A Walk Rally Application to Motivate Users to Visit Potential Sightseeing Resources

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***Abstract*—Tourist numbers have increased considerably in recent years and tourism is now a key industry in the world. While major tourism resources are attracting attention, there are other areas that also hold some value as tourist sites but are not recognized as such. In this paper, these sites are called "potential sightseeing resources". It is acknowledged that tourist sightseeing satisfaction will increase by visiting potential sightseeing resources. Thus, a method to recognize potential sightseeing resources is required. In this study, to effectively use potential sightseeing resources situated within various local events, we developed an application that acts as a guide system to support tourism, guiding users to potential sightseeing resources situated within the same areas as a local event. We also analyzed accelerated patterns leading users to potential sightseeing resources and verified the effects via an experiment. As a result, it was confirmed that the application was successful in leading users to potential sightseeing resources by the application; however, certain conditions are required for non-monetary incentives to be effective.**

I. Introduction

According to the World Tourism Organization [1], there were more than 1,184 million international tourists in 2015, and tourism is now a key driver of social and economic development. In addition, tourism has been growing for centuries and it is one of the most important economic sectors in the world. Thus, tourism represents one of the main income sources for many developing countries. Furthermore, Tintarev et al. [2] found that visiting places "off the beaten track" (isolated areas) leads to incidental discoveries and increased satisfaction. In our study, such spots are called "potential sightseeing resources". We focus on "potential sightseeing resources" (areas less frequently visited or not traditionally recognized as being of value to tourists) that have difficulty attracting visitors because of poor location and tourists ' low awareness, even though these places represent fascinating resources. While it is essential that tourists are made aware of potential sightseeing resources, there is currently no effective way to make people more aware of these areas. In this study, to effectively use potential sightseeing resources situated nearby to various local events, we developed an application to guide users to potential sightseeing resources situated close to local events as a tourism guide system to support tourism. In addition, we analyzed accelerated patterns to lead users to potential sightseeing resources and verified the effect by conducting a demonstration experiment for visitors at the Waseda Festival 2016, which is a festival held at Waseda University (Shinjuku-ku, Tokyo). We then performed an evaluation using logs and questionnaires.

II. Related research

There are various studies on information-providing systems and walk rally applications using mobile for tourists. Cheverst et al. [3] developed a system that provides visitors to a town with relevant local information. In that study, they aimed to improve users' convenience in choosing a sightseeing destination by providing information about sightseeing areas via photos and descriptions, and by classifying such spots. They found that users of the system had a higher level of satisfaction regarding their visit to the town than those who did not use the system. They focused on providing tourism information for tourists. However, our focus is not only on providing tourism information but also guiding tourists to potential sightseeing resources. Tintarev et al. [2] developed an information-providing application to increase interest and to lead tourists to places that are not well known. In that study, they succeeded in helping users make incidental discoveries and increased their satisfaction. They focused on introducing potential sightseeing resources. In contrast, we focus on both introducing potential sightseeing resources and non-monetary incentives to increase the likelihood for tourists visiting such sites. Brown et al. [4] researched the way visitors reach their destination using navigation methods. They found that often tourists will not take the shortest route to their destination but want to travel via more attractive routes while appreciating their surroundings. In that study, they analyzed the behavior of tourists. In our study we provide guidance to potential sightseeing resources based on the analysis result. Kinoshita et al. [5] developed an application to support sightseeing around

towns. They used a navigation system that simply used a compass. That system makes it possible for users to look around at their surroundings and enjoy the atmosphere around them. In addition, it was revealed that users engaged in more conversations about their surroundings and they took more photographs. The users focused on enjoying their surroundings via compass navigation. However, we focus on guiding tourists to specific places with this navigation method.

In this study, we developed an application to lead users to potential sightseeing resources situated within or close to a local event via walking rally applications for tourists using mobile devices. Thus, we aimed to effectively utilize potential sightseeing resources among various regional events. Our application provides information by way of photographs and descriptions about tourism resources, and lead tourists to various destinations using a navigation system that comprises a compass and the distance to the destination. It also introduces a non-monetary incentive to motivate user behavior.

III. Assumption

In this study, we assumed that "the Waseda Festival 2016 is a regional event. The various forms of entertainment offered at the Waseda Festival are tourism resources. The Waseda cultural facilities are potential sightseeing resources". We then developed the web application "WaseNavi", which guides visitors at the Waseda Festival 2016 (5th and 6th November 2016) and leads them to various Waseda cultural facilities. In this application, users repeat the next four steps to participate in a walk rally.

1) Select a checkpoint (destination)
2) Move to the destination using Navi
3) Enter keywords (check-in) → Acquire points
4) Try a quiz → Acquire points if users answer correctly

Then, we hypothesized that people who already have a specific destination in mind will stop at potential sightseeing resources on their way to their destination if they are aware that these exist. Furthermore, it is not clear what kind of evaluation these sites will receive when visitors reach the potential sightseeing resources. Thus, through this experiment, we test the hypothesis by verifying whether people who visit Waseda University to attend the Waseda Festival will then visit potential sightseeing resources within the university.

IV. Overview of the Application

A. Building block method

In this study, we adopt the building block method to make the application available in various regions and events. The outline is shown in Fig. 1. The building block method is a method that can be used to appropriately rebuild a system by combining the detailed elements analyzed during the system's construction [6]. This method has the advantage that it is possible to deal with various purposes of use. The "Content of Regional Description of Structure Date" boxes in Fig. 1 describe the content aspect.

It becomes possible to use this application in various areas by independently developing the content part in a JSON

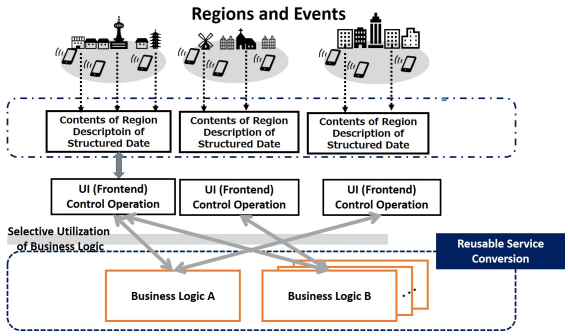

Fig. 1. Building block method

format. The content date format (Excerpt) is shown in Fig. 2. In Fig. 2, "lat" and "lon" show the location information of the content, "name" determines the name of the checkpoints, "label" represents the brief descriptions of each checkpoint, and "description" performs the detailed explanations. Furthermore, "visibleTimeFrom" and "visibleTimeTo" restrict the screen display time of each checkpoint. The terms "category" and "subcategory" show the categories of each checkpoint, and "place" indicates the location of each checkpoint by letter.

B. Non-monetary incentive

Ueyama et al. [7] researched non-monetary incentives such as ranking systems and point systems. They proposed using non-monetary incentives instead of monetary incentives as a method to ensure the positive participation of users in collecting information. The results showed that non-monetary incentives provided users' with the necessary motivation. Seaborn et al. [8] focused on gamification, which is a non-monetary incentive, and presented a systematic survey on its use. They showed that gamification is a developing approach to encourage user motivation. Thus, it is necessary to further investigate gamification in future research. In this study, we introduced non-monetary incentives for the further use of the application and the motivation to visit potential sightseeing resources. Regarding the detailed functions, we adopted a point system, ranking system (Fig. 3), and a quiz system (Fig. 4). For the ranking screen, users' points and rankings are updated in real time. It is thought that competing with other users will encourage users to earn more points. Regarding the


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{"id": "wasedasai2016-Sky-Link",
"lat": 35.7085278,
"lon": 139.7187352,
"name": "Movie Screening",
"label": "(4pt) Movie with all our might",
"description": "We are Sky-Link Studio! We .....",
"markerColor": "red",
"visibleTimeFrom": "2016-11-06 10:00:00",
"visibleTimeTo": "2016-11-06 17:00:00",
"category": "Arts and Culture",
"subcategory": "Video",
"place": "208 classroom of Building 10",
  ......
}
```


Fig. 2. Content data format (Excerpt)

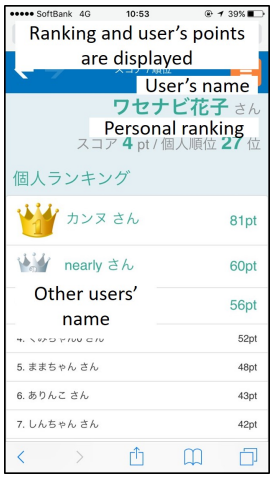

Fig. 3. Ranking screen

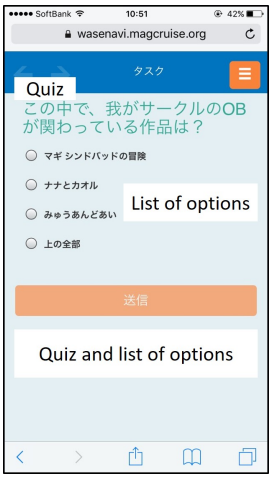

Fig. 4. Quiz screen

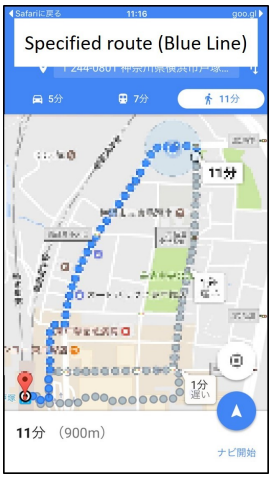

Fig. 6. Navigation by indicating specified route [9]

Fig. 7. Navigation by compass (this research)

quiz screen, quizzes were designed for each checkpoint. For many of the quizzes, the answers to various questions could be found at the site.

Points are earned when users complete a check-in and when a correct quiz answer is given. If users check-in and provide a correct answer at the same checkpoint, the number of points earned at the checkpoint comprises the check-in and the correct answer. For example, a checkpoint is worth 4 points: users obtain 2 points when they complete check-in and 2 points is given when they provide the correct answer. In this study, the following points can be acquired at checkpoints:

10 pts: Stage events displayed on screen for a limited time
6 pts: Four Waseda Festival entertainment events and four Waseda cultural facilities
4 pts: Remaining checkpoints

C. Overview of the system

The system architecture is shown in Fig. 5. Information regarding content and task information is sent from "Date of Potential Sightseeing Resources and Events" to the walk rally server and information regarding users is sent from "Date of Users" to the walk rally server. Information regarding behavior is sent from "Behavior of Date" to the walk rally server. Furthermore, description information regarding the user

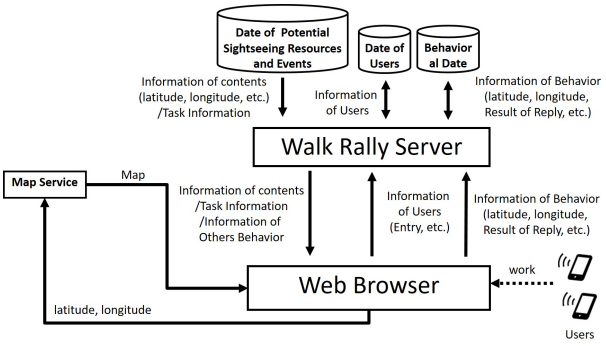

Fig. 5. System architecture

interface is sent from the walk rally server to the web browser and information and behavior information of the users are sent from the web browser to the walk rally server. In addition, the web browser sends location information to the map service, and the map information is returned. The users are able to use the application via the web browser using their mobile phone.

D. Navigation via compass

Brown et al. [4] clarified that tourists want to travel via a flexible route rather than a designated route when they head for their intended destination. Kinoshita et al. [5] developed a system where tourists could wander around a town using a compass. In this study, we adopted a navigation system that guides tourists with the use of a compass (showing them the direction of the destination) and the distance to the destination. In navigation applications such as Googlemap [9], the designated route is displayed as shown in Fig. 6. However, in our application, the compass (the direction to the destination) and the distance to the destination are displayed as shown in Fig. 7. In cases where there is very little time to spare (e.g., for business reasons or getting to a meeting), navigation systems such as Googlemap [9] are effective. However, we consider the navigation system used in this study to be more effective for tourists who have time and seek flexible routes.

E. User interface

The main user interfaces of the application are "Checkpoints list screen" (Fig. 8), "Navi screen" (Fig. 7), "Check-in screen" (Fig. 9) and "Quiz screen" (Fig. 4). We also use "Ranking screen" (Fig. 3), "Checkpoint history screen" (Fig. 10), "User registration screen" (Fig. 11) and "Help screen".

Regarding the Checkpoints list screen, users can choose the destination by choosing the category according to the users' preferences. This specification makes it possible for users to search for destinations that meet their personal requirements and tastes. For the Check-in screen, users can enter a 4-digit number located at the destination. Check-in is completed when the keyword is entered correctly, and users are then able to

Fig. 8. Checkpoints list screen

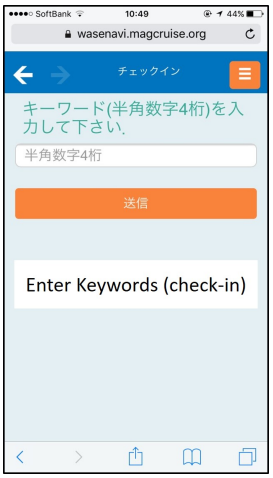

Fig. 9. Check-in screen

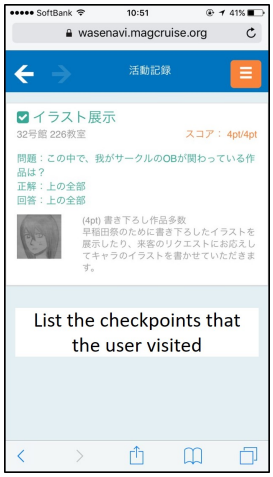

Fig. 10. Checkpoint history screen

Fig. 11. User registration screen

earn points and transfer to the quiz screen. On the Checkpoint history screen, the previous checked-in locations are displayed as a list. This specification makes it possible for users to confirm the checkpoints they have already visited. Using the User registration screen, users can create a user name. The application only requires a username and not the users' actual names; thus, there are no major issues regarding security.

V. Experiment

A total of 68 content locations were created in this experiment: 58 are various forms of entertainment at the Waseda Festival and 10 are potential sightseeing resources (i.e., Waseda cultural facilities). We chose locations within an approximately 1 km square area in the university campus. The positions and names of the locations are shown in Fig. 12. We placed checkpoints numbered 1 to 10 at potential sightseeing resources, and the checkpoints denoted by a dot are the various festival entertainment. Regarding earned points, checkpoints with a value of 4 points are indicated in red, those worth 6 points are shown in blue, and checkpoints worth 10 points are shown in yellow. As part of the Waseda Festival, students also ran a food stand on a street in the school. Thus, the

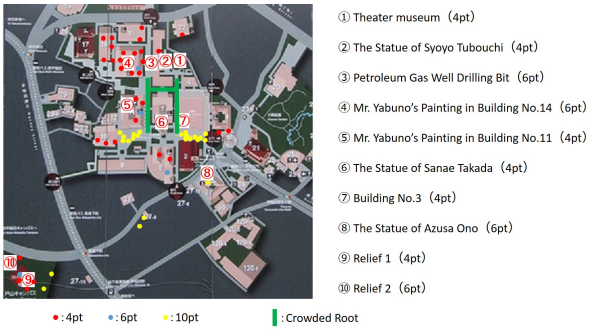

Fig. 12. Content position and name

roads represented by green lines in Fig. 12 are narrow, and with customers queuing for the food stand, they are likely to get crowded. Therefore, in this experiment, we led people to a street with a potential sightseeing resource, the "Petroleum Gas Well Drilling Bit". There was little traffic on the street because there were no food stands. We attempted reduce congestion at the Waseda Festival by leading people from the crowded streets with queuing customers at the food stand to a street with few passengers with the "Petroleum Gas Well Drilling Bit".

VI. Results and Discussion

A. Analysis by questionnaire

We surveyed 14 users of the application and 38 operators at the Waseda Festival. In these surveys, the application was evaluated from 1 to 6, with 6 being the maximum rating. The results of the users' questionnaires are shown in Table I and the results of operators' questionnaires are shown in Table II. The answers to questions 1 to 3 in Table I show that WaseNavi improved the users' overall satisfaction of the event. Furthermore, when we asked for opinions and impressions of WaseNavi, a respondent answered: "WaseNavi is a lot of fun. I could find something and places that I would not able to discover by just walking. It is not usually possible to go inside the building, but I could explore both inside and outside the building thanks to WaseNavi". These results show that WaseNavi was effective in promoting potential sightseeing resources and stimulating the Waseda Festival. Table II shows the results for questions 1 and 2, revealing that WaseNavi also led to the promotion of the event itself. The result for question 3 shows that WaseNavi was effective in promoting

TABLE I
User Questionnaire Results (N=14)

Questions	Average
1 The application was effective to find the checkpoint of interest	4.36
2 Navi helped to move outdoors	5.07
3 Navi helped to move indoors	4.50

TABLE II
Operator Questionnaire Results (N=38)

Questions	Average
1 The application was effective for increasing the number of visitors to the event	4.18
2 I want to operate Waseda Festival with the application next year	4.24
3 The application promoted the induction to Waseda cultural facilities	4.29

TABLE III
PEOPLE ' S REASONS FOR ATTENDING THE WASEDA FESTIVAL (N=38)

Choices	Highest primary purpose	Lowest primary purpose
1. Entertainments by Waseda students	19	1
2. Feeling the atmosphere of Waseda	15	2
3. Meeting friends and old friends	4	3
4. Visiting Waseda cultural facilities	0	32
5. Others	0	0

potential sightseeing resources. In addition, we asked the festival operators, "What do you think is the highest primary purpose and the lowest primary purpose of people who visit the Waseda Festival?" The results are shown in Table III.

The table shows that 84% (= 32/38) of operators think that "Visiting Waseda cultural facilities" is the lowest primary purpose of the Waseda Festival. However, the Waseda cultural facilities include many attractions and symbolize the abundant culture that has been developed since the university was established. Thus, it can be said that the assumption made at the beginning of the paper, "the Waseda Festival 2016 is a regional event. The various forms of entertainment offered at the Waseda Festival are tourism resources. The Waseda cultural facilities are potential sightseeing resources", is correct.

B. Analysis by log

In this experiment, 291 people registered for WaseNavi. Among them, 48 users walked around Waseda University and checked-in at various checkpoints gaining points. We analyzed the behavior log obtained from the 48 users. The analysis concerns leading users to potential sightseeing resources as shown in Table IV.

Table IV shows that the number of check-ins per entertainment at the Waseda Festival was 2.3 (= 136/58) and the number of check-ins per potential sightseeing resource was 8.9 (= 89/10). This indicates that WaseNavi was effective in leading users to potential sightseeing resources. There are various reasons why the number of check-ins per potential sightseeing resource was larger than that for other entertainment events. The main reason is that there was a particular detour at the Waseda Festival and there were many potential sightseeing resources on the detour route. The detour is shown in Fig. 13. The yellow line in Fig. 13 is the detour used in this experiment. This road is the route connecting the following three buildings:

Building No. 5
: The building housing the "Theater museum" and "The Statue of Syoyo Tubouchi"

Building No. 6
: The building housing the "Petroleum Gas Well Drilling Bit"

TABLE IV
ANALYSIS OF POTENTIAL SIGHTSEEING RESOURCES

Categories	The number of checkpoints (Place)	The number of check-ins (Times)
Entertainments in Waseda Festival	58	136
Potential sightseeing resources	10	89
Total	68	228

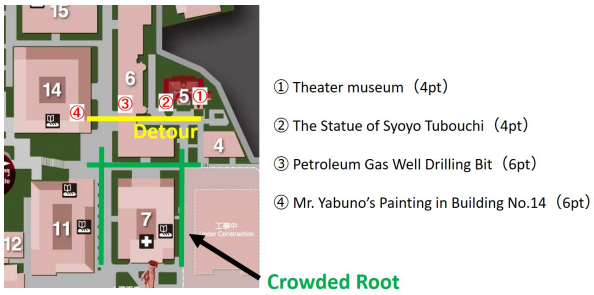

Fig. 13. Detour route

Building No. 14
: The building housing "Mr. Yabuno's Painting in Building No. 14"

A total of 11 users (out of the 48 who obtained points) used the detour. There was no entertainment and food stands along the detour, so it is a street that people usually avoid during the Waseda Festival. Nevertheless, it became possible for users to walk along the street because of WaseNavi and this helped to reduce congestion at the festival. It was also possible to check-in at four potential sightseeing resources when using the detour route. Thus, WaseNavi was effective in leading users to potential sightseeing resources.

Next, we examine the result of the quizzes presented at each checkpoint. The quiz results are shown in Table V. The term "Possibility of correct answer in situ" in the table represents the proportion of users that could provide the correct answer to a quiz question if they go to the destination because there were hints provided at the site. Table V shows that despite the possibility of the correct answer being provided in situ at potential sightseeing resources being just 30%, the correct answer rate is considerably higher at 67.4%. This means that the correct answer rate at potential sightseeing resources was high although many of the quizzes regarding potential sightseeing resources were difficult. Thus, it is presumed that many users were interested in the potential sightseeing resources and had made earlier investigations (e.g., Internet searches), evident in their answers to the quizzes regarding the potential sightseeing resources. The "Statue of Azusa Ono" in Fig. 14 is one example of a potential sighting resource that people had shown prior interest in. The answer to the quiz question regarding the "Statue of Azusa Ono" was not provided at the site. Nevertheless, 4 of the 5 people who checked-in at the "Statue of Azusa Ono" provided the correct answer. Thus, users were able to voluntarily investigate potential sightseeing resources on the Internet in their attempt to answer the quizzes.

We now examine how the differences in points affected to the likelihood of users going to the potential sightseeing

TABLE V
QUIZZES AT POTENTIAL SIGHTSEEING RESOURCES

Categories	Correct possibility in situ (%)	Correct answer rate (%)
Entertainments in Waseda Festival	100	79.7
Potential sightseeing resources	30	67.4

Fig. 14. Statue of Azusa Ono

resources. There were 10 potential sightseeing resources, 4 of which were worth 6 points and 6 worth 4 points. Table VI shows the analysis results for the number of visits per checkpoints divided by points earned for potential sightseeing resources. From Table VI, we can see that the number of check-ins per checkpoint worth 4 points was 9.67 (= 58/6) and the number of check-ins per checkpoint worth 6 points was 7.75 (=31/4). Many studies have pointed out the effects of non-monetary incentives [7] and gamification [8]. However, in this experiment, it was confirmed that a difference in points was not an effective motivation for users. A key reason for this was that there was other incentive that was more effective than points. Thus, it is presumed that certain situations are necessary for non-monetary incentives and gamification to be effective.

We now analyze the users' movements between checkpoints. The movements between checkpoints are shown in Table VII. Table VII shows that the users tended to go around checkpoints in the same building. Thus, the users had a tendency to visit the checkpoints closest to the next destination when they used WaseNavi. Therefore, we need to pay attention to the positional relationship of checkpoints to promote the event and lead users to potential sightseeing resources when using WaseNavi. In addition, it can be predicted that resources located some distance from other checkpoints will get fewer visitors.

Finally, the earlier assumption that "People who already have a specific visiting destination stop at potential sightseeing resources if they recognize there are potential sightseeing resources on their way to their destination" is correct. It was also found that visits to potential sightseeing resources were effectively promoted by our application. Furthermore, there were heuristic visits to potential tourism resources located between those sites that were the original purpose of the visit. It was also revealed that visitors who visited the potential sightseeing resources were actively seeking them. From the viewpoint of the festival operators, guidance to a detour via potential sightseeing resources produced a noticeable side effect, a reduction in congestion. The application also led festival goers to potential sightseeing resources within the university. From the viewpoint of operators, the application was able to provide new value above the traditional attractions of the school festival.

TABLE VI
ANALYSIS OF DIFFERENCE OF POINTS

Earned points （pt）	The number of checkpoints （Place）	The number of check-ins （Times）
4	6	58
6	4	31

TABLE VII
MOVEMENT BETWEEN CHECKPOINTS

The number of movements between checkpoints （Times）	178
The number of movements of the same building number （Times）	71
The rate of movement of the same building number （%）	39.9

VII. SUMMARY AND FUTURE CHALLENGES

In this study, we developed WaseNavi, an application that leads users to potential sightseeing resources within an existing event. Via our experiment, we showed that WaseNavi is effective in leading users to potential sightseeing resources. We also showed that the application succeeded in creating a detour and it is effective in easing congestion at busy events. Furthermore, we analyzed the motivation pattern of users' behaviors. As a result, it became clear that the users did not participate in the walk rally to gain more points but instead their emphasis was on the distance from their current location. As a future challenge, rather than displaying checkpoints by category, we could do so by distance from the user's current location. It is predicted that users will find the application easier to use after such improvements. Furthermore, because this experiment was conducted under the special condition of a school festival, we need to perform the experiment in a town, representing a more practical stage.

ACKNOWLEDGMENT

This research was supported by the foundation for the Fusion Of Science and Technology (FOST) in Japan. Also we would like to Waseda Festival staffs for carrying out the experiment.

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