

# Outdoor Studying System Using Bluetooth Low Energy Beacon -To Feel Cultural Sites-

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# 1. Introduction



# 1. Introduction

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☞ For Example their foot

What kind of people wear shocks in this parade?

- 1 Samurai belongs to high social position wear shocks
- 2 Samurai after 50th were allowed to wear shocks.
- 3 Everyone wear shocks if he would like to.

# 1. Introduction

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- ☞ If you answer the question, you cannot help looking their socks.(whether they are important or not)

# 1. Introduction

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- ❧ We have been studying about outdoor studying using Bluetooth Low Energy (BLE) beacon in Nikko, the world heritage site in Japan, in order to convey young students cultural traditional information

# 1. Introduction

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- ☞ We can look at a lot of contents with the Internet
- ☞ Such interesting contents make them as if they became to understand the object well. However, they sometimes find it is not enough to figure out the object indeed.
- ☞ Using the Internet and convenience tools on PC, students write and make their reports. However, they do not remember the contents after the class. The completed objects are out of them and they have little chances to make some other imaginations in their brains.

# 1. Introduction

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- ☞ We have been studying how such students become to learn active using ICT.
- ☞ Now we created an application for them to feel real world deeply using smartphone in Nikko. Smart phone is suitable contents to bring outside. Smartphone is a tool to connect a real traditional place and their ordinary lives.



# 2. Related Work

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BLE Beacons (1)

- ∞ Indoor location-based services to indicate locations and display information for education scenes.

Ex. Casa Batlló



# 2. Related Work

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BLE Beacons (2)

∞ Beacon Bank

The global BLE beacon market is expected to grow at a compound annual growth rate of 307.2% from 2015-2020. About 80,000 units were shipped in 2015.

New business named “Beacon Bank” using beacon of having already been established, is based on beacon sharing system

# 2. Related Work

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## ☞ Sightseeing Application

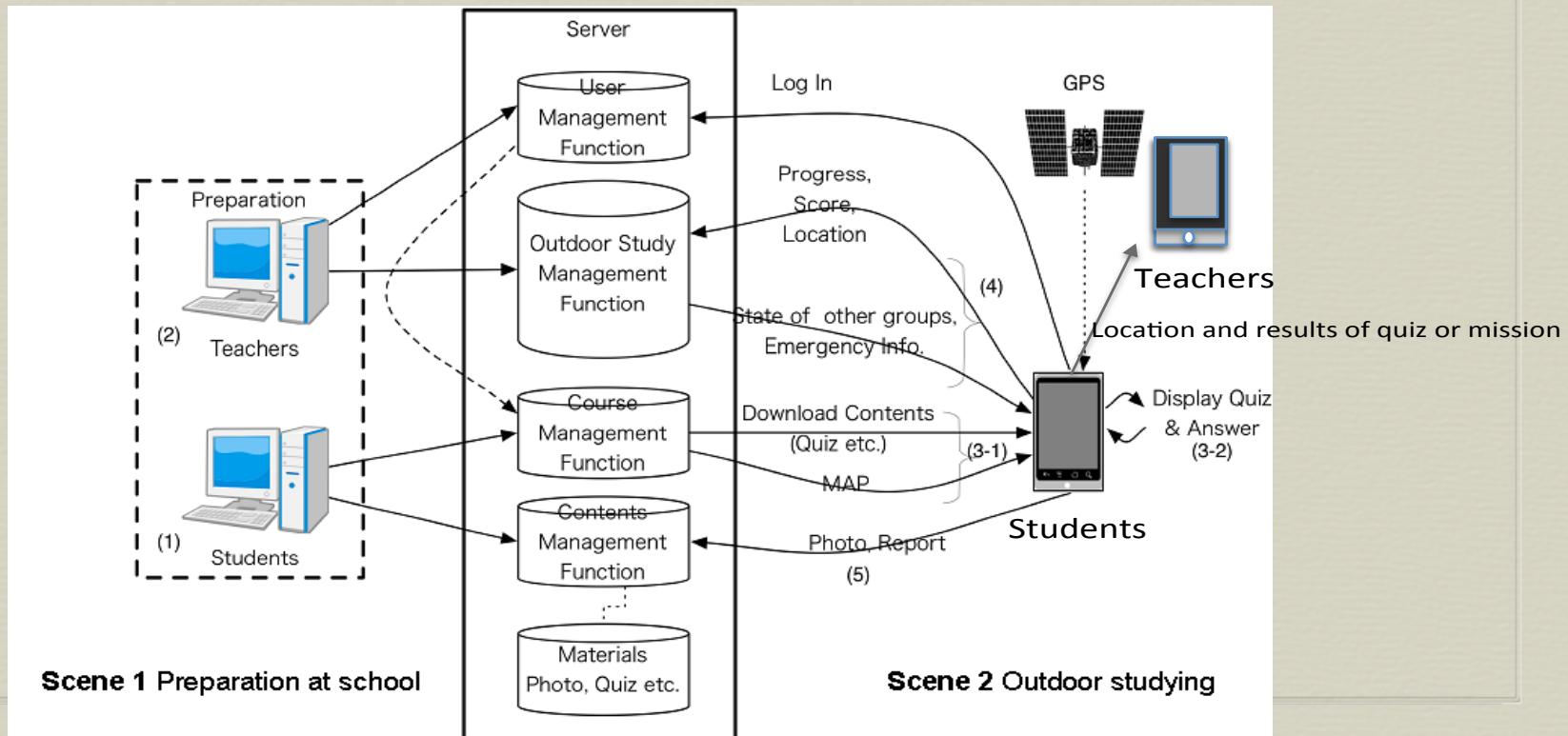
The EU's TAG CLOUD project (Technologies lead to Adaptability and lifelong enGagement with culture throughout the CLOUD) used smartphone technology to provide information about traditional cultural sites.



# 2. Related Work

## Our Previous Works about School Trip

94% of junior high school students and 97.1% of high school students go on few days' school trips in Japan (2011)



# 3. Our Application Using BLE Beacons

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## ∞ Our Purpose of the Project

To offer local traditional information from the area

Some shops continued for 7 or 8 generations in Nikko.

Shop owners have lived with the traditional Japanese ways.

If they have chances to tell about their traditional ways to live in cultural site, students will be interested in them.

# 3. Our Application Using BLE Beacons

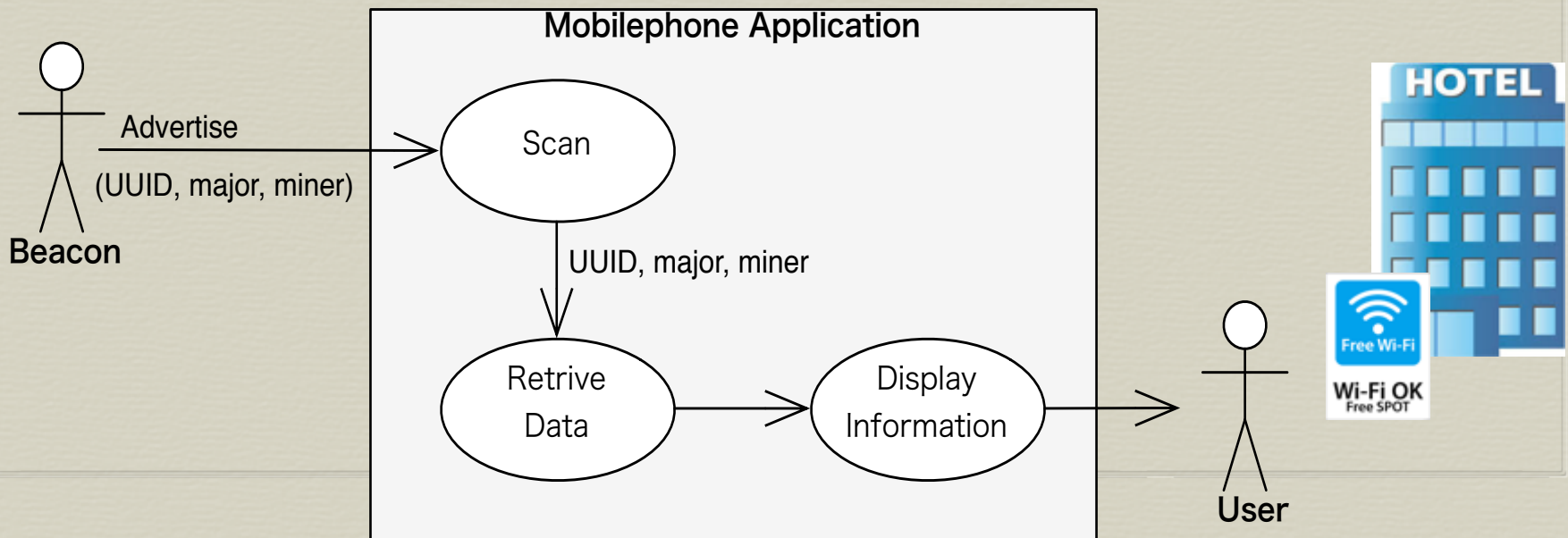
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## Design of Our Application

- (1) Protect the environment in the cultural heritage site
- (2) Push local and traditional information relating to the area
- (3) Push seasonal and temporally information
- (4) Protect individual privacy

# 4. Service proposal for Young Tourists and Foreigners

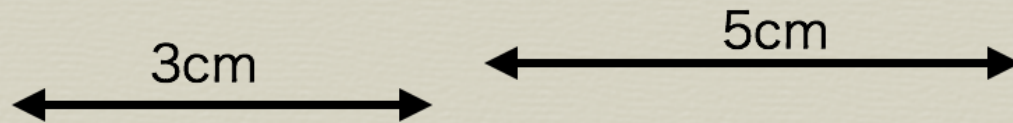
- (1) Tourists can install the application in the hotel or café, or at train station,
- (2) They can use the application without internet access on the road.



# BLE Beacon (1)



# BLE Beacon (2)



Raytac MDBD40

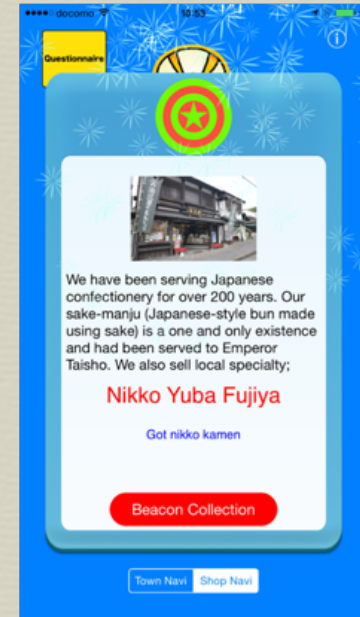
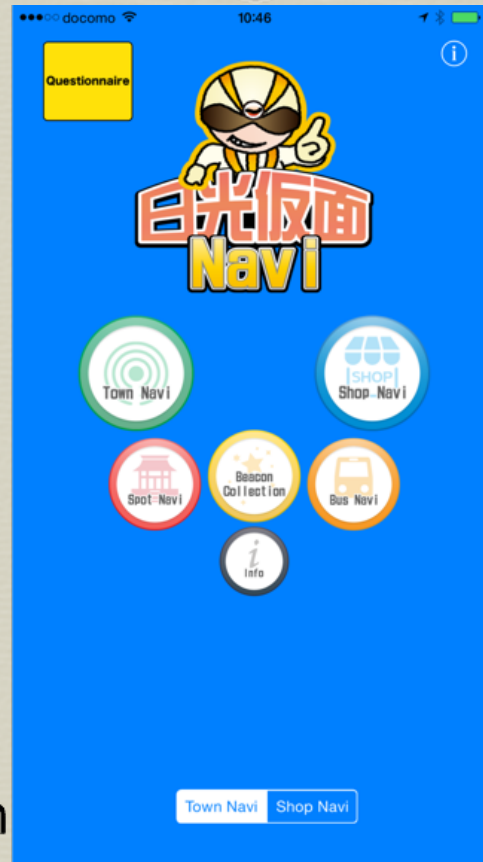


Waterproofed Shell  
Layered Acrylic Plate

# Application



Pop up when Town  
Beacon is found



Pop up when Shop  
Beacon is found

# Multilingual Thai and Chinese(Taiwan)

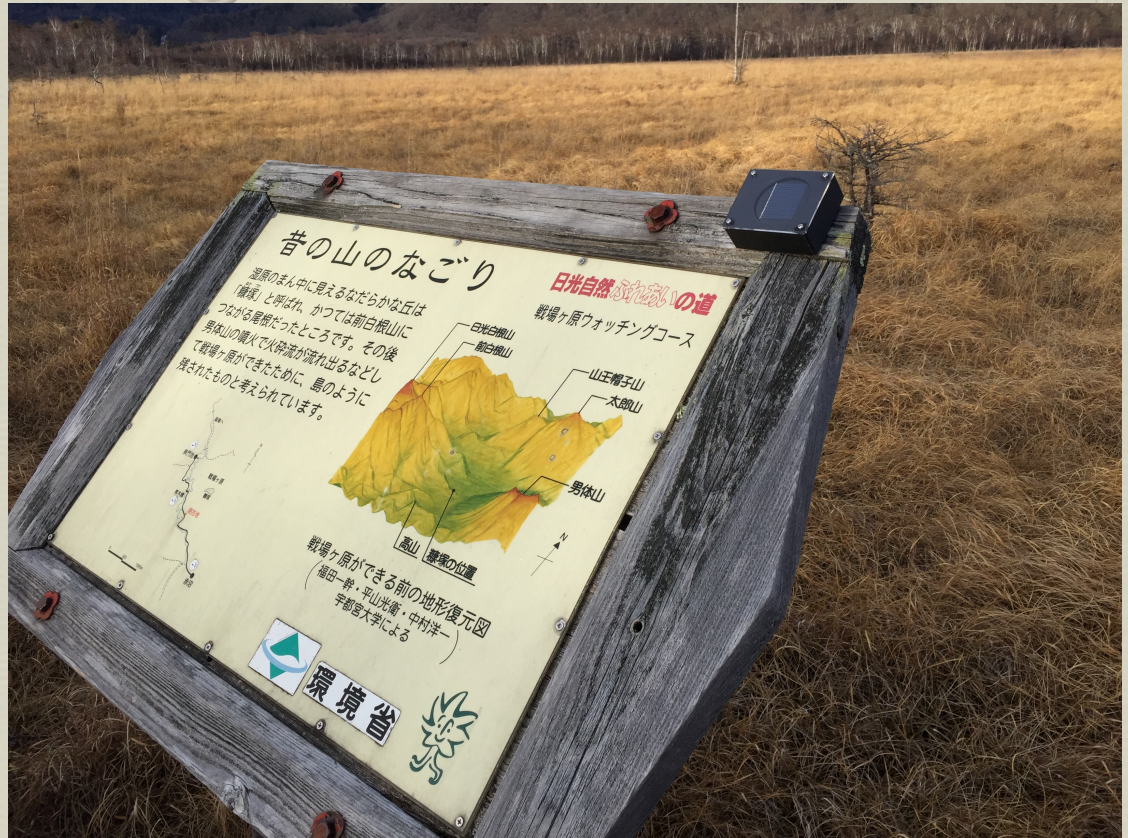
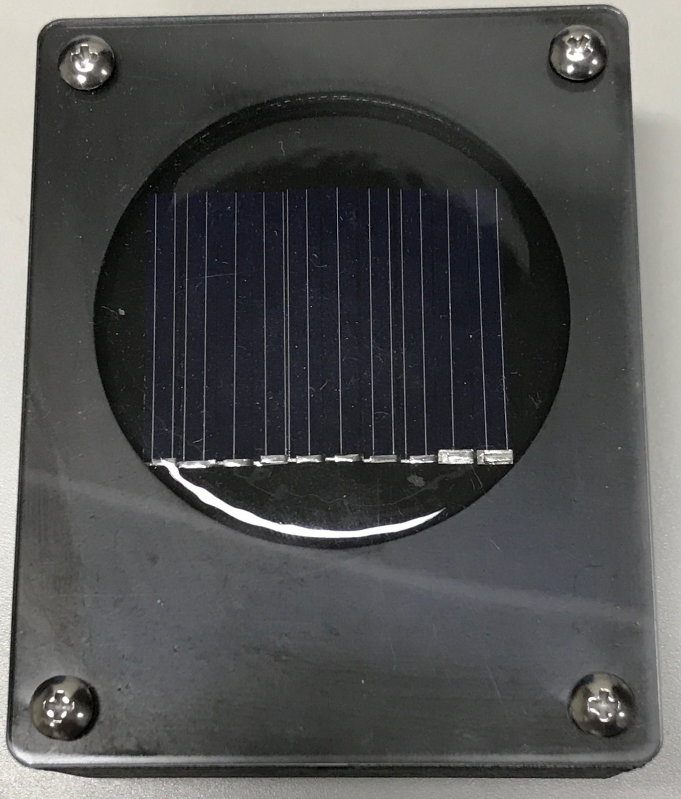


# Wearable Device

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# Solar BLE Beacon for sustainable use



# Location of beacons



# 4. Service proposal for Young Tourists and Foreigners

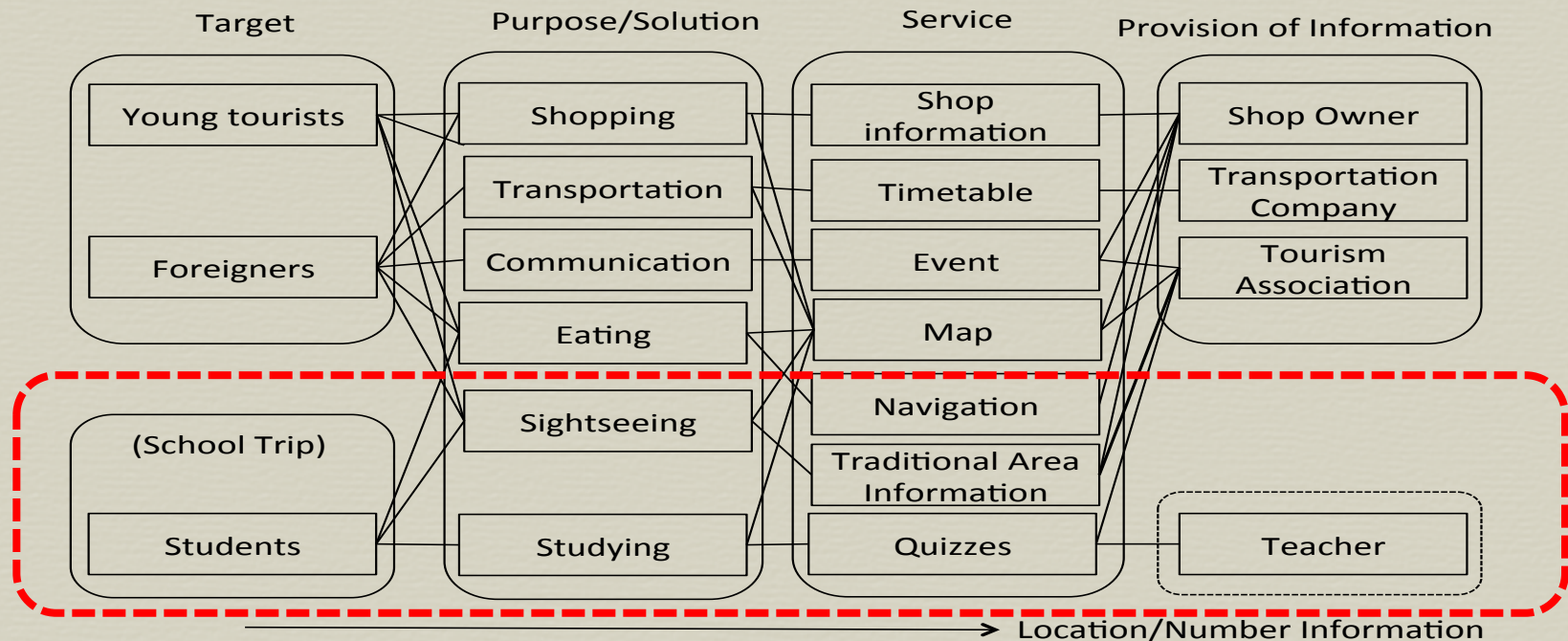
Screenshots of our application



Pages of Quiz function for school trip

# 3. Our Application Using BLE Beacons

## Service Flow



# 4. Experiments and Results

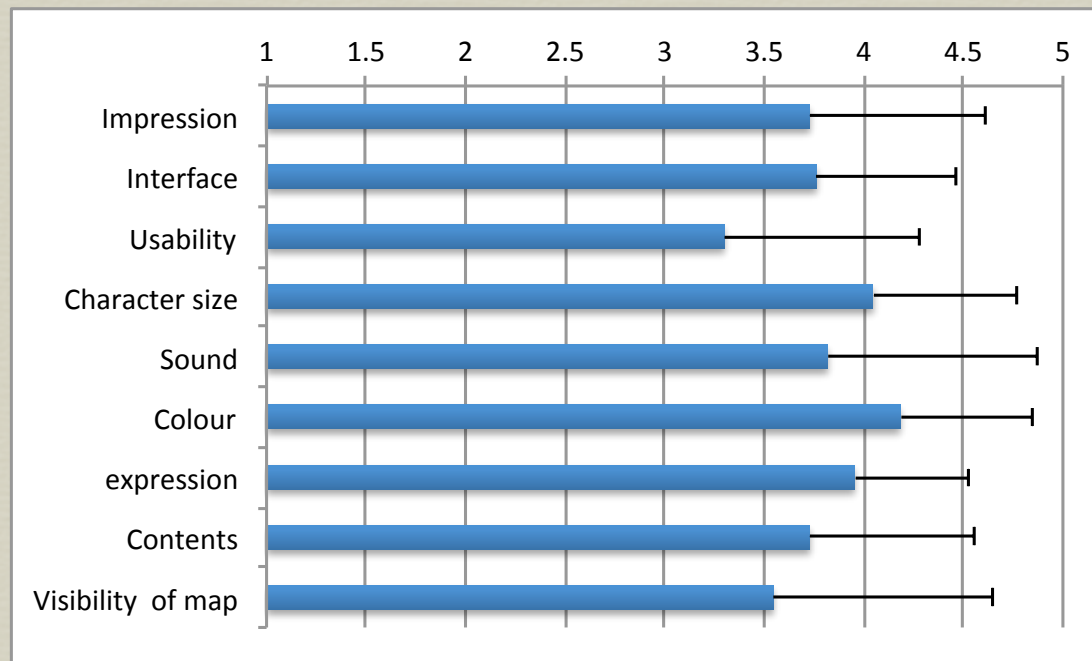
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∞ 28 students participated in the trial

= >23 students were required to complete 10 quizzes on the streets and 5 students walked around without the application for comparison on 26 September 2015

# 4. Experiments and Results

- *Research after the trial*



# 4. Experiments and Results

The students evaluated this quiz the highest of all.

The height of the place you are standing now is as same as

- 1 Seaside in Tokyo Bay
- 2 Second floor in Nikko Station
- 3 The Five-Storied Pagoda in Kyoto
- 4 Sky Tree, the highest Tower in Japan

Answer: 4

Interpretation: you are standing very high place now. Old people built holy places on high place. Pilgrims walked up the hill or the mountain and arrived at holy places with difficulty. Now, you may feel their spirits.

# 4. Experiments and Results

- ☞ Nikko En route to the main shrine (They have to walk up the road )



The holy place is higher than places of our living spaces

- ☞ Their daily lives The highest tower in Japan

# 4. Experiments and Results

∞ Writing map of Nikko Street  
(28students)

Quizzes' application users (23) . . . 9.18  
objects on average at the map from the station  
to the main shrine.

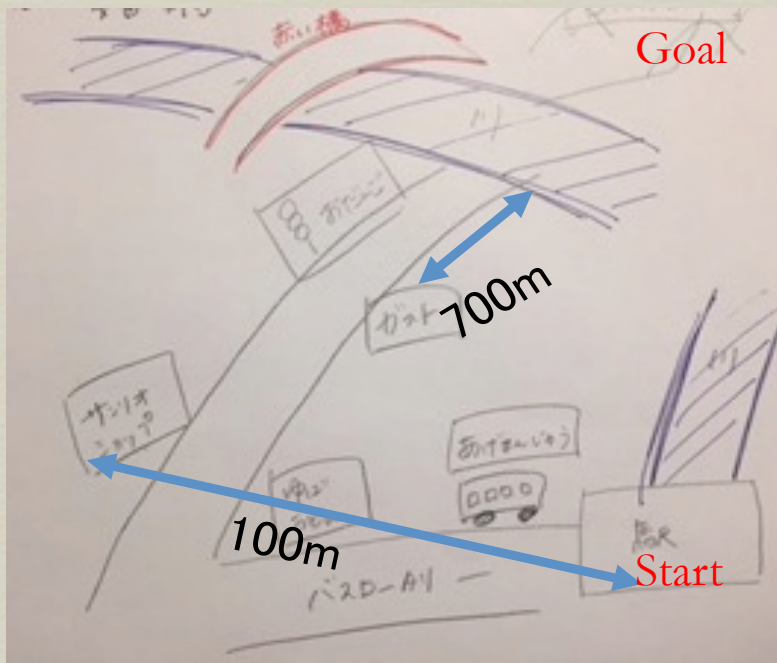
Non-App user (5) . . . 5.80 objects on  
average.

Quizzes' application users tended to remember  
not only answers of quizzes but also shops  
around beacons where they answered the  
quizzes.



Designing Mobile Application for young  
People to Visiting Cultural Heritages

# 4. Experiments and Results



Maps from the station to the main shrine  
after the experiment

# 4. Experiments and Results

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☞ After two months

The students answered the same questionnaire presented before the experiments.

They remembered the cultural objects well. In addition, they remembered several shops along the route, and 75% of them hoped to visit there again.

# 4. Experiments and Results

The Evaluation of our application before and after the experiment  
(Comprising Cluster Elements: 5 points' Likart Scale)

Cluster	(A) Before the trip			(B) 2 months fter the trip			(C) Incremental difference (B-A)		
	1	2	3	1	2	3	1	2	3
Nature	5.00	5.00	3.75	4.43	4.83	4.50	-0.57	-0.17	0.75
Landscape									
History/Culture	4.29	4.71	3.25	4.43	4.80	4.75	0.14	0.09	1.50
Street	4.43	4.29	4.50	4.00	3.83	4.00	-0.43	-0.45	-0.50
Hot Spring	4.14	3.71	3.50	3.57	3.50	3.25	-0.57	-0.21	-0.25
Traditional performing art/ Specialty	3.86	4.00	3.75	3.71	3.83	4.00	-0.14	-0.17	0.25
Food	4.71	4.43	4.25	3.71	3.83	4.75	-1.00	-0.60	0.50
Experience-based tour	3.43	3.57	2.50	3.00	2.83	3.75	-0.43	-0.74	1.25
Shopping	4.14	3.14	3.50	3.00	3.17	3.75	-1.14	0.02	0.25
Night Spot	3.71	3.00	4.50	3.00	2.67	3.00	-0.71	-0.33	-1.50
Relationship with peoplein the area	2.83	3.29	3.00	3.71	3.33	3.00	0.88	0.05	0.00
Easy reservation	4.00	3.29	3.75	3.00	3.17	3.00	-1.00	-0.12	-0.75
Price of hotels	4.57	3.71	5.00	3.00	3.17	3.50	-1.57	-0.55	-1.50
Traffic convenience	4.71	4.43	4.50	3.29	3.50	1.75	-1.43	-0.93	-2.75
Commodity price	4.14	3.57	3.75	3.00	3.83	3.25	-1.14	0.26	-0.50

# 4. Experiments and Results

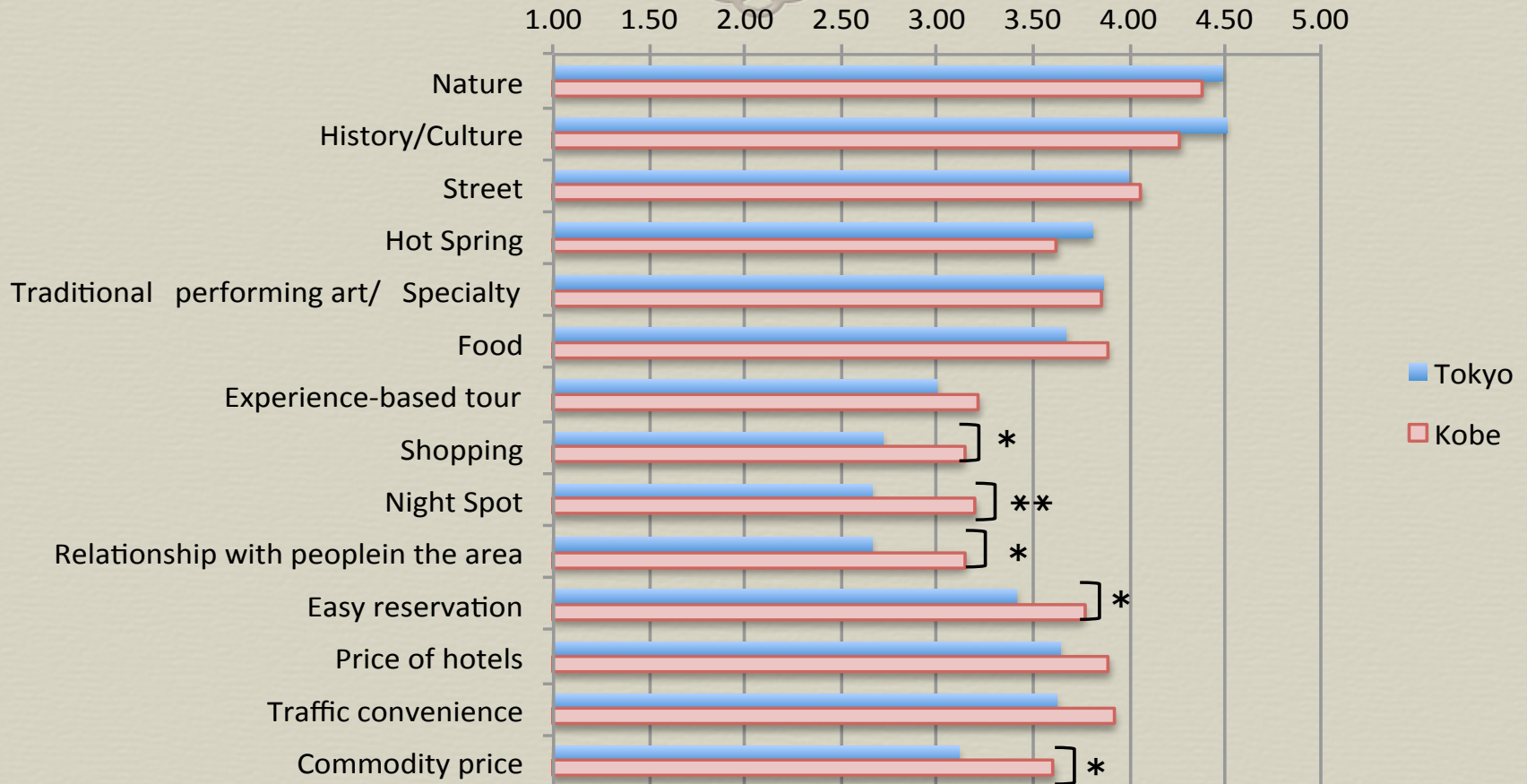
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## ∞ Regional Differentials of Evaluation about Tourism in Nikko

We performed another study in Kobe ( $n = 80$ ), which is in the Kansai area of Japan and is far from Tokyo. Students in Kobe seldom visit Nikko on their school trips.

We compared students in Kobe with students in Tokyo ( $n = 53$ ). The research objective was to understand users' regional differences. Students in Kobe evaluated Nikko higher than students in Tokyo..

# 4. Experiments and Results



# 4. Experiments and Results



The campus at Kobe is in the city center. The night spots are very beautiful .

In contrast Tama campus in Tokyo is located in the suburbs, near the mountains.

The purpose of this study was to define the construct of novelty in the context of tourism .

However, the results of our research indicate that students tend to wish for elements in their daily lives.

# 5. Conclusion

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## ∞ Evaluation of BLE Beacon -Application for Sightseeing on School Trip-

The evaluation of the BLE beacon application was high.

Students remembered the traditional objects and evaluated the history and culture higher after they visited Nikko.

Shop owners have cooperated with us and were prepared to input seasonal and traditional information using this application.

Staff in the tourism association use the bus timetables of this application in order to answer inquiries from tourists. Students, tourists, and people in the area have begun to use our application.

# 5. Conclusion

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## ☞ To Inherit Culture of the World Heritage Sights

Not only shop owners but also young people living in the area actively maintain the traditional cultural sites. The high school students near Nikko gathered information around Nikko Station on 8 February 2017.

We set BLE beacons at about 100 m intervals. However, according the results of our research, the area in front of the station has big impact because of its primary effect

We hence should to reinforce the information around the station.

We will install this information in our application. Such corroboration will encourage the junior high school students living near Nikko to inherit the Nikko area.

# 5. Conclusion

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## ∞ To Feel the Cultural Sites

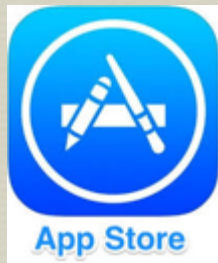
According to our research, students tended to wish for elements in their daily lives during travel. The characteristic points of traditional cultural areas are different from their daily feelings. Therefore, a smartphone application, which belongs to their daily lives, will be useful for connecting old traditional places with young people.

An application using BLE beacons provides local information and connects young and old, from the past to the future.

# 5. Conclusion

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In addition, we are planning to collaborate with other World Heritages.



Look up => nikkonavi

# Acknowledgments.

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Thank You  
for Your Attention