Application of QR codes as a new communication technology and interactive tourist guide in Jaboi, Sabang

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Abstract. The Indonesian volcano is only limited for the electrical energy capacity, but in developed countries, the volcano is not only used for power plan but also developed for the tourism industry. Jaboi is one of the volcanoes located in Sabang with a capacity of 80 MW. The five potential of geothermal spots can be used as geo-tourism tours. Besides to improve the economic sector, the main purpose of the geo-tourism is the management of the tours that will be provided for educative lessons about the friendly life in a volcanic area. In this paper, we produced the educational videos that placed on each tourist spot; the video contains the history of the site, geological background, and also information about the risks of living in a volcanic area. The QR code program is used as a medium for data transfer that can be scanned through a smartphone. This application is widely used in tourism as an economical alternative in technology. In the several spots that difficult to access, we also produced a safe route with a QR code program. The tracks will be overlaid on the smartphone with the ‘gpx viewer’ application, which possible to download from Google Play or App Store.

1. Introduction

Aceh is one of the regions with the most extensive geothermal potential in Indonesia (1310 MW) located in 17 places [1], one of them is in Jaboi, Sabang. Generally, the geothermal has been closely related to electrical energy with an 80 MW capacity power plant built in Jaboi. Furthermore, the geothermal also possible to develop for the tourism industry; it can have a direct impact on economic people around the volcano area [2]. Referring to [3], ten categories of attractions can be used in a geothermal area for tourism development. Among them, five classes are available at the Jaboi volcano, namely fumaroles, hot springs, volcanic sedimentation, and hot tubs. Figure 1 shows the potential distribution of tourist spots in Jaboi. In another side, the village is confronted with the Malacca Sea, which presents the beautiful panorama and becomes a very complex geo-tourism potential. The problem in geo-tourism management is how the trip can be structurally managed by the local community to produce a financial income, and what the effort to become an educational trip for the tourists [4]. One of the traditional solutions is the training knowledge about the geo-tourism to the local guides. However, this method requires a relatively long time, and belongs to an expensive [5]; the guide also must be trained in English to target world tourists. The QR (quick response) application codes is an economical solution from the side of technology; the method is being able to quickly connect the data from the offline world to online content, and receive all designed files [6].
The QR codes serve as a bridge between the physical and digital worlds. Thus, this method is often applied to museums or other underfunded cultural institutions [7]. In this paper, we make the lessons learned video from the tourism spot that presented in QR code as an interactive tourist guide in Jaboi Sabang.

Figure 1. The distribution map of Jaboi destination that will be potentially developed for geo-tourism.

2. History and QR Code Structure
Quick Response Code is a type of 2-dimensional barcode that can be read with smartphones and web applications. Although the Japanese company Denso Wave developed it in 1994 for industrial use, QR codes have become widely used in the advertising and packaging of products after being commercialized in 2011 [9], [6]. The QR Code is a cell-matrix composed of dark module patterns (logical '1') and bright pattern (logical '0'). Each QR code pattern consists of function patterns and encoding regions which are divided into several module patterns, where each design has a specific purpose for processing data readings such as position detection, timing, alignment pattern, format and information of the version that can be referred to ISO / IEC18004: 2006.

Based on the ISO, the minimum module resolution that can be read by most optical devices is 4 px (pixels) with a printout of 300 dpi (dots per inch). Referring to [10] the data on the 3x3 module can only be read through a high resolution camera, which has an accuracy rate of 95% for 5 MP (megapixel), and 100% in 8 MP. However, the smartphones in the market today have been used the high camera resolution over 10 MP. In terms of security [11] stated that QR code is a safe system, it caused the tourist only get the links on the front-end of the server through the internet. Thus it will not interference with the back-end database of an information system.
In general, tourism is considered an innovative industry. Therefore the QR codes have become a popular system; for example, the Cleveland of Art Museum and Bologna's of Archaeology uses a QR code for audio information in its museum collection. The same thing was done at the Natural History Museum in Washington, DC, that uses QR codes as part of the exhibition [12]. Moreover, in Manchester city, all of the streets, castles, vineyards, rivers, parks all open-air venues can inform the tourist with QR code.

3. Material and Methodology

Sabang Island is one of the city which more visited by local and foreign tourists every year. In this preliminary study, the research area is only focused on Jaboi as the location of the volcano. Figure 1 shows the tourism spot where the QR codes will be installed. The QR code pattern is printed in the form of stickers and mounted on board with dimensions of 40 × 60 cm. Furthermore, the board information also contains a short description, another destination of Jaboi and also includes the logos of several collaborative research that funded the program, e.g., Syiah Kuala University, Sabang Government, and the Ministry of Education and Technology. When a smartphone scans the QR code, it will be directed to geosabang.com as the website management and linked to the video that has been made before. This process is called the dynamic barcode, in which the contents in the barcode are possible to change by using the Hypertext Mark-up Language (HTML) without the need to reprint out the barcode. This QR code is generated from https://qrcode.studio that required the video link as a parameter input in the barcode system, the barcode dimension used in this system is 3×3 in order to obtain the accuracy of reading patterns from the smartphone camera.

The video that will be shown on each spot is including the history of the site, geological background, and the lessons learned about the risks of life in the volcanic zone. Figure 2 describes the development system and flow process in the QR code.

![Figure 2](image_url)

**Figure 2.** The flow process of dynamic QR code in Jaboi geo-tourism. The video destinations were firstly uploaded on YouTube account for an un-weighted server in the data process.

In another side, the tourism spot located in the forest area that makes it inconvenient to access. For example, Jaboi volcano and three craters, we also developed a safe tracking based on the QR code program. The process of the road is using the tracking feature on the Garmin GPS, where each of the craters will be pointed, and the safe tracking will be recorded. Briefly, the flow of making this QR code is shown in Figure 3. Furthermore, before scanning the barcode, the tourist needs to install the application like GPX Viewer on Google Play or App Store to open the ‘*.gpx’ type of data that gets from the QR code scanner.
4. Result and Discussion
The video information is one of the fastest and most economical methods used to achieve the lessons learned in the tourism industry. In this study, we used the barcode technology as a quick transfer of information from the offline board to the online source in the internet server. Based on the observations, it was shown that the local community has been aware and familiar with the tourism industry, this also evidenced by the existence of a small group that manages tourism in the village. Generally, the tourism spots in Jaboi can be categorized into two; the spots related to geological and cultural tourism. Moreover, although the culture is not correlated to geo-tourism; the collaborated of geological landscape and cultural aspect can help and increase the local people to prefer the geo-tourism. The board information was installed in 10 spots location, which 6 of them are related to geothermal tourism. For example (1) the hot spring, is mostly used by Jaboi people for swimming, (2) Batee Tamon is an underwater tourism spot that also has a hot spring, (3) tower explorer as a top view of Jaboi landscape and (4) the Jaboi volcano as the first spot in geo-tourism. Figure 3 shows the hot spring tourism in Jaboi Village.

Figure 3. One of the geological spots that installed the information board, (a) barcode information board, (b) photo documentation at site.

The tracking tour to the Jaboi Volcano and the craters have been a favorite spot for tourists. But for several years, the visitors have been reduced; it caused by unstructured tourism management. In another side, the local community may not always have time to guide the tourists. So that it causes minimal tourist visits. Furthermore, one of the efforts to increase the tourism visit in Jaboi Volcano and craters through provided for the safe road to the location. In this research, we also develop a tracking guide system that used a QR code program. The system is installed in the tourism spot that difficult to access by road. Figure 4 shows a description of the ‘get track system’ in the volcano area. The get the track system was first made by tracking to the Jaboi volcano through choice a relatively for the safe route, the route was made by using the Garmin GPS. However, in each of the crater, the coordinates were saved for marker information in the map. The GPX viewer application can be downloaded free through the Google Play Store for Android and the App Store for Apple. Figure 6.c is an overview of the overall track results, starting from the scanning of the barcode (shown as ‘You Are Here’) to the 4th crater.

After the QR code was installed in each of the spots, we analyze the response of local people related to the implementation of the barcode in Jaboi tourism, then the questionnaires were given to 30 people which distribution to village officials, tourism awareness groups and another local people.
Figure 5 shows the local people responses about the barcode and the video content in Jaboi tourism. Based on the result, it can be analyzed that the 23 or 76.6% of the local people are choosing the implementation of the QR code was a very useful technique for geo-tourism development in Jaboi, it caused by most of the community are interest to technological implementation in tourism. In addition, there were also 5 or 16.67% of the people chose no opinion and 2 people chose it as a bad idea for tourism. The next question is how the quality of the video content that placed in the QR code can provide an information to tourists and local people, the result showed that many of the people (33%) chose the video was very informative, 50% said it was good and there also were 5 people or 17% neutral about the quality of the video. Generally, the local community stated that the video could be as a media transfer for the lesson learned in the geotourism spot, it caused the video is related to historical and geological activities of the spot.

Figure 4. Get the track system on the volcano spot. Figure (a) the get the track system made by a QR code, and (b) is the gpx result on the GPX viewer application.
In another side, the barcode is used for an automatic route to explore the Jaboi volcano. Based on the questioners, it can be showed that 60% of the local people chose the barcode as a good idea for the self-guide to explore the volcano and their craters, but as many as 30% of the people chose no opinion on the system, and 10% chose for a bad idea, this was caused by some people who are not familiar with the modern technology in Jaboi tourism.

5. Conclusion
Technology and tourism are the two most entangled areas in modern daily life. This study has identified the usage of QR codes in various geo-tourism areas. Based on the results, it can be concluded that the implementation of the video application at the tourist spots is the most effective way to encourage the community towards geothermal tourism. The video can also be used as a media lesson learned for public people about the risks of life in the volcanic zone. Furthermore, the used of QR code as a video transfer medium is an efficient, economical, and modern technology.

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