

# The architecture of mobile information system for providing safety recommendations during the trip

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**Abstract.** The paper is devoted to the project of mobile information system for providing safety recommendations during the trip. The topicality of the research is caused by the rapid growth of tourism industry all over the world. According to the latest news, Ukrainian aviation companies had fewer plains then needed for 2018 summer vacation period. The deep analysis of dangerous sources with various examples is provided in the paper. In order to develop a project of the system the analysis of modern mobile applications for danger alerts is made. As a result the tasks that should be fulfilled are defined. Some tasks are described in the article, others are still going to be done. The functional features of the system that is being developed by the authors is described and justified. It is being developed in order to define a certain level of danger in any tourist destination and generate recommendations to ensure users safety during the trip that is planned. The paper presents the structure of the system modules and their components basing on UML diagrams. The roles of the users are defined and described. As a result the architecture of the system is developed in order to fulfil all the requirements.

**Keywords:** Information Systems, Mobile Applications, Danger Sources, Danger Predictions, System Architecture, System Modelling.

## 1 Introduction

The tourism industry is growing with every year all over the world [1]. Ukraine is also concerned. According to the latest news, Ukrainian aviation companies had fewer plains then needed for 2018 summer vacation period.

But when travelling far away tourist is not always aware of danger situations that can occur and their sources.

Every specific danger source needs different way to arrange safety. Theoretically, the government of the country and laws should guarantee safety of every person or society in all spheres of life. Practically, everybody should take care of themselves and know what to do when emergency of any kind happens. It is easy when you are in you native region and know all its features, but it is much harder when you travel far away as because you need to know much more information on the possible sources of

danger and ways to reduce their influence. So safe state can not arise by its own, as normal, the energy, time and information should be provided for its arrangement.

As it was mentioned above, it is quite difficult to arrange personal safety when travelling, as it is necessary to study a wide range of information on danger level in a region. That is why scientists in Lviv Polytechnic National University and Bukovyna University are working on a project of mobile information system for providing safety recommendations during the trip – “Safe Tourism”, main purposes of which is to detect danger sources in a region, count the danger level and provide personalized recommendations to the tourist on where to go and how to behave to avoid emergency.

The topicality of the research is caused by the lack and high need in information technologies to provide safety recommendations to tourists during their trips.

Main parts of the article are devoted to the analysis of danger sources and mobile systems for danger level detection, the developed by authors functionality and structure of the “Safe Tourism”.

## **2 Related work**

In sources [2-13] the analysis of dangerous situations and their results is given. In sources [14-17] the information systems to provide information on dangerous sources are presented and described. In [20-21] the algorithms to predict natural dangerous situations is described and experimentally. In [18-19, 22-25] the methods and systems to provide tourist recommendations to the users are described.

### **2.1 The analysis of danger sources**

Danger is a negative property of matter, which manifests itself in its ability to cause damage to certain elements of the world, other words: potential source of harm. If a human being is concerned, the danger sources can be as phenomena, processes, objects, properties that are able under certain conditions to cause damage to the health or life of a person or systems that provide human livelihoods [2].

Danger sources can be: natural, industrial, social.

The general set of danger sources counts more than 150 names, and it is not even quite full [2].

Among natural dangers are bad, or even extreme, weather conditions, natural fires, poisonous plants, dangerous animals, insects, bacteria etc.

Below are given the real examples of worst natural dangerous situations among recent years:

Forest fires in Greece this summer has taken more 90 lives. It was one of the worst fires in Greece among recent years [3]. The fire in Tennessee (USA) in 2016 was the biggest in last 100 years. It took 13 lives, destroyed more than 1000 buildings and lasted nearly one month [4].

The victims of the earthquake in Haiti in 2010 are nearly 3 millions of people, 316 thousands of them died. The natural disaster was getting even worse as it led to growth of violence and robbery [5].

Tsunami in the Indian Ocean that was caused by Sumatra-Andaman earthquake was the worst in the human history. It took nearly 230000 lives in 14 countries as the waves were more than 30 meter high [5].

As it was mentioned above, animals can also be harmful. For example according to ISAF (International Shark Attack File) before 2012 year 2569 shark attacks were registered: 484 victims died [6]. The most dangerous is Florida coast as there were registered 812 attacks.

Moreover, in Ukraine in Lviv region there were registered 8 victims of snakes this spring (2018) [7].

Among industrial are the dangers caused by use of vehicles, the operation of lifting and transport equipment, the use of combustible, flammable and explosive substances and materials, using processes that occur at elevated temperatures and high pressures, using electric energy, chemicals, different types of radiation etc.

A large number of industrial disasters is associated with nuclear energy usage, both for military and industrial purposes. Thus, by 1993, all nuclear powers carried out at least 2146 explosions: the USA - 1149, the USSR - 715, France - 194, Great Britain - 45, China - 42, India - 1. This led to an increase of the radioactive background on the Earth, which contributed to the growth of the number of cancer patients [8].

One of the most wide known industrial catastrophes is The Chernobyl disaster — caused by 4th explosion reactor unit of the Chernobyl Nuclear Power Plant. Radioactive dust was moved to many European countries by the wind [9].

But the nuclear energy is not the only one that can harm people. For example, pollution in Great Britain is killing 50,000 people a year [10].

To social dangers belong not only terrorist attacks, wars, criminality but cultural diversity and that is why different norms of behaviour, large crowds of people, poverty etc.

It should be mentioned that recently the risk of terrorist attacks is growing according to the registered situations. The biggest and most wide known attack occurred 11th December 2001 year, when passenger planes hit two towers of the World Trade Centre [11].

The other social danger is war, for example Russian aggression in the south region of Ukraine, which is still going on. It led to more than 2500 deaths among civilians that are registered [12]. This number is recently growing.

As it was mentioned above, the crowd can also be harmful. More than 100 people died in the crowd in India after religious festival. Another example is situation that has occurred in Cambodia during the festival of water. The crowd has led to death of 465 people and hundreds of injured [13].

## 2.2 Information systems for danger level detection and following user informing

Of course, there is a great amount of user applications that inform users on the danger situations that are likely to occur, but they are mainly taking into account weather conditions and terrorist attacks.

The following mobile information systems provide the user with danger alerts:

- Weather dangers alerts: NOAA Weather Radar and Alerts, AccuWeather, Windy
- Forest fire alert: BC Wildfire, Wildfire Analyst Pocket
- Terrorism dangers alert: Terror Alert, TerrorMate, News about Terrorism WTA

These systems are chosen because of their popularity and high rating on Google Play platform (virtual shop of mobile applications for Android operating system) [14].

Below the analysis of mobile information systems that provide the user with weather danger alerts is presented.

NOAA Weather Radar and Alerts is a powerful mobile system for weather predicting and weather danger alerts. The system is developed by one of the leading mobile development companies Apalon [15]. Among the general functions (weather forecast, location search, bookmarks, different maps views etc.) it provides the user severe weather alerts and hurricane tracker.

The AccuWeather is an weather forecasting platform that predicts weather conditions very accurately [16]. The motto of the system is:

“To save lives, protect property, and help people to prosper, while expanding AccuWeather as a healthy and profitable business.”[16]

The system provides alerts in the following cases:

- Rain – more than 12.7 mm
- Snow – more than 2.54 mm
- Ice – more than 0.254 mm
- Sustained Wind – more than 48 kph
- Wind Gust – more than 64 kph
- Thunderstorm Probability – 75%

**Table 1.** Functional comparing of Information systems for weather alerts

<b>Name</b>	<b>Company</b>	<b>Weather Alerts</b>	<b>Hurricane Predictions</b>	<b>Map</b>	<b>E-mail Alert</b>
<b>NOAA Weather Radar and Alerts</b>	Apalon	+	+	+	–
<b>AccuWeather</b>	AccuWeather	+	–	+	–
<b>Windy</b>	Windyty	+	+	+	+

The Windy (or Windyty) is weather forecast visualization tool [17]. Among general weather forecast it provides various weather alerts. The alert consists of the following information: the type of dangerous weather condition, wind, amount of precipitation, temperature, clouds, time/duration etc. Among these functions, the system provides the waves forecast to inform users on if it is safe to do any activities in water (sea, ocean, lakes, rivers, etc.) The other feature that should be mentioned is that AccuWeather provides the users information on various height under the ground, so it is quite useful for pilots, paragliders, skydivers [17].

### 3 The functionality and architecture of the safety recommender system

"Safe Tourism" is the mobile information system for providing safety recommendations during the trip. Its main functions are to define a certain level of danger in any tourist destination and generate recommendations to ensure user's safety during the trip that is planned (Fig. 1).

The system considers the presence of all the factors that can affect the level of risk in a specific destination, namely: natural, technological and socio-political situations.

The main classes of the system users are tourists and administrators (Fig. 2).

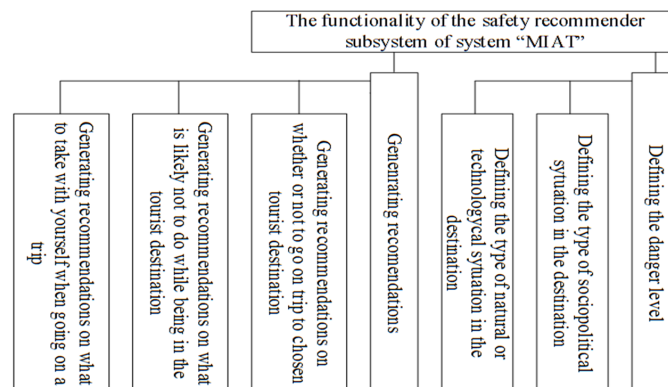


Fig. 1. The functionality of the system "Safe Tourism" [19]

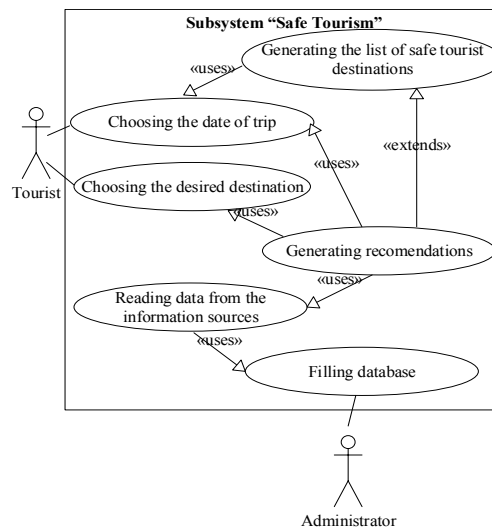
Tourists provide information on the planned period of trip realisation and desirable tourist destinations [18, 19]. The system determines the level of danger according to this input data. If the user does not specify the desired destination or the calculated level of risk is significant the system generates a number of tourist destinations with minimal level of danger in the chosen period of time [20]. System administrators are responsible for its correct functioning and adding new information of the system database. The architecture of the system is complex and extensive (Fig.3) [20].

The main structural components of the system are:

- "Danger Determination" (DD) is a systems component that is responsible for the analysis of the current natural, technological (industrial), and socio-

political situation in the tourist destination today and archives of natural situations for the selected season. Besides these component generates a list of tourist destinations with low level of danger in the chosen period.

- “News Monitoring” (NM) is responsible for finding information in the world news website (namely BBC World News). It looks for date about present unfriendly political, social, natural and technological situation in a particular region. Search is based on a number of key words from the system database. For example: "fire", "flooding", "rainy season", "revolution", "terrorist", and so on.



**Fig. 2.** Users of the system

Weather Information Extraction” (WIE) is responsible for finding information in world-class weather resource and it forecast for a specific period of time, if it exists.

“Recommendations Generator” (RG) is an important component that generates recommendations based on the result of the DD functioning. Recommendations are divided into two types: the advice on social behaviour and communication and the advice on things to take with yourself on the specific trip.

“Database data input” is a component that is used for “remembering” the results of system work in the database “Danger sources”. The database consists of structured and detailed information on danger sources, their peculiarities and ways to minimize the risks.

As it was already mentioned above the system has two types of users, tourists and administrator, which is why there are two types of user interfaces that give the user different opportunities (Fig. 3).

The most complex components of the system are News Monitoring and Danger Determination. Their architectures are described in figs 5 and 6.

The News Monitoring component consists of the following subcomponents:

- “Key-words database reading” component – reads information on key words search list that consists in database “Danger sources”.

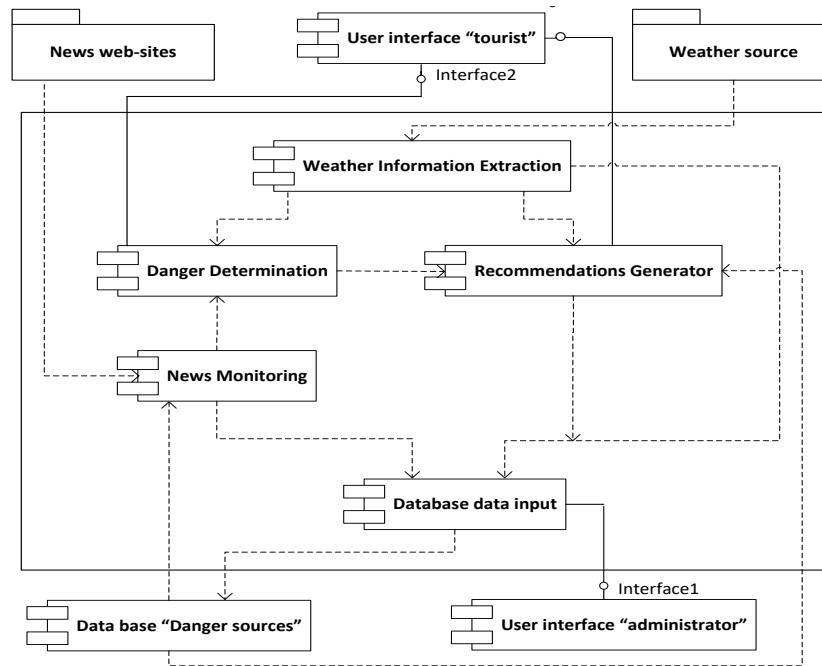


Fig. 3. Architecture of the system “Safe Tourism”

- “Web-site grabbing” is devoted to searching articles according to key-words list through news web-sites and putting it in temporary news.txt file in the cloud.
- “Danger sources search” detects the most important articles according to the news popularity in the Internet. The result of Danger source search is the result of the component functioning.

The Danger Determination component consists of the following subcomponents:

- “Attractivity computing” is devoted to defining most popular regions for the tourist trips, taking into account seasonal issues and destination features.
- “Danger predictioning” component functioning is based on developed methods to predict natural dangers [21].
- “Danger sources determination” component defines which emergencies are more likely to occur in a region and what are the danger sources.
- “Danger level computing” counts the influence of every danger source and possible level of threat.
- As a result the beta version of the system is developed (Fig.6)

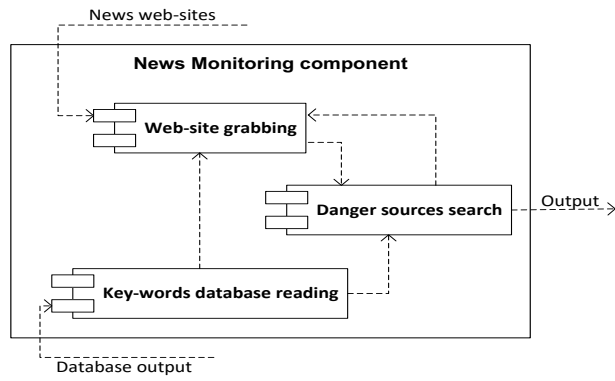


Fig. 4. Architecture of the News Monitoring component

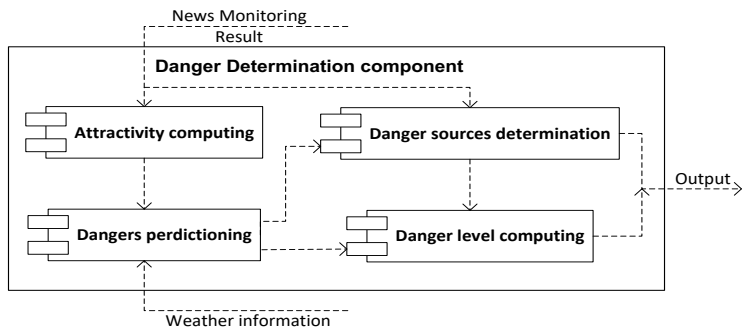


Fig. 5. Danger Determination component structure

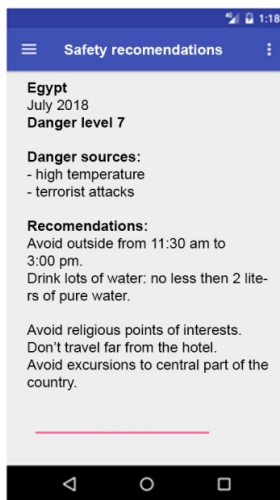


Fig. 6. “Safe tourism” recommendations user interface



## 4 Conclusions

Scientists in Lviv Polytechnic National University and Bukovyna University are working on a project of mobile information system for providing safety recommendations during the trip – “Safe Tourism”, main purposes of which is to detect danger sources in a region, count the danger level and provide personalized recommendations to the tourist on where to go and how to behave to avoid emergency.

As a result the authors developed and presented the architecture of the system “Safe tourism” to give personalized recommendation on how to avoid danger situations or minimize the risk taking into account various dangerous situations using several kinds of information sources: database with archived information on past dangerous situations and ways to minimize risks, up to date internet news web-sites and up-to-date weather conditions sources. The structure of the system is presented with the help of UML diagrams.

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