



Research Article

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## A Mobile Application for Touristic Routes in Riobamba-Ecuador and Its Usability Analysis

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### Abstract

*This work presents an application for touristic routes implemented in a prototype system. The prototype was developed with Ionic Framework v5 which is an open-source UI toolkit for building performant high-quality mobile apps, with Angular as integration and web API in .NET 5.0. Google maps and Open Weather API were also included. An experimental analysis was performed to assess and validate the usability of the App prototype and the results evidenced a positive degree of satisfaction perceived by the users. Most of them enjoyed using the application, found the application simple to use, and thought that the interface was friendly. Even though the RutasRio App is still in its prototype stage and could be improved, we aim that this App contributes to the dynamization of the touristic sector in Riobamba in a post-pandemic COVID-19 scenario. As the App is in the first stage of implementation, the results obtained in this study could be useful for future works conducted to improve its functionalities.*

**Keywords:** Riobamba, touristic routes, app, usability, Ecuador

### 1. Introduction

The tourism industry has been transformed worldwide by the development of information and communication technologies (Tussyadiah, 2016) and nowadays is strongly linked with the managing of large amounts of digital information (Kenteris et al., 2009; Tenemaza et al., 2020).

The increase in the use of apps in smart devices is evident in many aspects of human life

including touristic activities due to the effect of these technologies on individual behavior (Gupta et al., 2018; Wang et al., 2014) which allows enhancing the experience of the visitors before, during and after the trip in touristic destinations. Tourists are seeking memorable experiences and need instant access to information about destinations, routes, and touristic services (food, accommodation, and transport), finding in the use of smart devices and apps the right tool to achieve it.

Apps have become an integral part of the tourist experience and the preferences of tourists are now pointed to personalized and autonomous activities instead of pre-organized packages; therefore, the demand for mobile applications to support touristic activities is increasing day by day. In fact, with the increasing use of touristic apps, travel becomes extensive allowing independence and flexibility in its activities (Wang et al., 2016), and also the stress involved in planning and consuming tourism has been reduced by the use of travel apps which increase feelings of safety and confidence among travelers (Coves-Martínez et al., 2022).

Cycling tourism is an emerging trend and is expected to continue growing (Han et al., 2020). This activity includes trips along routes to explore destinations by bicycle with the purpose of doing sports, adventure-seeking, challenge, physical, mental and spiritual relaxation, entertainment, or enjoying nature (Duran et al., 2018).

Touristic cycle routes are frequently linked with adventure tourism, sports tourism, nature tourism, rural tourism, and sustainable tourism and their importance has been widely appreciated (Han et al., 2017; Kaplan et al., 2015; Nickerson et al., 2014; Payne and Dror, 2015). Several studies (Faulks et al., 2007a; Gazzola et al., 2018a; Karanikola et al., 2018; Ritchie and Hall, 1999) have dealt with the importance of cycle routes and their role to boost small and rural economies having a sustainable feature in the environmental, social and economic dimensions.

The first consideration for a cycle journey is the selection and planning of the route because a well-chosen route can enhance the cycling experience and ensure personal safety (Mou et al., 2022). Hence, the use of applications in smart devices to find touristic routes has been reported as the most used feature (Kenteris et al., 2009) and generally integrates Location Based Services (LBS) which are mobile applications that provide various query functions based on the device location obtained via GPS (Karaş et al., 2021). Nowadays, the use of applications designed for mobile devices is widely used in touristic routes; however, there are still several challenges regarding functionality, design, and usability (Kenteris et al., 2009).

Usability can be described as the capacity of a system or application to provide the conditions for its users to perform the tasks safely, effectively, and efficiently while enjoying the experience (Lee et al., 2019). Usability has been often associated with the functionalities of a product and the term *user friendly* is often used as a synonym for *usable*.

A usability analysis includes an evaluation conducted with the app users considering their level of satisfaction and utility as key components; usability tests are commonly used in experimental environments and also in field studies. In general, a usability assessment aims to improve the user experience and is a key factor to analyze the utility of any application.

This work aimed to present an application for touristic routes developed as a prototype and the usability assessment of the application.

## 2. Methods

### 2.1 Study Area

Riobamba is an inter-Andean small city of Ecuador located in the center of the country (Fig. 1); its coordinates are 1°40'00"S - 78°39'00"O. There are several large mountains and volcanoes (Chimborazo, Carihuayrazo, Altar, Iguayata, Tungurahua, Sangay) surrounding Riobamba. Administratively, Riobamba has 5 urban parishes (Velasco, Veloz, Maldonado, Lizarzaburu, and Yaruquies) and 11 rural parishes (Licto, San Juan Cubijies, Punín, Cacha, Licán, Calpi, Flores, Pungalá, Químiag, and San Luis). Riobamba has a projected population in 2020 of 264,048 inhabitants (Instituto Nacional de Estadística y Censos, 2020).

Riobamba has an altitudinal average of 2750 m.a.s.l. and an annual temperature average of 12°C. The main natural touristic attraction around Riobamba is the Chimborazo volcano, which is the highest mountain in Ecuador with 6.263 m.a.s.l.



Figure 1: Location of Riobamba in Ecuador

## 2.2 App prototype

The application design was based on the information collected in a previous study that assesses the need for a resource of innovation to promote the touristic sector in Riobamba (Quevedo et al., 2022) and was hosted in the Universidad Nacional de Chimborazo server ( Fig. 2). The scope of the application was to provide an effective alternative to users that would like to find information and maps of touristic routes to practice biking around Riobamba also allowing the record of personal routes. So, we design and include in the App 10 routes that integrate different levels of difficulty (high, medium, low), distances, height difference, and approximate time to perform the route. In this paper, we detail the user's process and the flow diagram of the App prototype.

Unach				
Inicio	<input type="text"/>	Todas	Todos	<input type="text"/>
Dashboard	Riobamba-San Gerardo	Ciclismo	Fácil	16,94
Administración	Riobamba-Cubijes	Ciclismo	Fácil	15,59
Rutas	Riobamba-Canal-San_Luis	Ciclismo	Moderado	27,71
	Riobamba-Punín-Chalán	Ciclismo	Difícil	33,79
	Riobamba-Punín-P_industrial	Ciclismo	Difícil	40,44
	Riobamba-Quimiag-Guano	Ciclismo	Difícil	47,35
	Riobamba-Canal-San_Luis-Univ	Ciclismo	Moderado	32,32
	Riobamba - Pulinguí	Ciclismo	Difícil	37,00
	Riobamba-El_Canal-Yaruquíes	Ciclismo	Fácil	13,64
	Riobamba-San Luis-Inmaculada	Ciclismo	Moderado	34,00

Figure 2: Dashboard of RutasRio App hosted in Universidad Nacional de Chimborazo server.

### 2.3 Usability assessment of the prototype

To evaluate the usability of the prototype, we developed a field study that allowed the use of the mobile application in a realistic environment, which could be difficult to simulate in laboratory experiments (Kjeldskov and Stage, 2004). During the testing, the participants were asked to accomplish a list of tasks using the application (Fig. 3). Fifty participants contributed to the test, 35 males and 15 females. The age of the participants varied from 18 to 45 years, being the average age 25 years. All had a mobile phone with Android or iOS. The test process consisted of three parts: an explanation of the scope of the App, testing the use of the app, and filling out a questionnaire.

#### Task list for the use of the App

1. Install the app RutasRio.
2. Register and create an account.
3. Identify the routes available.
4. Select one route according their preferences.
5. Create a new route including the upload of images.

**Figure 3:** Task list for the use of the app

The participants interacted using the app and then were asked to fill out a questionnaire based on previous studies related to usability assessment (Gavalas and Kenteris, 2012; Lewis, 1995; Ricci and Nguyen, 2007). The questions were answered using a five-point Likert scale (Bertram, 2009) where 1 is translated to 'strongly disagree' and 5 to 'strongly agree', the intermediate value 3 corresponded to a neutral response. We decided to use the Likert scale because it measures attitudes and behaviors by using a series of options ranging between two extremes, allowing a very simple style chosen for the response registration. Moreover, differently from a scale with two contrasting alternatives, the Likert scale permits a better articulation of the personal opinion by allowing the user to select alternative responses. The questionnaire statements (Table 1) included 12 questions and a final option to write any additional comments.

**Table 1:** Questionnaire statements

Code	Questionnaire statement
Q1	It was possible to complete the tasks using the application?
Q2	Did you feel comfortable using the application?
Q3	The information provided was easy to comprehend?
Q4	The screens of the application were clearly organized?
Q5	Did you enjoy using the application?
Q6	The application was simple to use?
Q7	The use of the app is intuitive?
Q8	It was easy to find information?
Q9	It was easy to upload information?
Q10	Does the application have a friendly interface?
Q11	Will you easily remember the app use?
Q12	What is your overall level of satisfaction with the use of the application?
AC	Please provide any additional comment

### 3. Results

#### 3.1 App prototype

The prototype has been implemented as an App named RutasRio, in consideration to the relation of the words “Rutas” for Routes and “Rio” for Riobamba; and, 10 routes were designed and selected to be included in the App (Table 2).

**Table 2:** Routes implemented in RutasRio App.

CODE	ROUTE	DISTANCE (km)	AVERAGE TIME (hours)	HEIGHT		LEVEL (low, medium, high)	
				Maximum	Minimum	Physical	Technical
R1	Riobamba - San Gerardo	17,2	2	2810	2648	Low	Medium
R2	Riobamba - Cubijies	15,9	2	2795	2504	Low	Medium
R3	Riobamba - El Canal - San Luis	28,3	3	2818	2640	Medium	Low
R4	Riobamba - Punín - Quebrada de Chalán	34,7	4	2818	2557	High	High
R5	Riobamba - Vía a Punín - Parque industrial	41,4	4	2825	2607	High	Medium
R6	Riobamba - Químiag - Guano	48,0	5	2817	2398	High	High
R7	Riobamba - El Canal - San Luis - Universidad	32,9	3	2818	2631	Medium	Low
R8	Riobamba - Pulinguí	37,5	3	3339	2780	High	High
R9	Riobamba - El Canal - Yaruquies	14,1	2	2812	2736	Low	Low
R10	Riobamba - San Luis - Inmaculada	34,6	3	2822	2640	Medium	Medium

The physical level of difficulty included 3 routes with low level (R1, R2, and R9), 3 routes with medium level (R3, R7, and R10), and 4 routes with high level (R4, R5, R6, and R8); while, the technical level of difficulty was represented by 3 routes with low level (R4, R7, and R9), 4 routes with medium level (R1, R2, R5, and R10), and 3 routes with high level (R4, R6, and R8).

The minimum high registered by a route was 2.398 m.a.s.l. (R6); while the maximum high (3.339 m.a.s.l.) was present in R8. The average of minimum highs of the routes designed was 2.614 m.a.s.l and the average of the maximum highs was 2.867 m.a.s.l.

The average time duration of the routes was 3 hours being the longest route R5 with a duration of 4 hours and a distance of 48 km; and the shortest R9 with a duration of 2 hours and a distance of 14 km.

The prototype was developed with Ionic Framework v5 which is an open-source UI toolkit for building performant high-quality mobile apps, with Angular as integration and web API in .NET 5.0. Google maps and Open Weather API were also included. The application RutasRio can be used in all mobile devices with Android or iOS operating systems provided with network functionalities.

The user's process of the application includes:

1. The download and installation of the app.
2. The users are prompted to sign up or log in to the app by either creating a username and password or using the existing ones (Fig. 4)

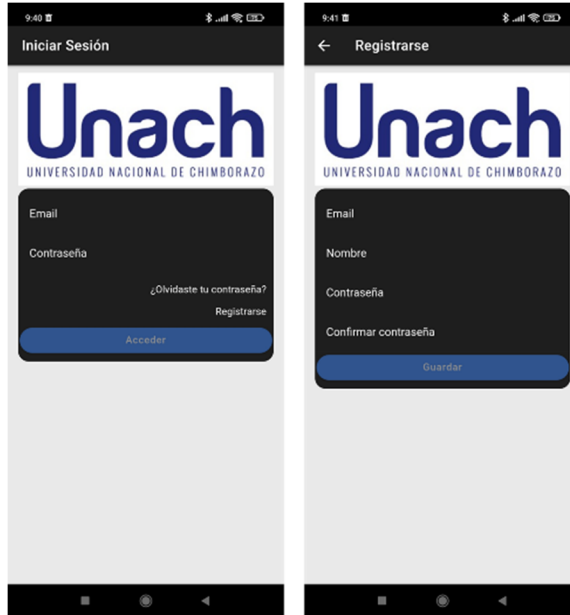


Figure 4: Sign up and log in - RutasRio App.

3. The users are redirected to the app's main screen. The app finds the device location and the routes available are displayed on the screen in a list. Once a route is selected, the weather forecast report is also available (Fig. 5).



Figure 5: Forecast report – RutasRio App.

4. It is also displayed an options menu where it is possible to create and record new routes (Fig. 6). At each route, it is available the option to include photographs of key points and a front page. The device location on the map is updated when a user moves through locations. The application maintains a data file with routes made by the user.



Figure 6: Record a new route – RutasRio App

A synthesized flow diagram that represents the options and the operative process of the application is schematized in Fig. 7.

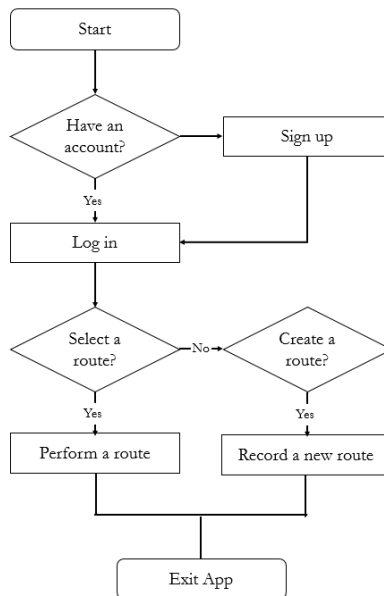


Figure 7: Synthesized flow diagram of the application process

### 3.2 Usability assessment of the prototype

The results measured in a numerical scale are shown in Fig. 8 and assert that the user experience has been positive in most of the cases. Our results of usability evaluation showed mean values above the middle score which is an indicator of the validity of the App.

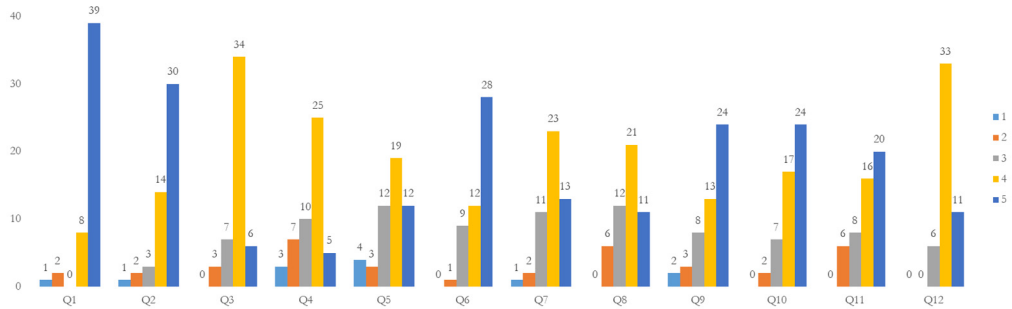


Figure 8: Usability assessment of the prototype.

The responses obtained in question 1 (Q1) reveal that most (94%) of the participants were able to complete the requested tasks using the application; question 2 (Q2) showed that 88% of them felt comfortable using the application and, question 3 (Q3) displayed information confirming that 88% indicate that the information provided was easy to comprehend.

Question 4 (Q4) presented evidence that 60% of the participants think that the screens of the application were clearly organized; while, 62% said in question 5 (Q5) that enjoyed using the application and, 80% expressed in question 6 (Q6) that the application was simple to use.

Most of the participants (72%) found in question 7 (Q7) that the use of the application is intuitive; (64%) think that that was easy to find information, which is evidenced in question 8 (Q8) and, 74% express in question 9 (Q9) that it was easy to upload information.

Question 10 (Q10) revealed that 74% of the participants think that the application has a friendly interface; while, 72% said in question 11 (Q11) that they easily remember the application use. Finally, question 12 (Q12) revealed that most of the participants (88%) perceived a positive overall level of satisfaction with the use of the application.

The questionnaire has the last item where was possible to give any additional comment (AC) and some participants proportionate comments that could allow improving the performance of the application. The most relevant were related to the following statements: 1. This kind of application will be highly beneficial for tourists interested in biking activities. 2. The application could contribute to the dynamization of the touristic sector and the economy associated in Riobamba. 3. The application could become a tool that supports the process of touristic planning. 4. The application is functional but should be improved through the implementation of new options and upgrading the design. 5. The application should include the possibility of interaction among the users allowing the growth of a user's community. 6. The routes available are varied and generate interest. 6. The users would like to keep using the application to perform a route that fits their interests. 7. The application should include some recommendations of touristic services (restaurants, bars, bike services, tour operators, hotels, transport services) around the routes. 8. The application should enable an option to rate each route after accomplishing it. And, 9. The application should include the possibility of sharing photos and routes in the user's social networks.

All participants agreed with the possibility that the App improves the content by introducing new options in further versions.



#### 4. Conclusions

This paper presents a prototype of an App namely RioRutas and its usability assessment. The prototype is directed to dynamize the touristic sector of Riobamba, providing a set of routes around Riobamba and containing information about points of interest, the difficulty of the routes, weather forecast, and duration.

The field study revealed a positive degree of satisfaction perceived by the users. Most of them enjoyed using the application, found the application simple to use, and think that the interface is friendly.

The touristic routes available were positively perceived in terms of variety and quality. The users also felt interested in keep using the application to try others routes available that fit their interests.

Participants found easy the use of the application and most of them provided recommendations to improve its performance.

The usability analysis was carried out to assess and validate the utility of the prototype and also to receive useful suggestions about how to improve the App and also to eliminate any problems that users could experience during its use. As this is the first stage of the App implementation, the information generated here will be the basis for the app improvement in the next versions.

As in other studies including cycle tourism and sustainability as factors (Faulks et al., 2007b; Harris, 2003; Karanikola et al., 2018; Quevedo et al., 2020a, 2020b; Richins and Hull, 2016), we support the statement that cycle tourism is an activity that contributes to sustainable development, especially in areas not characterized by mass tourism, such as Riobamba. In fact, there is an increasing number of tourists looking for alternatives that include experiences based on the contact with local people appreciating the landscape and culture of the territory under principles of sustainable development. However, in Riobamba, it is still an emergent touristic activity and further research is needed to understand its complexity.

Cycle tourism has been identified as a concrete expression of sustainable tourism (Gazzola et al., 2018b), and even when the RutasRio App is still in its prototype stage, we aim that this app contributes to the dynamization of the touristic sector in Riobamba in a pos pandemic COVID-19 scenario.

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