2015 4th International Conference on Interactive Digital Media (ICIDM)
Desember 1-5, 2015 Bandung - Indonesia

Designing Gamification for Taxi Booking System (Case Study: Bandung Smart Transportation System)

Supriyanto[*1], Hilwadi Hindersah[*2] and Ary Setijadi Prihatmanto[*3]

[*]*School of Electrical Engineering and Informatics*

Bandung Institute of Technology, Ganesa Street 10, Bandung 40132, Indonesia

[1]supri06yanto@gmail.com

[2]hilwadi@lskk.ee.itb.ac.id

[3]arysetijadi@lskk.ee.itb.ac.id

***Abstract*— Traffic congestion is one of the main problems in the transportation system. This continues to happen because road capacity is no longer able to accommodate the number of vehicles, while the number of vehicles continues to increase every year. Based on statistical data sourced from the Indonesian National Police, the number of private vehicles increased significantly each year. People prefer to use private vehicles to travel. Security issues, comfort, and travel expenses flexibility are the reason they prefer to use private vehicles.**

Taxi should be a solution for them, because taxi is more flexible, convenient, and safe compared to other public transportation. But the problems of security and ease of access that back into obstacles. Bandung Smart Transportation System (BSTS) is present as one of technology Intelligent Transportation System (ITS) use Bandung City as a case study. BSTS is a system developed with the aim to collect all traffic information integrated with the transport system infrastructure and manage information centrally.

This research discusses the designing of gamification system in a taxi booking service. Aims to increase the interest, motivation, loyalty and further the public to continue using BSTS and use public transportation. If peoples more interested in public transportation, expected to reduce the use of private vehicles. So the number of vehicles can be reduced and traffic arrangements can be run better as it can be ascertained that the drivers on the road is a professional driver.

***Keywords*— : Intelligent Transportation System, taxi booking service, gamication, traffic congestion, traffic control.**

I. INTRODUCTION

Traffic congestion is one of the problems that arise in the transportation system. Traffic congestions are basically caused by road capacity can no longer accommodate the number of passing vehicles. In addition, there are other factors that cause continuous traffic jams occur and the more difficult to resolve. These factors include the increasing tendency for people to use private vehicles due to safety issues, the convenience and flexibility of public transport.

This phenomenon may continue to increase the number of vehicles, making it increasingly difficult to control and traffic management. Increasing the number of road users also enables increased traffic violations and crimes on the street. A study on the transportation mention that traffic offenses which cause more accidents carried out or caused by drivers who are not professional than the professional drivers, namely the taxi and other modes of public transportation drivers[1].

Taxi is one mode of public transport that is flexible, convenient, and easy to get, because it does not have a fixed route and are not limited by the operating hours. Efforts to improve the facilities and taxi services are already done, such as fleet renewal and fast booking service. But has not been able to increase public interest to use a taxi.

Taxi booking service is one form of technology in the Intelligent Transportation System (ITS) which aims to reduce private vehicles and accompanied by a reduced number of drivers who could potentially commit a traffic violation. Control and regulation of traffic is increasingly easy to do because every taxi unit can be detected through the application, and you can bet that there are vehicles on the road the amount of control and driven by professional drivers. The problem arises in the application of taxi services, due to the lack of community participation for use.

Therefore required an innovation is the application of gamification in the service. The aim is to encourage certain behaviors and motivate the users of the system, in this case would be used to encourage people to use public transportation via taxi booking service. Taxi booking services integrated with location-based social media applications. This enables taxi service can be used easily, fast, and fun[2].

II. BACKGROUND

2.1 Intelligent Transportation System

Intelligent Transport System (ITS) is to integrate road users, transportation systems, and vehicles through a system

978-1-5090-1669-3/15/$31.00 ©2015 IEEE

of information and communication technologies as well as help the transportation system as a whole to work effectively and efficiently[3]. The main goal of ITS is to reduce traffic congestion, improve traffic safety, increase the effectiveness of travel and increase productivity without having too much development or infrastructure changes to the transportation system. ITS has several sub-areas[4] as follows.

1. Advanced Traveler Information System (ATIS).
2. Advanced Traffic Management System (ATMS).
3. Advanced Public Transportation System (APTS).
4. Emergency Management System (EMS).

The number of motor vehicles in Indonesia in 2008 to 2013 according to the State Statistics Agency sourced from the Indonesian National Police are shown in TABLE I.

TABLE I

NUMBER OF MOTOR VEHICLES IN 2008-2013

Year	Car	Bus	Truck	Motorcycle	Number
2008	7489852	2059187	4452343	47683681	61685063
2009	7910407	2160973	4498171	52767093	67336644
2010	8891041	2250109	4687789	61078188	76907127
2011	9548866	2254406	4958738	68839341	85601351
2012	10432259	2273821	5286061	76381183	94373324

Passenger cars and motorcycles have added a significant amount in each year. It concluded that, public interest in modes of transport continue to decrease and causing the volume of vehicles on the road increased. Therefore, this study discusses more about Advanced Public Transportation Management System (APTMS).

ITS overcome the problem of lack of information on public transportation or in certain circumstances it is too much information and open about public transportation, the ordering process is difficult, and communication barriers between modes of transport with the manager[5]. Furthermore, intelligent mobility solutions and management of demand for public transportation are both very important to reduce congestion. The new technology aims to ensure the number of vehicles in accordance with road capacity to contain it.

Lately started to develop some innovative system based on social networks such as ridesharing, CarSharing, and TaxiBooking. The system is based on the interaction between users or between users and drivers of public transport modes that aim to improve the efficiency of travel, speed up the exchange of information, increase public participation.

2.3 Gamifikasi

Gamification is the application of game elements in activities that are not based game. Aims to motivate users into doing extra activities in the activity to obtain certain benefits[2]. More specifically, gamification aims to increase user engagement, increase user motivation to perform activities that exist in the system, increasing the interaction between users, and increase user loyalty. Fig. 1 is the stage of system design gamification called gamification D6 Design Framework[6].

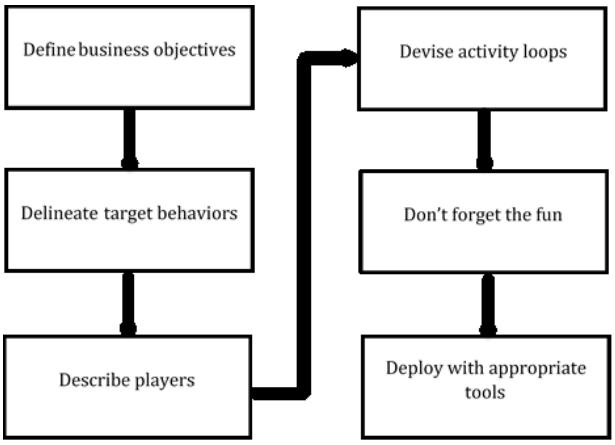

Fig. 1 Gamification Design Framework[7]

Gamification has four main components[8].

1. Points is something that users get every activity or specific conditions.
2. Rewards is something that users get is based on the amount of points that have been obtained.
3. Badges that is something that is used to indicate to other users that the player has reached a certain status or level.
4. Leaderboard is a model that is used to indicate that the ratings of users to be monitored by all users.

The fourth application of the above components correctly can result in a system where participation, loyalty and motivation can continue to grow. The idea is to create a cycle of gaming activities in a non-gaming system, as illustrated in Fig.2. Activities begin from activity challenges predetermined victory condition. Whenever the user reaches the destination, it will receive the award which is usually made in the points system. Based on a point system, then be ranked in order to motivate more users won the challenge, which ultimately resulted in the change of status of users in social networks.

Fig. 2 Gamification life cycle[9]

The application of gamification can be seen in some of the social networking system. At the Foursquare application, users will be awarded Newbie when first using the application. The predicate will continue to increase in line with the number of "check-in" is done, the predicate is designed as an enticement to encourage people to use Foursquare. Although they did not get the rewards are real, but the design of the title is enough to attract people to use it[10]. This proves that, gamification can increase the involvement and enthusiasm of a person to perform certain activities.

Gamification is also used in ITS, with regard to interest, people's desire to use these technologies. An example is the system Ride Sharing, the system is trying to cope with traffic problems with the concept of sharing the vehicle and fuel costs. Vehicle owners can share a vehicle with other people who have the same destination. The concept of social networking these systems lies in the interaction between vehicle owners and others looking for a vehicle. Gamification visible from points and level of each user, whether the car owner or the passenger.

III. ANALYSIS AND SYSTEM DESIGN

Gamification design taxi booking system using gamification D6 Design Framework[6].

3.1 Define business objectives

Business objectives of gamification on taxi booking service is as follows:

a. increase public interest in order to use the taxi booking services;
b. increase motivation and loyalty of the public to always use the taxi booking services;
c. increase competition among taxi drivers.

3.2 Delineate target behaviors

Target user behaviors is as follows:

a. booked taxis thereby increasing the points;
b. provide an assessment to the taxi to enhance the reputation of himself;
c. taxi drivers are always in a condition to log into the system to get a taxi booking;
d. taxi drivers improve service and maintain the facilities to get a good assessment of passengers.

3.3 Describe players

Players / users of the system is the passenger and taxi drivers. Passengers are all road users who do not drive a vehicle. While taxi drivers are all taxi drivers who drove the official taxi or taxi company who owns the number.

3.4 Devise activity loops

There are three sections in each scenario user activity, namely: activities that must be performed by the user, why users should do and reaction/ answer given by the system related to user activity. Scenario user activity is divided into user activity Semut App scenario as a taxi passenger as shown in TABLE II and user activity scenario Semut Taxi as a taxi driver shown in Table III.

TABLE II

ACTIVITY SCENARIO FOR TAXI PASSENGER

No	Activity	Objective	System responses
1	Booking taxi by logging into the condition Semut App	Passenger data is indispensable when making a booking taxis. Then to make a booking, passengers must be registered and logged in a state.	If logged in, the system continue the process of finding the nearest taxi. If not, the system gives a warning for users to logon.
2	Passengers wait for the process of finding a taxi.	The system looks for a taxi around the passengers. It takes 60 seconds to perform a search.	The system displays the countdown animation, which shows the time needed to find a taxi that is 60 seconds.
3	Passengers cancel the order when the search process or when existing taxi who took the order.	Provide facilities for cancellation for any reason. Like do not agree with the taxi taking, or tired of waiting for a taxi when the search process	The system gives a negative reputation as much as 1 to passengers by giving notification of the approval of the cancellation of the order.
4	Passengers provide an assessment to the taxi drivers and taxi facilities provided.	Giving an assessment to taxi to not only compete for the passengers but also compete maintain his taxi service and facilities.	The system gives 1 positive reputation for each assessment carried passengers.

TABLE II

ACTIVITY SCENARIO FOR TAXI DRIVER

No	Activity	Objective	System responses
1	The driver is always enabled applications and are always in a state of login.	Facilitate the search for the last location of the taxi to broadcast the order entry.	The system gives 1 point every 24 hours to the taxi driver.
2	The identity of the driver set that displayed complete with the actual photo.	Provide complete information to passengers.	The system gives 100 points to the taxi driver.
3	Driver racing with other taxi drivers take incoming orders.	Provide good services to passengers. So that passengers willing to give a good assessment.	The system give 5 points to the taxi driver.

3.5 Don't forget the fun

An element of fun is reflected in the use of gamification components namely points, badges, levels of reputation. Semut App users can increase the number of points they have to book a taxi. Semut App users can also enhance the reputation of which is owned by conducting an assessment of the taxi used every time you make a reservation. The driver has a reputation that should be improved. Reputation taxi drivers will rely heavily on the judgment given by the passengers and the number of points collected. In addition to reputation, taxi drivers are also awarded points that can be collected by performing certain activities. The number of points can improve the reputation if above a certain level.

3.6 Deploy the appropriate tools

Gamification system integrated with Semut applications that are part of the system BSTS. It has been explained earlier that the Semut App is a location-based social networking application. Integration with social networks aims to facilitate access to taxi booking services and accelerate the distribution of taxi booking services, so that the number of users can be increased more quickly. Semut App use components awarding points and badges are realized in the form of tiers in the form of the predicate. Points Semut App users increased 5 points if completed an order and transaction taxi service. Predicate users changed for the better as the number of points. Taxi drivers use a different application to the passengers, the application adapted to the activity of driving to avoid activities that could interfere with driving. Taxi drivers use Semut Taxi to receive taxi orders. Semut Taxi use badges gamification components are realized in the form of reputation. Reputation is the calculation of the average of ratings obtained driver of passengers on each transaction conducted taxi service. Reputation can be increased by adding points earned, 500 points will represent ½ star reputation.

IV. IMPLEMENTATION AND TESTING

4.1 Implementation of Gamification

4.1.1 Gamification Taxi Service on Semut App

The concept of booking taxi gamification on Semut App was developed with the concept of providing points and badges are realized in the form of tiers in the form of the predicate. Predicate is divided into 4 levels of users, with the following specifications:

1. Newbie

Newbie predicate is given to the user with a number of points 1 up to 1000.

2. Addict

Addict predicate assigned to the user the number of points 1001 to 10000.

3. Geek

Geek predicate assigned to the user the number of points 10001 to 50000.

4. Freak

Freak predicate is given to the user with a number of more than 50000 points.

To get points from the taxi booking services, users must make a reservation has been confirmed. If the taxi booking confirmation has been made, users get 5 extra points.

In addition to using points and levels as badges, these systems also implement rewards in the form of reputation. Reputation is given as the user's status in the community of Semut App. Reputation chosen as a reward intended as social status in society. A good man is one who has a good reputation. The aim is to stimulate road users to perform activities that are good for the onward journey to transform into a good road users.

Reputation using a bar graph consists of 8 rods, each rod contains 100 reputation, each represented by a reputable green color if the value of the positive reputation and red if the value of a negative reputation.

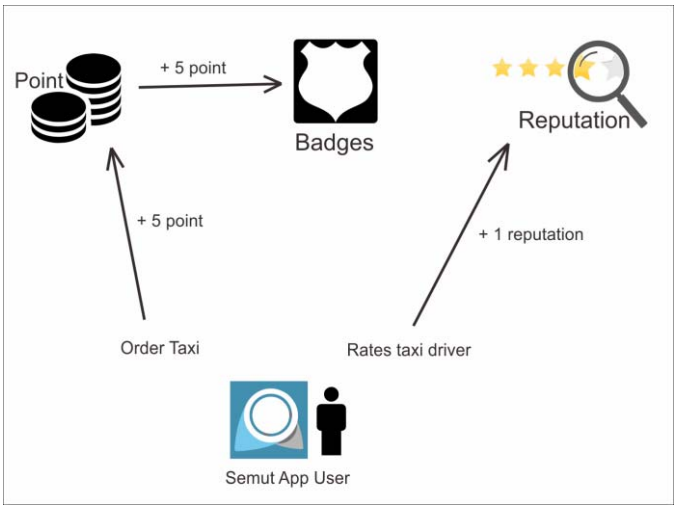

Fig. 3 Gamification Taxi Service on Semut App

Users collect reputation with some of the following conditions.

1. Every Booking taxis (until order confirmed), users get 1 positive reputation.
2. Provide an assessment to the taxi using the facility rate, the user is given 1 positive reputation.
3. User cancel the booking taxis when the order is confirmed, the user gets 1 negative reputation.

4.1.2 Gamification on Semut Taxi

Semut Taxi involving taxi drivers as users. Here is a challenge that is given to the driver of the taxi system.

1. Taxi drivers must always activate the application in order to receive information about booking taxis from passengers.
2. Taxi drivers have to compete for orders as quickly as possible take a taxi from Semut App.
3. The driver must provide the best services and facilities to the passengers, because passengers can provide an assessment to the taxi driver.

The driver must meet the challenge to get a reward from the system. Reward given consisted of points and gained the reputation of a judgment against the driver and the taxi facilities. Reward mechanism described in Fig. 4, a taxi driver declared active when login into the application. The driver is given 1 point each day when activating the application. Taxi driver get an additional 100 points again by uploading a photo on the application. Drivers earn 5 points every time take a taxi order and complete the order (the order status completed). The driver will receive an assessment of the services and facilities provided from passengers. This assessment will be accumulated with other passengers assessment and used as a measure of achievement or the reputation of the driver, then the driver will be displayed.

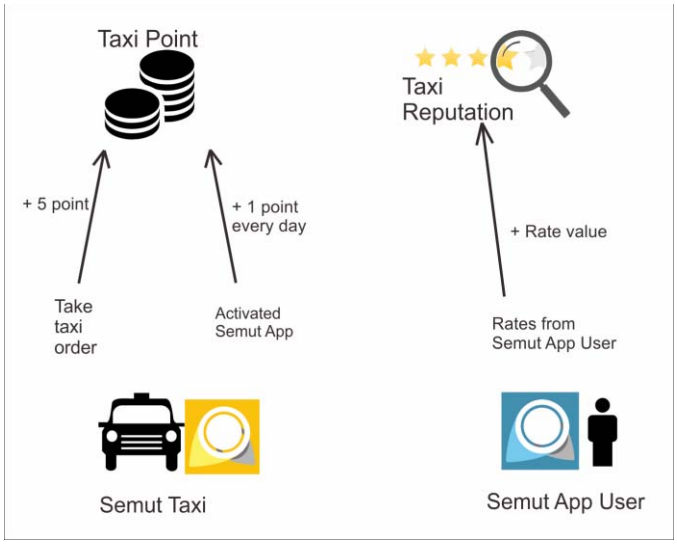

Fig. 4 Point and Reward mechanisms on Semut Taxi

4.2 Testing

System testing involves people in Bandung. Respondents were selected randomly by a variety of professions. Respondents involved are all road users, whether using a private vehicle or public transportation. Taxi driver played by two people and a simulated operation in the city of Bandung. Small simulation with two driver's role is made for Semut Taxi cannot be distributed to taxi drivers.

Testing gamification aims to find out the opinions and impressions of the respondents related to the following questions.

1. Having tried to book a taxi using Semut App, whether the respondent agrees with the opinion that the Semut App more easily, quickly, effectively and efficiently compared to the way other bookings?

2. Is a taxi booking system integration with location-based social media equipped with a points system, the level and reputation can attract respondents to use a taxi service?

3. Do awarding points and increased levels for each booking taxis and increase its reputation on social media to each give to the taxi rate may motivate respondents to continue to use a taxi service?

4. After trying a taxi booking system which is packed with social media, the points system, the level and reputation; whether respondents would continue to use the taxi booking system on Semut App in the future?

Here is the recapitulation of the questionnaire that was filled by the respondent after trying several test scenarios. The number of respondents who participated in the testing of as many as 40 respondents.
Fig. 5 shows the summary of the questionnaire for the first statement "taxi booking on Semut App is fast, easy, effective and efficient compared to the way other reservations".

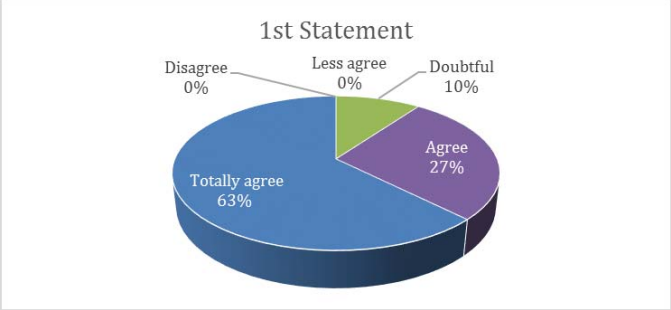

Fig. 5 graphs the results of questionnaires first statement

Fig. 6 shows the summary of the questionnaire for the second statement "taxi booking system integration with location-based social media equipped with a points system, the level and reputation can attract me to use taxi service".

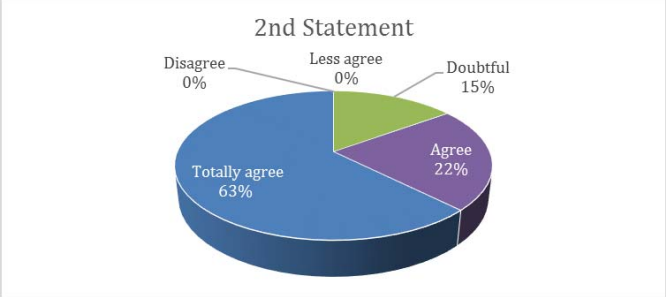

Fig. 6 Graph results of the questionnaire a second statement

Fig. 7 shows the summary of the questionnaire for the third statement "awarding points and increased levels for each booking taxis and increase its reputation on social media for each deliver value to taxi can motivate me to continue to use the taxi service".

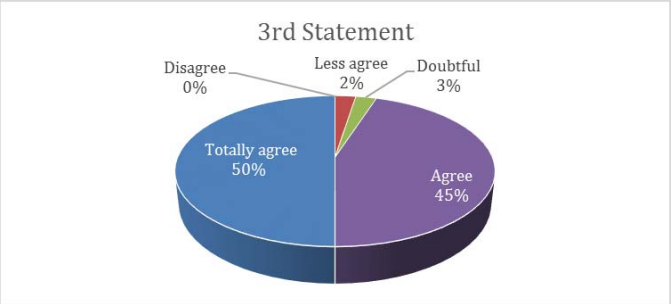

Fig. 7 graphs the results of questionnaires third statement

Fig. 8 shows the summary of the questionnaire for the fourth statement "after trying a taxi booking system which is packed with social media, the points system, the level and reputation; I will continue to use a taxi booking system on Semut App in the future ".

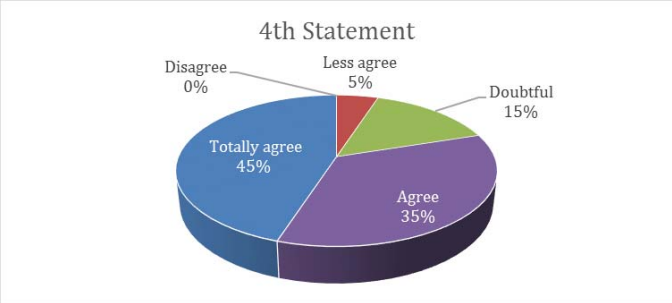

Fig. 8 graphs the results of questionnaires fourth statement

V. CONCLUSION

Based on research that has been done, it can be concluded that the design and implementation of the concept of gamification and social media in a taxi booking system has been successfully carried out. Furthermore, some of the conclusions obtained with regard to public opinion and the impression of the taxi booking system on Semut App. Based on the questionnaire involved 40 respondents, obtained some results as follows:

1. 63% of respondents stated strongly agree that booking a taxi on Semut App is fast, easy, effective, and efficient compared to the way other reservations;
2. 63% of respondents stated strongly agree that booking a taxi is integrated with social media comes with a points system, the level and reputation can attract respondents to use;
3. 50% of the respondents strongly agreed that awarding points and increased levels for each booking taxis and increase its reputation on social media for each scoring to taxi can motivate respondents to continue to use the taxi service;
4. 45% of the respondents strongly agreed that after trying a taxi booking system which is packed with social media, the points system, the level and reputation, the respondents will continue to use a taxi booking system on Semut App in the future.

These results can not indicate whether gamification taxi booking system can increase community interest in the taxi booking system, the motivation of people to continue to use the taxi service and increase user loyalty use a taxi booking system.

ACKNOWLEDGMENT

Thanks to School of Electical Engineering and Informatics, Institut Teknologi Bandung as the organizers ICIDM 2015 that has given us the opportunity to contribute.

REFERENCES

[1] T. Rosenbloom and A. Shahar, "Differences between taxi and nonprofessional male drivers in attitudes towards traffic-violation penalties," *Transp. Res. Part F Traffic Psychol. Behav.*, vol. 10, no. 5, pp. 428–435, 2007.

[2] S. Deterding and D. Dixon, "Gamification : Using Game Design Elements in Non-Gaming Contexts," in *CHI 2011: Conference on Human Factors in Computing Systems*, 2011, pp. 5–8.

[3] European Commission, "Intelligent transport systems," 2010.

[4] B. Singh and A. Gupta, "Recent trends in intelligent transportation systems: a review," *J. Transp. Lit.*, vol. 9, no. 2, pp. 30–34, 2015.

[5] O. Oihana and M. Linaza, "Position Paper on Intelligent Transport Systems Introduction," *Netw. Electron. media*, 2010.

[6] K. Werbach and D. Hunter, *For The Win: How Game Thinking Can Revolutionize Your Business*. Philadelphia: Wharton Digital Press, 2012.

[7] K. Julius, "Designing Gamification," *Univ. Oulu, Oulu Bus. Sch.*, no. January, p. 68, 2013.

[8] RefineCatch Limited, *Introduction to Gamification*. Association for Project Management, 2014.

[9] Y. Liu, T. Alexandrova, and T. Nakajima, "Gamifying intelligent environments," in *Ubi-MUI '11: Proceedings of the 2011 international ACM workshop on Ubiquitous meta user interfaces*, 2011, p. 7.

[10] J. Frith, "Turning life into a game: Foursquare, gamification, and personal mobility," *Mob. Media Commun.*, vol. 1, no. 2, pp. 248–262.