

An Observation on Social Acceptance of Location-Based Augmented Reality Games in Open Space

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Mohammad Ghifari Haekal^{1,*}

¹ Department of Computer Science, Faculty of Mathematics and Natural Science Bogor Agricultural University, Indonesia

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ABSTRACT

Collaborative application of Augmented Reality (AR) is getting more widely applied in various fields such as education, art, and entertainment. However, the development of AR is affecting social acceptance aspect. Observation is necessary to determine the rate of social acceptance in society. Beginning with article study to conclude social problems, then formulating scenario that will be used to analyse public experience with real social problems. There are two approach that have been performed, questionnaire usage with semantic differential targeted to 30 respondents and interview discussion targeted to 10 respondents. This research confers the perception of users and the perception of bystanders with quantitative and qualitative measure for each scenario. The result of this research will provide insights about social acceptance for augmented reality application amidst Indonesian society.

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1. Introduction

1.1 Background

Augmented reality trends have influenced numerous sector, including education, manufacture, entertainment, art, and construction [12][13]. These trends are also proven beneficial, especially in improving the potential of information technology [3]. One of the examples of AR implementation from entertainment industry is Pokémon Go which appears to be using real-time location features. Pokémon Go became popular in Indonesia with number of feedback scores reaching 84.6% based on research conducted by numerous company [10].

A lot of arguments propose the advantages and disadvantages of Pokémon Go application. Escalation of physical activities that affect general health, social skills, and outdoor activity is being one of the arguments [1][11]. This escalation is caused by the application mechanism that oblige user to be in a physical environment when using it. This mechanism also involves another user to interact with each other in open space. Meanwhile, many reports regarding problems that happen to

* Corresponding author.

E-mail address: Mohammad Ghifari Haekal (ghifarihaekal7@gmail.com)

Pokémon Go application usage are also found. The problems reported includes kidnapping, trespassing, and violence [9].

Social acceptance is an obstacle in development of augmented reality technology [2]. Social acceptance is focused on users, and societies, especially concerning comfort during augmented reality usage in social context. However, research about social acceptance of augmented reality is still not enough in numbers [4]. This is what underlies the research for social acceptance of augmented reality to be relevant.

Prior research about social acceptance of augmented reality has been conducted in a healthcare environment [8]. User wears a Head Mounted Display (HMD) device in controlled environment, which is a hospital. This research shows that most of the device users favor the use of augmented reality application and willing to use it for their work environment in the future. However, to conduct a research on collaborative application like Pokémon Go, it is not suitable to be done in a controlled environment. The research needs an involvement of society's perspective that will be analyzed. The social acceptance of Pokémon Go experiment's objects are the users of Pokémon Go in an open space. Utilization of semi-automatic survey using web scraping method will be conducted on two technology news websites. This survey is used to gather information about problems that are happening towards the application [7]. Therefore, the article will be categorized based on social problems that are provided in social acceptance model. Then, determination of social problem will be carried out to be designed and illustrated on some scenario and represented to users for social acceptance evaluation. Scenario illustration method will be utilized in this research [6]. The result of this research will provide cognition towards social acceptance, which is the society's response of social problems that are happening to the development of augmented reality technology in Indonesia right now.

2. Methodology

This research is conducted in 5 stages of methods, which is social problems determination, scenario arrangement, questionnaire design, data collection, and data analysis.

- **Social Problems Determination**

Social problems are determined based on studies from popular technology websites, which is TechCrunch and TechinAsia. Determination of the websites are based on their website popularity rankings in <http://demistifyasia.com>. Acquisition of news from TechinAsia website are done in two site's languages (Indonesia and English). The process of articles data acquisition in some stages are also conducted to determine social problems based on researches [5]. Stages that are conducted is as the following:

- **Data Acquisition**

Selenium library and python language are used to acquire articles about Pokémon Go. However, before creating a program, it is necessary to do collection of URL parameter on chosen news websites. Picture 2 shows search function that are utilized on TechinAsia website. After the parameter is obtained, a program is created using driver.get function in Python language with iteration of every page and data on chosen websites. Picture 3 shows the usage of parameter with driver.get function. There are two steps that will be undergone to acquire data. First step, in form of article information acquisition, which is title, URL, and release date. Afterwards, article content is acquired through the URL. Picture 4 shows the example of article acquisition result in form of text.

- Data Clearance

Special characters and symbols won't be necessary for research data, therefore clearing data for unimportant characters will make data processing easier. Data clearance will also be conducted to incomplete data, such as data with no description or data with scraping fault.

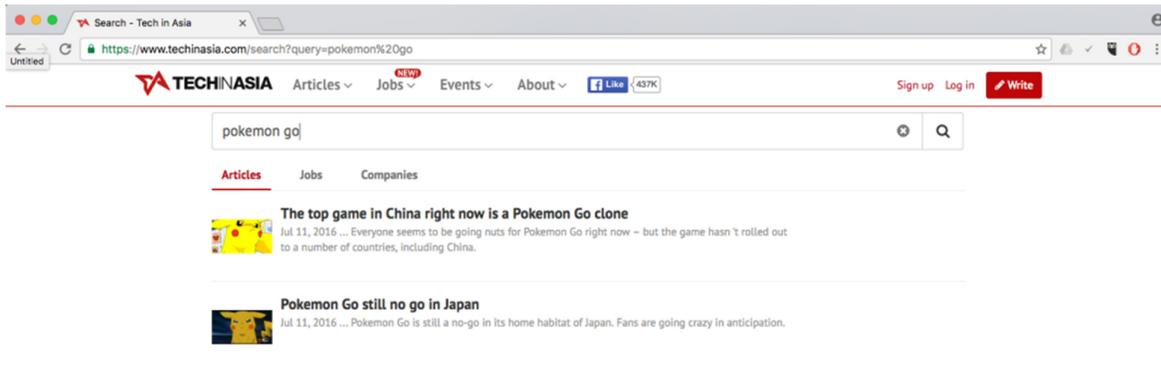


Fig. 1. Search function in TechnAsia website

```
driver.get("https://id.techinasia.com/search?page=1&query=pokemon+go")
```

Fig. 2. driver.get function in Python program

Errors or mistakes that commonly happens appeared from video content with little to no description and websites with different structure. The result of data clearance will be saved in database for further analysis.

- Data Categorization

Article will be categorized manually based on social acceptance models (Wustenhagen *et al.* 2007). There are 3 categories in social acceptance, which is political social acceptance, society acceptance, and market acceptance. However, market acceptance category will be derived into two problems, social and technology. These two problems are derived because of findings in some article that shows different types of market acceptance. Table 1 shows the results of social problems derivation for data categorization.

• Scenario Arrangement

Scenario illustration will be used to create scenario arrangement (Koelle *et al.* 2015). Every scenario is made based on two perspectives of observation, first person as user perspective and second user as bystander perspective. Utilization of agent in each scenario with blue and red color will simplify comprehension of the arranged scenario.

Table 1
 Derivation of social problems for data categorization

Category	Problem
Social and Political Acceptance	Policy and Privacy
Public Acceptance	Public
Market Acceptance	Social Technology

- **Questionnaire Design**

Questionnaire will be designed using semantic difference. This stage is necessary to measure perception in every scenario made. Semantic difference is a good method to measure emotional response in psychological term and human interaction, and it is also easier to be understood [](Koelle *et al.* 2015). Table 2 shows semantic difference pairing for every connotation.

Table 2
 Semantic difference pairing for every connotation

No	Negative	Positive
1	Anxious	Calm
2	Threatened	Safe
3	Unsure	Confident
4	Observing	Observant
5	Suspecting	Polite

Then, the respondent will be asked to answer the questionnaire based on base calculation scale which consists of 11 points results from -5 until +5. Picture 5 shows calculation scale with semantic difference.

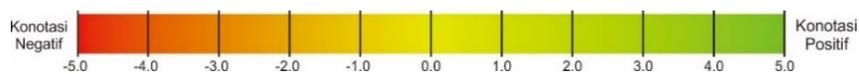


Fig. 3. Calculation scale of semantic difference

- **Data Collection**

In this stage, data will be collected through two sessions, survey scenario and interview. Survey scenario session will be conducted by giving questionnaire in form of semantic connotation table to respondent, and the respondent will be asked to answer questions based on given scenario. Interview session will be conducted by asking respondent about perception and experiences that the respondent have according to given scenario. In the interview session, two scenarios will be chosen as discussion materials when the interview take place.

3. Results and Discussion

- **Social Problems Determination**

Data acquisition was conducted on October 10th 2016 and resulting in 277 articles which has been cleaned and categorized. There are 125 categorized articles from TechCrunch news website and 152 categorized articles from TechinAsia news website. Table 3 shows the result of data categorization based on social problems.

Table 3
 Semantic difference pairing for every connotation

No	Problems	Percentage (%)	Articles
1	Privacy & Policy	2.89	8
2	Public	6.50	18
3	Social	44.04	122
4	Technology	21.66	60
5	Others	24.91	69
	Total	100.00	277

Articles with social category shows up the most in both chosen news websites. Specified results in form of comparison between two languages in chosen news websites will also be provided to give better comprehension of occurring problems trends. Figure 5 shows the comparison of problems category in two language, English and Indonesia from the chosen websites. One article is selected and determined randomly to be a foundation in scenario arrangement. Article selection is determined based on time for each scenario. Table 4 shows the results of article selection for each category.

- **Scenario Arrangement**

Explanation for social problems which has been illustrated have been made to comprehend the purpose and goals of each scenario created. Figure 6 shows the results of created scenario based on the selection of social problems.

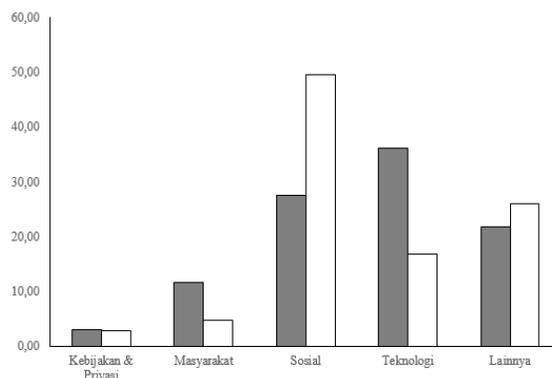


Fig. 4. Comparison of problems category in two languages, Indonesian (Gray) and English (White) from chosen news websites

Table 3
Article selections from each problems category

No	Judul	Masalah
1	<i>I attended a Pokémon Go event, and things got kinda weird</i>	Sosial Kebijakan & Privasi
2	5 Hal yang Harus Kamu Hindari Ketika Main Pokémon GO	Privasi
3	<i>PokeFit gives Pokémon Go a real-time fitness dashboard on Android</i>	Teknologi
4	<i>Pokémon Go is doing a lot of good here are 3 surprising ways</i>	Masyarakat

1) Social Problems Scenario

This scenario portrays complete strangers who attend Pokémon Go community event in a park. Then, one person (A) greets and talks to the second person (B). This scenario is created to test the interaction pattern between two complete strangers that happens to meet and interact with each other.

2) Privacy and Policy Problems Scenario

This scenario portrays a housing area when B is strolling around and accidentally see A playing Pokémon Go and trespassing others property. This scenario is created to test the articles related to Pokémon Go application usage in others property.

3) Technology Problems Scenario

This scenario portrays a condition when a person is playing Pokémon Go in a crowded public area, such as park. Starting with A that plays Pokémon Go while walking and then bumped to B accidentally. This scenario is created to test NTT Docomo articles that stated the usage of Pokémon Go while walking around can cause accidents.

4) Public Problems Scenario

This scenario portrays a condition where Pokémon Go is played in a public area such as downtown area. Starting with A group that play Pokémon Go in the same area with B. Then, the A group argue and yell at each other. This scenario is created to test the perspective of public towards the interaction pattern of Pokémon Go players in their surroundings.

- **Questionnaire Design**

After the result of each scenario are recorded, the questionnaire has been designed accordingly. There are be four table of semantic difference pairs which has been categorized for each scenario. The questionnaire is also containing personal data, such as name, gender, age, job, home address, phone number, and character's level for research information.

- **Data Collection**

The questionnaire was given randomly to 30 respondents with various age between 15-35 years old which consists of 21 men and 9 women. The respondents have different jobs, from students, private employee, and entrepreneur. Respondent with observer perspective is a person who hasn't played Pokémon Go yet. Respondent with

user perspective is a person who plays Pokémon Go whose character reached level 10 or above. This research was conducted in Taman Sempur area, Bogor. Taman Sempur was chosen as the research area because there are a big Pokémon Go community in this area so that the experience of the social problems can be perceived and researched directly. Data collection in the interview session were conducted with discussion and audio recording to 8 randomly picked respondents. Table 5 shows the respondents characteristic results based on gender and age.



Fig. 5. Scenario results based on social problems

- **Data Analysis**

There are two forms of analysis results from data analysis, semantic difference calculation and interview discussion.

- **Semantic difference calculation**

Semantic difference is calculated by classifying it into two perspective, user's perspective and observer's perspective. The calculation is using average and

standard deviation of the scale which has been used on questionnaire. Table 6 shows the summary of semantic difference calculation data for each scenario.

Table 5
 Respondents characteristic results based on gender and age

Characteristics	Category based on	
	Numbers	Percentage (%)
	Genders	
Men	21	70.00
Women	9	30.00
	Age	
15-20 Years	12	40.00
21-25 Years	10	33.33
26-30 Years	3	10.00
31-35 Years	5	16.67

Table 6
 Semantic difference calculation data summary

No	Scenario	n-th semantic difference average connotation					Total Average
		1	2	3	4	5	
		User					
1	Social Problem	2.67	2.27	2.53	1.60	3.33	2.48
2	Privacy & Policy Problem	0.73	0.13	0.47	-0.53	-0.47	0.07
3	Technology Problem	-0.27	0.80	0.27	0.93	0.80	0.51
4	Public Problem	1.67	1.73	1.33	-0.87	0.80	0.93
		Bystander					
1	Social Problem	1.80	1.07	2.27	1.60	1.67	1.68
2	Privacy & Policy Problem	-1.73	-2.00	-1.53	-1.80	-2.73	-1.96
3	Technology Problem	-1.80	-1.27	-0.27	-0.20	-0.27	-0.76
4	Public Problem	1.00	1.40	-0.07	-1.07	-0.13	0.23

Connotation:

1. Tense/Calm 2. Threatened/Safe 3. Afraid/Confident 4. Observing/Observed 5. Suspicious/Friendly

1) Social Problems Scenario

The result from 1st scenario user's perspective semantic difference shows positive respondent scores. Respondent assume that meeting and socializing with strangers are common which has been shown with total average of 2.48. Observer's perspective also shows positive score, even though it is less than user's perspective with the total average of 1.68. The cause for the smaller score were many negative answers given by women observers as small as 0.60 and 15-20 years old observers as small as -0.43.

2) Privacy & Policy Problems Scenario

2nd scenario semantic difference calculation result for user's perspective shows neutral respondent's score with the total average of 0.07. Meanwhile,

observer's perspective calculation shows negative score from respondents with the total average of -1.96. The significant difference happens between user's and observer's perspective. Opinion conflict on the needs of user's self-consciousness to respects other's property is the main factor of the difference. Women respondents also approve that this has been a bad thing, the statement is also supported with the negative total average of -2.11.

3) Technology Problems Scenario

Semantic difference calculation for the 3rd scenario from user's perspective shows neutral result from respondent with total average of 0.51. Observer's perspective calculation also shows neutral result with total average of -0.76. Some of the observers state that despite this kind of occurrences can be assumed neutral, it still disturbs the surroundings. This has been shown with the average for the 1st and 2nd connotation that results in negative scores, -1.80 and -1.27. Observers with age category of 15-20 years and 21-25 years give more negative answers which scores -1.26 and -2.00. The negative scores of -1.26 can also be found from women observers.

4) Public Problems Scenario

The 4th scenario semantic difference calculation for user's perspective shows neutral result with total average of 0.93. Respondent assume that the situation of playing in public spaces is a normal thing, but in connotation 4 the average scored -1.07. Some of the respondent state that user's self-consciousness needs to be taken care, so they don't disturb their surroundings. Observer's perspective calculation also shows neutral result with total average of 0.23. The significant difference happens between observers with age category of 21-25 years and 26-30 years, which scores 2.07 and 2.80.

▪ Interview Analysis

Based on data collection from interview session to 8 respondents, social acceptance benchmark can be acquired. Analysis was conducted by discussion and giving interview guidance to respondents.



Fig. 7. Discussion and Interview

1) Social Problems Scenario

Based on the interview result from respondent for social problems, the respondent stated that they don't feel awkward and they feel happiness from the interaction that occurred. Despite not all respondent feel the same, especially women respondents that feel unhappy. However, from the interview result can be concluded that the interaction between someone with common hobbies can triggers continuous communication. Some of the quotation regarding discussion illustration are translated as below:

Quotation 1: "...when I talk about Pokémon Go, it just connects, and it doesn't feel awkward..."

Quotation 2: "...luckily I joined a community, and I can meet new people, so it doesn't feel awkward..."

Quotation 3: "...I'm a person who's open, as long as the people is not acting like he/she knows all about me, it's not a problem..."

Quotation 4: "...when I meet new people, it still feels pretty strange, especially when meeting complete strangers..."

2) Privacy & Policy Problems Scenario

Based on respondent's interview result for privacy & policy problems, it can be concluded that situation like this still happens frequently. Users stated that they often get warned when playing inside other's property. One of the unique experience of the user is when they enter uncommon buildings like hospital, school and even police office. This kind of things is perceived as common for users when they have asked for permission first, but some observers perceive this as uncommon things. Some of them perceive that situations like this should have been avoided by users because it disturbs property owner's comfort. Some of the quotation regarding discussion illustration are translated as below:

Quotation 1: "...I've entered YPHB building, then I ask to the security so I can get in. The security just acts normal, nothing's wrong when you enter people property as long as you ask for permission..."

Quotation 2: "...I entered a police office and got scolded. But from there, I learned that when a Pokémon shows up at uncommon place, we must ask permission first from the owner or the people nearby ..."

Quotation 3: "...Impolite, it looks like that people doesn't have manners or ethics. More importantly, we need to know the place, time, and condition. So, don't prioritize your own happiness and manners which are available in the environment..."

Quotation 4: "...So we must think about the place, if it's like playing nearby other people's house, so it's like we are uncertain to visit their house..."

3) Technology Problems

Based on respondent's interview result for technology usage problems, it can be concluded that respondents stated the need of awareness towards the

surroundings when using the gadgets so that situations like this won't happen. Gadget's over usage can also endangers people in the user's surroundings, not only the user. Some of the quotation regarding discussion illustration are translated as below:

Quotation 1: "...it's wrong when you play it while walking. Should have play it while sitting. We can play at the pokestop and no need to walk..."

Quotation 2: "...looks like the player is not focused, he/she should also use the camera so the surrounding area is visible so doesn't crash..."

Quotation 3: "...it's okay, but they also should know the corridor also oblige to interact with surrounding environment, so if there is a waterfall in front of them they'll just walk and they'll fall ..."

Quotation 4: "...yeah, I'm upset, all that only for getting Pokémon Go. Only because a game, they can bump with other people..."

4) Public Problems

Based on respondent's interview result for public problems, it can be concluded that situation like this has been perceived as normal, especially for the observers. However, reaction between players needs to be noticed so that it doesn't interfere their surroundings. Respondents perceived that it is uncommon for the public that's not familiar with augmented reality. However, with numerous publication that continuously been done, augmented reality can be accepted in public's environment. Some of the quotation regarding discussion illustration are translated as below:

Quotation 1: "...I think it's not a problem. As long as they also know the place, doesn't disturb surrounding environment also..."

Quotation 2: "...as long as we play here, it doesn't matter. In this environment, there are a lot of community, yeah maybe they take it as a normal thing. But if possible, don't go as far as screaming too..."

Quotation 3: "...yeah it's okay isn't it, for happiness. The request is as long as they don't endanger themselves and don't harm other people it's not a problem ..."

Quotation 4: "...for me when seeing it the first time it's pretty weird, especially for the ones who doesn't know about technology. But because there are publications from television, at last we also know and it becomes normal..."

4. Conclusion

Qualitative and quantitative results of this research were represented from scenarios which are based on Pokémon Go application evaluation. This research was conducted with two approaches, semantic difference calculation and interview discussion. Semantic difference calculation concludes that user's answers give more positive results compared to observer's answers with the average of 1.0 and -0.20. This result is caused by the controversies in which the users assume that the social problems has become normal condition. Meanwhile from observer's perspective, the social problems still catch their attention. Gender difference is quite significant as shown by women which gives more negative answers and also give different outputs for each scenario. Interview discussion concludes

that respondents gives more positive answers, whether it is from the perspective of the users or the observers. However, many limitations such as communication, interaction, and privacy also need to be noticed between users so that Pokémon Go application won't interfere with publics in their surroundings.

References

- [1] Althoff, Tim, Ryen W. White, and Eric Horvitz. "Influence of Pokémon Go on physical activity: study and implications." *Journal of medical Internet research* 18, no. 12 (2016).
- [2] Azuma, Ronald, Yohan Baillet, Reinhold Behringer, Steven Feiner, Simon Julier, and Blair MacIntyre. "Recent advances in augmented reality." *IEEE computer graphics and applications* 21, no. 6 (2001): 34-47.
- [3] Chi, Hung-Lin, Shih-Chung Kang, and Xiangyu Wang. "Research trends and opportunities of augmented reality applications in architecture, engineering, and construction." *Automation in construction* 33 (2013): 116-122.
- [4] Billinghurst, Mark, Adrian Clark, and Gun Lee. "A survey of augmented reality." *Foundations and Trends® in Human-Computer Interaction* 8, no. 2-3 (2015): 73-272.
- [5] Nadilah, Farisah. "Asosiasi dan Geovisualisasi antara Data Tweet Terkait Kebakaran Hutan dengan Data Cuaca di Provinsi Riau dan Kepulauan Riau." (2016).
- [6] Koelle, Marion, Matthias Kranz, and Andreas Möller. "Don't look at me that way!: Understanding User Attitudes Towards Data Glasses Usage." In *Proceedings of the 17th international conference on human-computer interaction with mobile devices and services*, pp. 362-372. ACM, 2015.
- [7] Mitchell, Ryan. *Web scraping with Python: collecting data from the modern web*. " O'Reilly Media, Inc.", 2015.
- [8] Nilsson, Susanna, and Björn Johansson. "Acceptance of augmented reality instructions in a real work setting." In *CHI'08 extended abstracts on Human factors in computing systems*, pp. 2025-2032. ACM, 2008.
- [9] Serino, Maeve, Kyla Cordrey, Laura McLaughlin, and Ruth L. Milanaik. "Pokémon Go and augmented virtual reality games: a cautionary commentary for parents and pediatricians." *Current opinion in pediatrics* 28, no. 5 (2016): 673-677.
- [10] "Pokemon GO Hype in Indonesia 2016." W&S Indonesia - PT. Nusaresearch. Accessed May 2, 2018. http://yimresearch.com/sample/voluntary_surveys/detail.php?ID=88.
- [11] Kogan, Lori, Peter Hellyer, Colleen Duncan, and Regina Schoenfeld-Tacher. "A pilot investigation of the physical and psychological benefits of playing Pokémon GO for dog owners." *Computers in Human Behavior* 76 (2017): 431-437.
- [12] Carmigniani, Julie, Borko Furht, Marco Anisetti, Paolo Ceravolo, Ernesto Damiani, and Misa Ivkovic. "Augmented reality technologies, systems and applications." *Multimedia tools and applications* 51, no. 1 (2011): 341-377.
- [13] Hasan, Rosaliza, Hesham Ahmed Abdul Mutaleb Abas, and Faieza Binti Abdul Aziz. "Review of Augmented Reality Applications in Manufacturing Engineering." *Journal of Advanced Research in Computing and Applications* 5, no. 1 (December 2016): 11-16.