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## **AN EDUCATIONAL MOBILE CITY LEARNING APPLICATION FOR KIDS**

Mehmet Ocan  
Anadolu University

Furkan Goz  
Kocaeli University

**Abstract:** Along with the development of technology, mobile devices have started to take place in every aspect of life. One of these is entertainment sector thanks to the visual and interactive interface of these devices. However, by their accessibility and ease of use, mobile devices have extremely simplified touching to entertainment which has led to waste of time for people, especially children. It is crucial for children to divert their wasting time to education in terms of their development. That can be viable with turning the education into fun. In this work, we aim to develop a mobile application which enables children to learn about the cities in their country with pleasure. Integrating game and education, this application will ensure the children recognize the historical, geographical and cultural features of the cities. In the game, children start an exploration from a city. They proceed by travelling over cities using a map while they both enjoy and learn.

**Keywords:** Game based learning, mobile programming, learning for kids

### **Introduction**

There is much easiness that rapidly developing technology brings to our lives. Today, mobile platforms have become one of the most important tools for this easiness. People use mobile devices not only at home, but also at school or work and on the road. For this reason, people are a large part of the time during the day with these devices we can say. However, while mobile devices can be used in a useful way, they can be also harmful. It is really difficult for children to control it. When children spend their time with mobile devices, educational outcomes become important for their development. We thought that we could do this by attracting interest of children. This can be achieved if we can bring together education and entertainment. This idea can be provided with what we have designed. Children will play games as well as explore the cities in the country and learn new information.

In the literature, there are applications for educational purposes in mobile platforms. Puja and Parsons (2011) present a location-based mobile game of business consulting simulation for students. Users take the role of consultants at a virtual company and physically move to different locations to conduct interviews to discover the weaknesses of the company and they can make change recommendations. Wang and Tseng (2014) examine learning performance of students in environmental education using mobile game-based learning. They prepare a model which combine skills, challenge, incentives, cognitive load, playfulness and learning performance. In the result of this study they indicate that individuals with high skills and challenge can be good character students. In study of Kircı and Kahraman (2015) plan an education application for primary school kids in a mobile platform. A kids can learn a course with presented examples and they can have some exams whenever they desire from smartphones. Their main purpose is attracting attention of kids together with presenting a useful application. Bartel and Hagel (2014) present a mobile game-based learning. The application focuses a joyful stabilization of knowledge and the engagement of students. Steps are described for the realization of the concept in a university. Cheah and friends (2013) present an interactive mobile game to teach about sustainability issues. They created this game named as "LifeTree", and it introduces a new design strategy. Initial user testing has indicated that the game is found to be interesting and relevant to learn environmental issues. Urturi, Zorilla and Zapirain (2011)

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\*Corresponding author: Mehmet Ocan- E-mail: mehmet\_ozcan@anadolu.edu.tr

present a system composed of Serious Games oriented to first aid education based on mobile platforms. It includes what you will do in certain conditions and it shows basic knowledge about healthcare. The application permits an objective evaluation of therapy process. Alobaydi E, Alkhayat R, Mustaffa N. , Arshad M. and friends (2016) propose a solution that is faced by these children in learning Arabic vocabulary by developing a learning system. They evaluate on 20 students in elementary school and obtain from the statistical analysis. It indicates that the applications of the ubiquitous technology are preferred and helpful in performance of students in learning Arabic vocabulary.

The rest of the study is organized as follows. Non-Functional and Functional Requirements includes under the Requirements title for application. In the following section we introduce Proposed Method which has Database Design and Implementation Details. In the last part conclusion and future direction of this study are presented in Conclusion title.

## **Requirements**

### **Non-Functional Requirement Analysis**

#### ***Performance***

Our program is mostly consisting of graphical part. However nowadays, most of mobile devices have two or more core. Also, our program does not keep high detail graphics and enormous database. Result, performance is not trouble.

#### ***Portability***

Program is portable for android mobile devices but also we can make an IOS edition of the program later.

#### ***Security***

This program does not include important information about user so that it is safe enough. Just user name and city are hold. In addition, user cannot change the database manually and program does not have any internet connection for first edition. For further editions, we may add internet connection our game. Result of this connection, we can use authentication and authorization.

#### ***Maintainability***

We use the Object Oriented Programming Principles. So, if the program requires maintaining, we will recover it quickly. In addition, we keep track of the user recommendation and upgrade the version.

#### ***Integrity***

We do not allow the users to insert, update, and delete operations to the database so they do not change the important database information. Integrity is achieved with this way.

#### ***Availability***

It is available for all time when user wants to use it. When users like and show their interests in our program, we will continue developing this application by upgrading and extend its support time longer.

### **Functional Requirement Analysis**

This game includes a Turkey map. User chooses a city at initial, because, by starting the initial city, user aims to tour all cities of Turkey and collect high points. The game includes some question related to the current city. Related to user's grade, city which is completed has different colors at Turkey map. (No reached cities: white, 75% success or above: green; 75% - 50% success: yellow, 50% - 25% success: orange, 25% - 0% success: red)

Users are allowed to play the game again for yellow, orange or red cities to improve his/her grade, but are not allowed for green cities. User can zoom into the map.

## Proposed Method

### Database Design

In this application we use SQLite (Web Page, accessed 4/2017). We created some tables. *Users* table which has *UserId* and *UserName* attributes for user information. Each user can have different game screen. *Cities* table includes *CityId*, *CityName* and *AdjacentName* that user can learn just neighbors of current city attributes. *GameInformation* table is necessary to hold user how much learn cities. It has *UserId*, *CityId*, *CorrectCount* and *WrongCount* attributes. *Categories* table is important to present different type questions to user. It has *CategoryId* and *CategoryName* attributes. *QuestionInfo* table which has *CityId*, *QuestionId* and *AnswerId* is used to obtain answer of each question. For variety of options of each question we use *CorrectAnswer* and *WrongAnswer* tables. They have *CityId*, *QuestionId*, *Question* and *Answer* attributes. Attributes of *Questions* table *QuestionId*, *Question*, *CategoryId* and similarly *Answers* table includes *AnswerId*, *Answer* and *CategoryId* attributes. Lastly because of reaching for some changing and updating program *Admins* table is essential for this game. *AdminId*, *AdminName* and *Password* are attributes of it.

Figure 1 is showed to database design of this game:

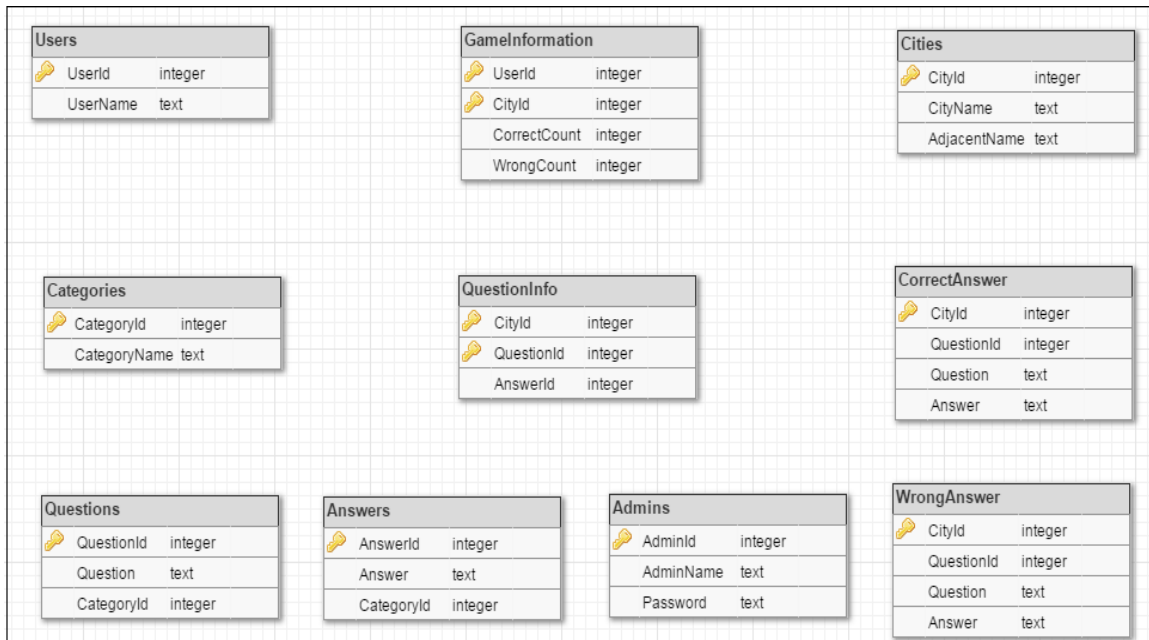


Figure 1: Database design

### Implementation Details

This application includes some design steps from start to completed stage and we use a diagram to explain these. We can show this diagram in figure 2.

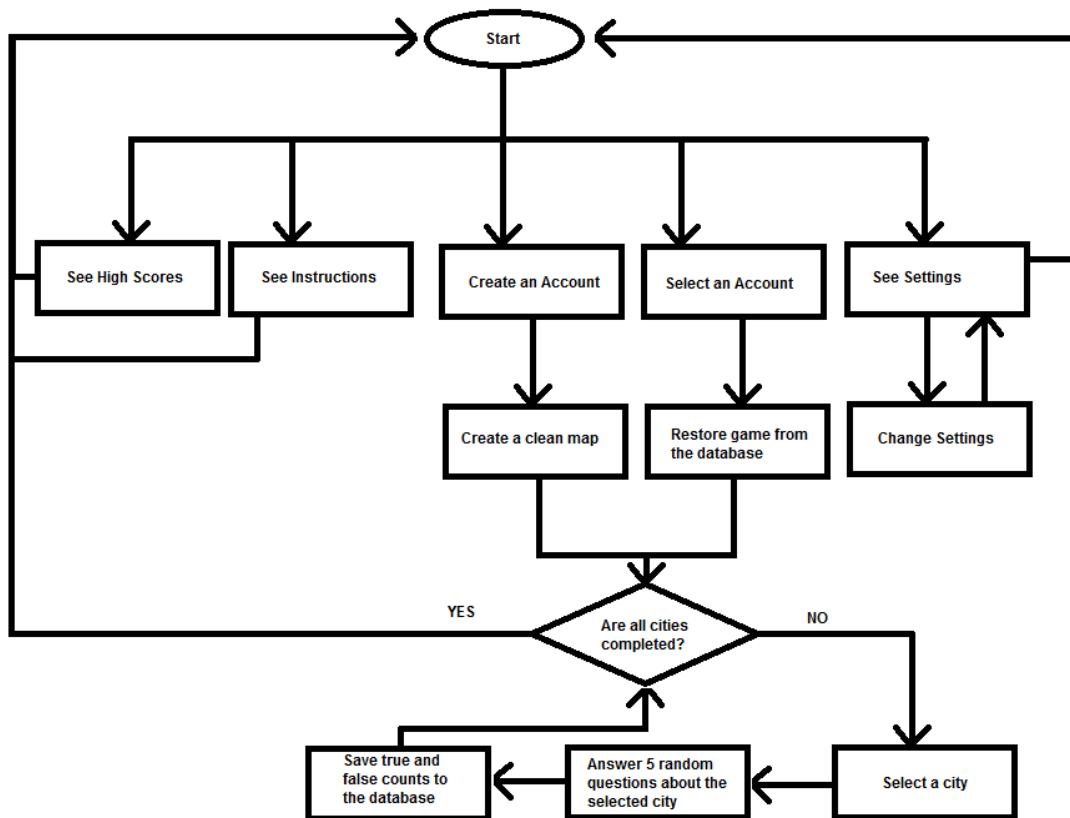


Figure 2: Game steps

In the main screen, there are five buttons and each of those buttons leads to a different screen. During their and implementation of their listeners, used methods and classes are generic methods and classes which are always used. Their safety is guaranteed by the android itself. In the profile creation screen (new game screen), there is a text view to enter the name of the new account and a button to proceed. Entered name is checked by querying it from the database to check its existence. Every account should have a unique name and our code guarantees it. In the profile selection screen (resume game screen), there is a list view that lists the accounts saved in the database and a button to proceed. Saved accounts are queried from the database. Possible exceptions are handled in the code. Querying process is guaranteed to be safe by the SQLite itself. In the map screen, there is only an image view. It shows the current status of the map. It is scalable and it has sliding ability which allows the user to see different parts of the zoomed map.

Scalability is implemented by using android scale gesture listener and some custom methods. Recognizing the scaling event and calculating the scale ratio are done and guaranteed by the listener. Our custom methods take a part of the map that should be shown according to the scaling value and scales it into the screen size. Our custom methods limits the scaling ratio between one and five, and they guarantee all of the written functionalities work without exceptions.

Sliding can be done in the zoomed map and it is implemented by using android scroll gesture listener and some custom methods. Recognizing the sliding event and calculating the amount of slide are done and guaranteed by the listener. Displaying the resulting map of the slide is done by our custom methods. Map boundaries are checked to prevent possible exceptions. Our custom methods guarantee that sliding process works fine. Other than its useful sliding and scaling abilities, map also offers ability to select a city which is one of the cores of our project. Although we researched much, we haven't found a useful listener for the selection event, so we wrote a listener. The listener can capture most of the click events without a problem. It's not in the perfect form that can be written, but it is good enough to play the entire game without much problem. After the image view is clicked, there is an algorithm (can also be called as a useful trick) that finds the clicked city. Clicked location is send to a fake map that is held in the background. In the fake map, blue values of the every pixel of the every city are held its license number. We use the number in the clicked location to identify our city. The algorithm and the fake map guarantee the city selected is identified correctly. After a valid city selection, quiz screen becomes visible.

In the quiz screen, random five questions and, for each question, one true and three random wrong answers are queried from the database. Questions and answers are queried from two different views called True Answer and

Wrong Answer. Safety of these queries is guaranteed by the views and the SQLite. Questions are shown in a label one by one, and their true answer is placed randomly on a button. Each button has the same amount of chance to get the true answer. Randomness is guaranteed by the android's Random class. After each question is answered, an alert dialog is seen which shows the question is answered right or wrong, tells the points won or lost, and the city's small map as icon. These functionalities are guaranteed to work flawless by our custom methods even if there are not enough questions in the database. After five questions for the selected city is answered, true and false counts are recorded into the database. Recording is made by insert queries, so SQLite guarantees its safety.

In the high scores screen, for each user, user's game information is queried from the database, user's total point is calculated, calculated scores are sorted by using bubble sort algorithm, and they are placed into a list view in the descending order. All of these works are done by using custom methods. These methods guarantee that they can work safely.

In the instructions screen, there is only a text view that shows instructions. Its text is hardcoded and we don't believe it can cause any abnormality in the application.

In the settings screen, user can adjust the volume of the game music and the sounds. Currently there is no in-game music, but we can place a one someday, so we wrote some code. These doesn't cause much trouble but for safety reasons their work is guaranteed by the written code.

In figure 3 we can see green cities are completed by user. We can say users obtain some info of green cities. Red cities can be started to cover because these are neighbors of green cities and other cities cannot be reached. These are not neighbor any green cities.

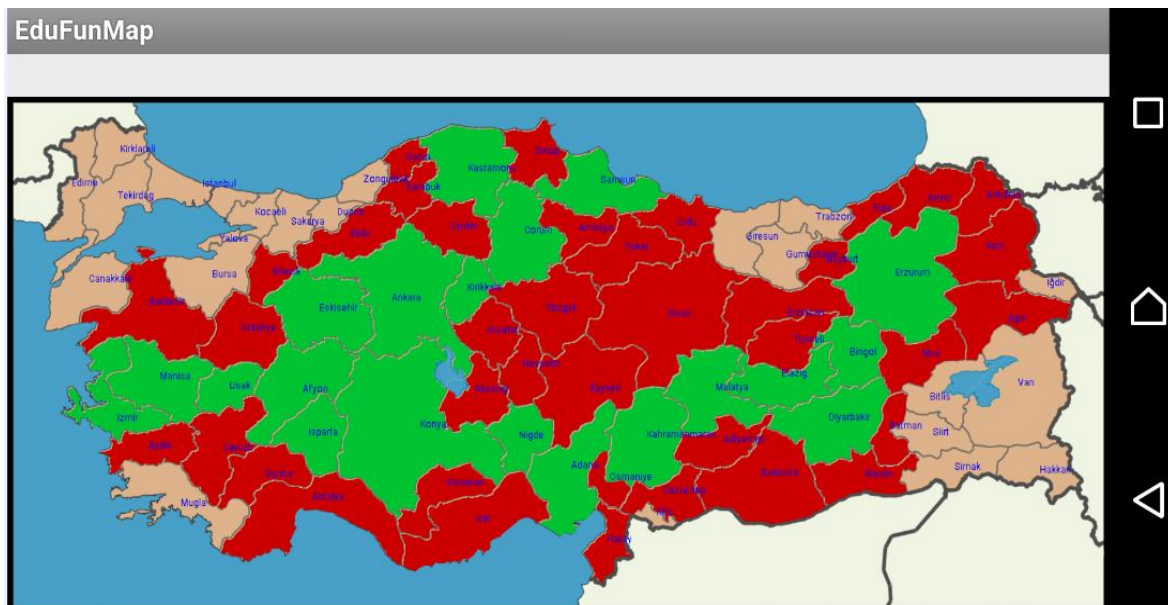


Figure 3: Map screen

## Conclusion

We develop an application which provide children to learn about the cities in their country specifically Turkey for mobile devices used in every aspect of life. This game was accomplished in terms of performance, portability, security, maintainability, integrity and availability. This game ensures the children learn cities in different categories which are historical, geographical and cultural properties of their countries with pleasure due to game and education integrated. With increasing similar educational games, wasting time of children diverts to educational purposes.

In future, we plan to record more questions and answer to database of the application. In this way it can be provided to sustainability and wide range of information. With success of these steps a road can be opened to adaption of various countries.

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