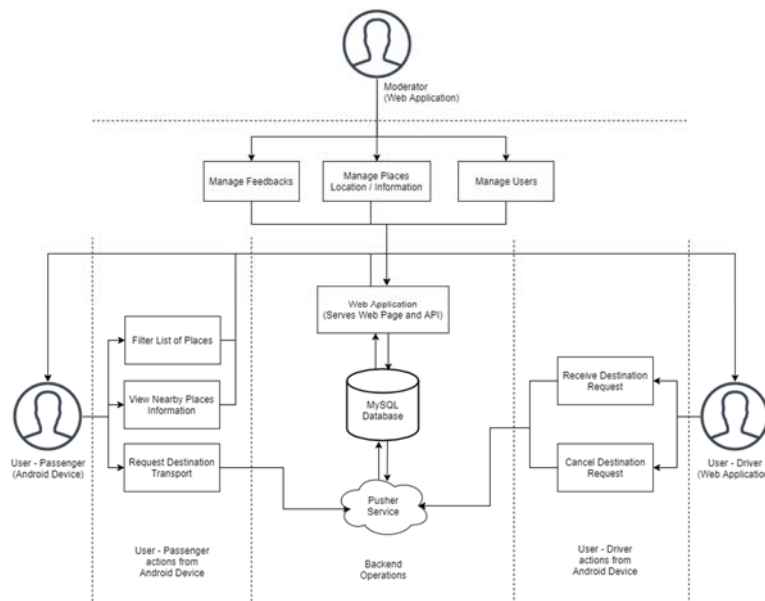

Fig. 2. System process flow between user and service provider

Some features of the platform that have been developed are explained as follows:

- View location information: This platform shows the available locations on the map. It intends to help tourists and travellers to go to nearby places of which can be tourist attraction spots, health facilities, shopping complexes, and more. These locations are added into the database by the moderator through the web application interface. Moderators are needed to ensure locations placed on the map are correct and contains updated information. Figure 3 shows the example of the location information, the nearby places and "Get There" button to show the transportation information.

- Filter list of places: The map is intended to show as much information as possible for the users to make trip planning easier for tourist and travellers. The map filtering module will fetch the map data based on the location tags to prevent the map to be too cluttered and make it easy for the users to plan their trip. The tags such as tourist attraction spots, health facilities and shopping complexes will be managed by the moderator from the web application interface.

- Request Destination Transport: Figure 4 shows an example of the flow to request a transportation. The transportation menu (middle screenshot) appears after the user clicks on the "Get There" button. Choosing Taxi will show the route from current location to exact destination. Choosing Bus will show the nearest bus on the route and nearest bus stop. Choosing Others will show other possible modes of transport available as set by the moderator onto the location from the web application. After confirming the request, a signal will be sent from the server to the nearest available Taxi driver and if he accepts, the routes on the map will be updated to show the route from the Taxi to current location marker with a blue marker.

- Receive, Accept and Cancel Destination Request: The Taxi driver will use a separate android application to receive request signal. After a user confirms a request, a signal will be sent from the server to the nearest Taxi driver. The driver application must be active to receive the signal. The Taxi driver can choose to accept or reject the signal. If rejected, the signal will be passed on to the next nearest available driver. If more than 5 drivers rejected the signal, the application will stop searching for drivers and pop up transportation information as if the user clicked on Others.
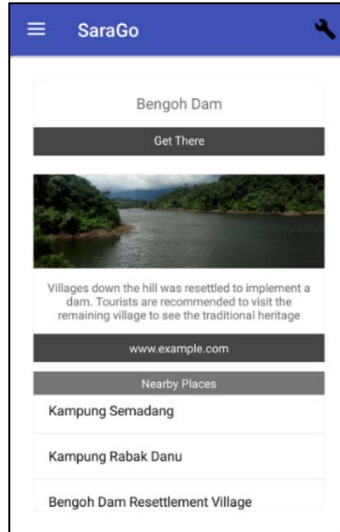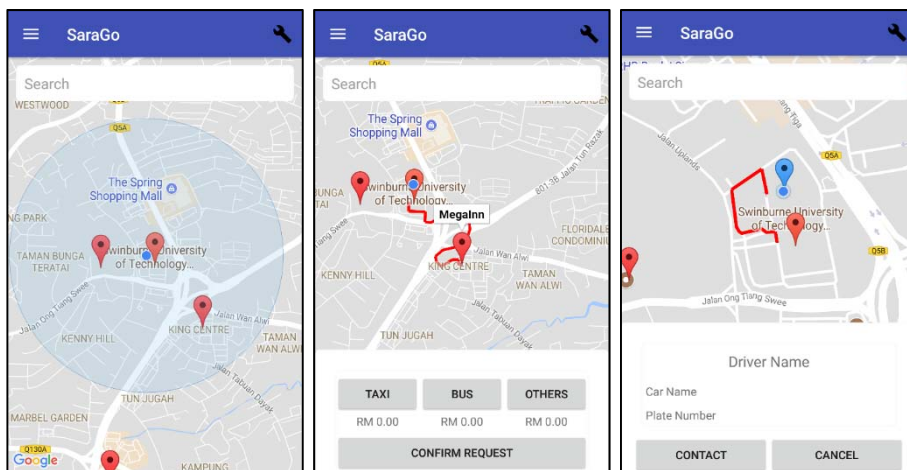
Fig. 3. A marker shows location information

Fig. 4. Requesting a transport to get to a destination by Taxi from Swinburne to Mega Inn

As the application is in a very early stage of development and more modules will be added soon. Some of the modules include a payment module to manage the payment transaction, a scheduler module to book the transport at an earlier time and an emergency button to alert the moderator in case of suspicious activity or vehicle breakdown.

4. Challenges and Future Directions

The key challenges to the deployment of this platform and the possible solutions for each challenge are discussed below.

Firstly, drivers on standby at the rural area may not receive the requests due to the unavailability of internet connectivity at some parts of the rural areas. Sending the request signal using Short Messaging System (SMS) may extend the connectivity but issue persists when certain areas have no internet connectivity nor phone line. Future research in low powered wide area may produce solutions that can transmit the request signal without internet connectivity and phone line.

Secondly, although the location marker can be placed onto the map, some roads are incomplete or pass through the sea. For this case, current solution is to disable the transportation services and only provide transportation information. Another possible solution would be in the form of a more interactive location information however to generate a custom interactive content for every location would be very difficult.

5. Conclusion

The connection of rural communities in Sarawak with those living in urban areas is hampered by limited public transportation systems and poor road networks. Some rural communities have developed their own informal transportation systems (such as shared vans and pick-up trucks), while some depends on their own transport, in order to travel from one place to another. In addition, the lack of employment opportunities causes rural young workers to increasingly move to urban areas for better living standards. A digital inclusion strategy is proposed to facilitate transportation management and trip planning in rural areas. A digital platform is to be developed to improve the accessibility of information about transportation and travel-related services in rural areas, and to empower rural residents to have become self-employed transportation services providers. The anticipated outcomes of the project include: (1) an increase in the uptake and use of mobile technologies in rural communities; (2) an improved accessibility of both public and informal transportation services in rural areas; (3) facilitating transportation services for travellers visiting rural areas and the delivery of rural products to the markets; (4) promoting the creation of good-paying jobs for rural workers in order to improve their economic status; and (5) stimulating the growth of eco- and community-tourism in rural areas.

Acknowledgment

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