Technologies and applications for the support of tourism in Krasnoyarsk region

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Abstract. In this article we describe modern information technologies and applications for the support of tourism in Krasnoyarsk region. Applications provide services for registration of tourist groups and control of their travel. All information is automatically sent to the Territorial center of monitoring and forecast of emergencies, as well as to rescue and emergency services. The software is developed in form of a mobile application for tourists and online web-system for the emergency services.

1. Introduction
Tourism is quickly developing in Russia as well as in other countries of the world. Krasnoyarsk region with its vast areas and gorgeous landscapes is very attractive for many types of tourism: mountain, water, ecological, historical, business, etc. [1]. Growing internet and information technologies promote growth of tourism providing much advertising of new tourist paths covering reserved places and Northern territories [2]. Broad usage of mobile phones and extending coverage of networks provide not only communication, but also navigation and guiding [3, 4].

Development of tourism in the world goes along with the big amount of scientific researches dedicated to studying of different types of danger and the ways of protection [5, 6, 7]. Such studies are carried out in Siberia region also [8]. Much attention is paid to the usage of new information technologies for tourism safety. Russia’s strategy of “digital economy” implies wide interaction of the society and the state with usage of electronic services and mobile phones for safety [9]. However, most of the existing informational resources both in Russia and in the world are dedicated to the support of tourist business. In the past few years many web-sites were created for life safety, as well as educational resources, forums, portals of monitoring [5, 10]. It should be noted that the task of providing safety in tourism must be solved not only as how to inform people. It is necessary to provide the work of the emergency services in accordance with the law of Russian Federation [11] and using international experience [12].

We used modern information technologies and developed two kinds of applications for the support of tourism in Krasnoyarsk region: mobile application and online web-system. The developed mobile applications and the tourism monitoring web-system are adapted to the Russian legislation and allow to provide new-quality to tourist’s safety due to direct interaction with the emergency services. Applications have been developed on the basis of modern informational technologies using standard functional of smart phones, tablets and other devices with Internet, which makes it accessible for most of the modern tourists.
2. Tools and technologies for application development

Modern technologies in application development allow to speed up the process of designing, to increase the quality of applications and also extend their lifetime. For registration and monitoring of tourist groups it is necessary to create two modules, one for tourists and one for the emergency service’s dispatcher. The module for tourists is developed for registration and monitoring of tourist groups and should be completed in form of a mobile application so that any user can use it on their phone or tablet [10]. Dispatcher’s workplace should be designed in form of a web application, because dispatchers use personal computers and they should be able to process and monitor many tourist groups simultaneously.

There are several modern approaches to mobile application development. First one is development of native applications optimized for a specific platform. Narrow specialization allows to use all advantages of a platform – high speed of uploading and operation, access to all functionality of the equipment. Native applications for iOS are developed on Swift or Objective-C, for Android it is Java and Kotlin [13]. If you use this approach, you need to create several applications for each of the platforms. It significantly increases the cost and time of development.

The second approach is development of a web-application, which is actually a website optimized for mobile devices. In this case you don’t need to download applications, it is enough to use a browser. The main feature of such applications is that they are cross-platform. They can be used on all devices without additional customization. The constraints deal with the lack of access to equipment and the necessity to have Internet connection.

The third approach is the hybrid applications. Such applications integrate advantages of native and web applications: they are cross-platform and have access to a device’s equipment. Hybrid applications are developed for several platforms with usage of a universal programming language, for example, JavaScript (TypeScript). A ready application can be developed for any platform.

As our application needs access to a device’s equipment, at least for the module of geolocation, the second approach is not an option. Considering that except for the tourist’s module, it is necessary to create a web application for a dispatcher, hybrid applications allow to use a unified approach to building of both parts of the system.

To develop our application, we chose one of the most popular platforms, which allows to design both web and hybrid applications and it is called Angular. Angular is an open framework written in TypeScript, it is developed by Google and the open society. For integration of the application and the device’s equipment, the technology Ionic is used. Besides the tools providing access to device’s equipment, Ionic provides a library of standard visual components with the features specific for each of the platforms (figure 1) [14].

![Figure 1. Technologies integration.](image)

Modern software development is a multi-level, complex process consisting of the client and server parts. Angular and Ionic allow to implement the client’s part of the application (frontend). But besides the frontend, the application should have a software-and-hardware part implementing the logics - the
backend. Backend is often a separate application written in PHP, Python or other script languages. This application provides the access to the data base which is necessary for the client’s part. But there is a modern solution – Cloud Firestore combining the mechanisms of data storage and access. Cloud Firestore’s main part is a document-oriented NoSQL data base providing storage and synchronization of the server and several users in real time due to special event listeners. Besides, this service provides possibility to be controlled by users (Firebase Authentication) and to separate access to different parts of data basing on roles.

In Angular, interaction with the Cloud Firestore service and Firebase Authentication is completed by the developer (Google) in form of libraries. It makes integration with these services a lot easier and allows to save time both at designing of your own backend and at integration with the both modules (tourist’s and dispatcher’s).

As it was mentioned earlier, the result of building of a client’s application for tourists is an executed file for the target platform. The result of building of an application for dispatchers is a JavaScript file which needs to be placed in the Internet in order to provide access for all the users (emergency service’s dispatchers). For this it is convenient to use Firebase hosting of Google. Firebase hosting is a part of the platform with the services described above. It provides security for the application and allows an easy launch of Angular using only one command.

Thus, Angular and Ionic together with Firebase services [15] allow to easily create mobile and web applications with the required functionality.

3. Applications for tourism safety

On the basis of a hybrid approach we have developed a mobile application of a tourist’s safety and an application for the emergency services.

The mobile application allows to register tourist groups: the number of people, beginning and ending time of the route, intervals between the checkpoints of the routes (figure 2). Tourist route can be chosen from the catalogue of the existing routes or be created with the help of a digital multi-scale map.

![Figure 2. Mobile application for tourists safety.](image-url)
Because the area of Krasnoyarsk region is so wide, there are numerous tourist routes of different length and seasonality: walking, water, mountain, ski, horse and other. Most of them are located in thinly populated areas and it is difficult to send a signal if something goes wrong. Besides, severe weather conditions can significantly harden even short routes. For this, our mobile application provides emergency notifications, forecasts and information about the restrictions valid for the areas.

To get the application started, you need to register using an e-mail address or other contacts. It allows to keep a base of users and to make voice calls in case of emergencies. The application’s input data is information about the route, number of people, report data on the route’s progress.

Reception of notifications, forecasts and the data of online monitoring of natural and technogenic dangers became possible due to integration with the system of the Center of monitoring and forecast of the emergency situations of the Krasnoyarsk region [16, 17]. The municipal online service controls tourist groups and processes the incoming messages. The work of operators and the administrator is implemented in form of an adaptive online web-resource available for viewing through web-browsers. Users get information about dangerous weather and hydrological phenomena, parts of daily operational summary and they also have access to thematic educational resources.

4. Conclusion
Usage of modern information technologies and accessibility of mobile devices allow to provide a higher-quality tourism safety due to online-interaction of tourists with the emergency services, and also by providing the online monitoring system’s data. Our software has been implemented in the Territorial center of monitoring and forecast of emergencies and in Ministry of emergency situation’s study center of the Krasnoyarsk region and of course it is also used by tourists.

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