Palestine Polytechnic University

College Of Information Technology And Computer Engineering

RunAway

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Abstract

RunAway is an augmented reality mobile game application on android system that uses location-based information to augment the reality that the mobile camera captures with extra information retrieved from a server. RunAway developed to solve problem of use the smart phones continuously for long hours that cause serious health problems. Sitting for too long time without movement can causes damage to the spine. Using mobile phones for long hours leads to laziness and boredom. Our motivation for this project stems from the fact that people spend a lot of time playing games. So we intend to solve this problem by develop augmented reality game application which will make users have to move, run and jump. RunAway boost excitement and suspense for the users of smart phone devices its look like a sport-augmented-reality game that will help the users interact with game. The scope of this mobile application target mobiles running android operating system, Palestine Polytechnic University it's the testing area for this project. The methodology that followed in developing this application is system development life cycle. The procedural steps of the project begins with planning, analysis, and design, implementation, testing and maintenance of the system. We developed the RunAway game that use many technologies as: "android development SDK "android studio", "augmented reality", "Wi-Fi", "GPS", "mobile camera", "mobile Sensors: accelerometer, orientation, location (GPS), compass used to determine the acceleration, direction of the smart-phone camera and the user current location". The RunAway application get JSON array of game objects from the web server application. Then the application uses the smart device camera feed to display, on real-time, and as an overlay, the game objects that surroundings depending on the location and the direction of the smart device camera at that time. The application displays information about the distance between the user and the game object and what the user collect. In addition, when the user get an object the player hears a nice sound after 10 minutes the game end and the user get the result. In conclusion, RunAway application developed to make outdoor game the free mobile users from sitting for long time, help the users interact with game, and encouragement users to walk and move rather than laziness.

Keywords

- OS: Operating System

- AR: Augmented Reality

- VR: Virtual Reality

- GPS: The Global Positioning System

- PHP: Hypertext Preprocessor

- SDK: software development kit

- DB: Database.

- JAVA

- Android

- Android Studio

- Wi-Fi.

- JSON: JavaScript object notation.

- Google map API's.

- API: Application programming interface

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1 Introduction

1.1 Over view of the chapter

This chapter aims to clarify the main idea of the project, it also include problem statement, scope, background, motivation, objectives, methodology, and project time-line.

1.2 Introduction

The wide spread of smart-devices and their uses whether iPad, tablets or smart phones from children to adult, presents great opportunity to develop new type of applications.

World is contracting with the growth of mobile phone technology. As the number of users is increasing day by day, facilities are also increasing. Starting with simple regular handsets which were used just for making phone calls, mobiles have changed our lives and have become part of it. Now they are not used just for making calls but they have innumerable uses and can be used as a Camera , Music player, Tablet PC, T.V. , Web browser etc . And with the new technologies, new software and operating systems are required.

More than half of people around the world now uses a smart-phone using different operating system, but android is the most popular smart-phone operating system in the world as of 2016.

Mobile gaming has expanded rapidly since the groundbreaking release of the original iPhone in 2007. Unsurprisingly, the mobile game market has grown on average nearly 33 % annually, and generated over $9 billion in revenue in 2012. Hence the reach and impact of mobile games is huge – roughly 129.4 million people in the U.S own smart-phones; approximately a 55% mobile market penetration. In addition the global mobile android OS market share around 86.1% in 2017.The number of android mobile phone users in the world is expected to pass the five billion mark by 2019[2].

1.3 Problem statement

Development of an android application which has the capability of using the features of smart-phones and concepts of augmented reality to submerge the virtual information of user's surroundings by detecting and tracking user's location in real time, and transfer the games from traditional games to make it more interactive games.

Large population use smart phone today, on average every use spend about more than 6 hours daily. The use of smart phone continuously for long hours cause serious health problems. Sitting for too long without movement can causes damage to the spine. We intend to solve this problem by develop augmented reality game application which will make users have to move, run and jump. The most successful games of all time in this market most importantly have a specific paradigm of interaction with users, and in RunAway application by using AR the user will interaction with game ,also to make it more exciting we added a sound when the user get a game object.

1.4 Scope

The scope of this mobile application will target mobiles running android operating system, Palestine Polytechnic University will be the testing area for this project.

The project will be completed by April 2018. This application can be used by children and adults and is about creating an Augmented Reality (AR) game based on using smart devices camera, location sensors and other sensors.

1.5 Background

1.5.1 Android

" Android is a OS mobile operating system have developed a lot in last 15 years by Google, Starting from black and white phones to recent smart phones or mini computers, mobile OS has come far away. Especially for smart phones, Mobile OS has greatly evolved from Palm OS in 1996 to Windows pocket PC in 2000 then to Blackberry OS and Android[1]."

Android is a OS, based on the Linux kernel, and uses Java as the development language, and designed primarily for touchscreen mobile devices such as smart-phones and tablets. Android has an App base of millions of Apps available on Google play store and other App stores.

One of the most widely used mobile OS these days is android. It is considered to be the most widely used Mobile OS today with more than 85 percent market share[4]. Android is a software bunch comprising not only operating system but also middleware and key applications. Android Inc was founded in Palo Alto of California, U.S. by Andy Rubin, Rich miner, Nick sears and Chris White in 2003. Later Android Inc. was acquired by Google in 2005. After original release there have been number of updates in the original version of Android[9].

Android is a powerful operating system supporting a large number of applications in Smart Phones. These applications make life more comfortable and advanced for the users. Hard-wares that support android are mainly based on ARM architecture platform.

1.5.2 Why we chose android ?

- Open Source & Open Platform: The biggest advantage of Android is that it is an open source, integrated software platform. Developers can release updates and revisions which users can download on their own[8].

- License Free: license expenses is not noticeable in the Android development because of its free sourcing advantage[8].

- The Android SDK (Software Development Kit): allows you to create your own apps. SDK includes a comprehensive set of development tools like debugger, libraries, handset emulator, sample code, documentation and tutorials. So if you get hands on an SDK, you can develop applications on your own for Android[8].

- Development Language options: android uses the standardized and open programming language Java. The emulator of the Android platform has a modern design and is easy to use[8].

- Can access all API's made available by android OS vendor[8].

- Variety of devices: the good thing coming from Android's presence on lots of different devices is that you are not bound to the specific group of users. Android devices come with the wide range of screen sizes and prices, therefore, much more people are able to install your mobile app[29].

- Faster review in Google Play: Since Google Play has much more simple guidelines and review systems, it takes less time to feature app to the app store. In general, it takes up to two or three days to get the app published on the Google Play while it can take weeks with the Apple's official store[29].

- Cheaper to feature on Google Play: it is not only faster to publish your first mobile app on the Google Play store – it is also much cheaper. While it takes to pay $99 a year to feature apps in Apple store, on Google Play you are charged only one with $25. Big difference, especially for independent app developers on a short budget[29].

- More beta testers: speaking of beta testers, it is also a lot easier to find them on Android platform than for iOS apps[29].

1.5.3 Disadvantage of android

- Longer to develop: take a time and effort in learning.

- Not cross platform: install and run only on android OS devices.

1.5.4   World wide smartphone OS market share

This one is without a doubt a huge advantage of Android platform. With the global reach of 74.24% it has the biggest audience and, therefore, you can reach more potential customers. Take whatever data you can find, they all tell the same thing – Google is shaping up to be the biggest player in mobile devices OS market and starting your first mobile app on its platform will give you more users globally. Well, at least in theory[23].
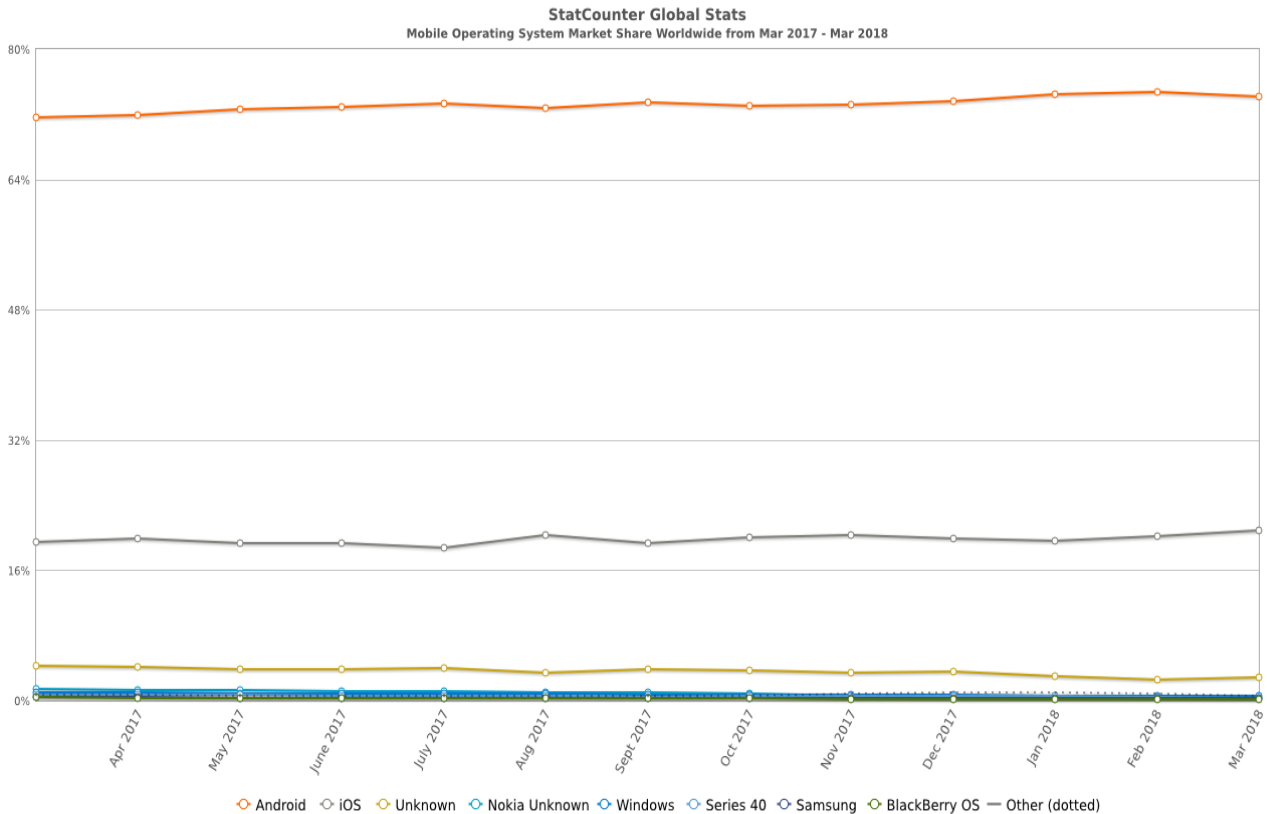
Figure 1: Smart-phone OS market share

1.5.5   Unity 3D?

" Unity: is the ultimate game development platform. Use Unity to build high-quality 3D and 2D games, deploy them across mobile, desktop, VR/AR, consoles or the Web, and connect with loyal and enthusiastic players and customers[27].

1.5.6   Why we choice android studio not Unity 3D?

- License cost: The developers need to have licenses for the best graphics, deployment and performance improvements. These licenses are expensive to purchase. Moreover, the use of rendering, buffer support, stencil support and pretty more features scale up the development costs due to expensive licenses[11].

- Memory hogging: The game developed leveraging Unity engine consumes more memory, which in turn creates OOM(Out of memory) errors and debugging issues in the apps[11].

- Source code: The code is stable in Unity as opposed to other engines and packed with a great architecture that improves the game app performance. But, unavailability of the source code makes finding, addressing and fixing the performance issues difficult[11].

- No editor for Linux.

- Unity Still under development.

- Expensive if you need all features.

- Using the engine requires you to agree with their policies: like if you unexceptionally make too much money, you must purchase the Pro version or they may sue you[12].

1.5.7 Augmented reality (AR)

" Augmented Reality is a new sort of technology that creates an interaction between the real world and virtual data (such as objects, images, text, etc.). This virtual data is superimposed into reality through images in 2D or 3D through the screen of a connected device, such as a smart-phone, tablet, or connected glasses[7]."

Augmented reality devices generally use some sort of geolocation, such as the GPS data of a user's device. This data helps the technology gather information about someone's immediate surroundings, so that information can be imposed in a way that is more personal[7].

As you can imagine, while augmented reality offers fun and interactive ways for general users to learn, experience, and imagine new things, it also offers many applications for businesses and brands[7].

1.5.8 Why we chose augmented reality (AR)?

- Trend in technology.

- Games become more active.

- Portability and outdoor use.

- Mobile augmented reality applications are rapidly growing in popularity, due to its easy download features and dynamic uses on any smart phone[3].

1.5.9 Disadvantage of augmented reality (AR)?

- Battery consumption.

- Needed a position sensors and some of them are not available on all mobile phones.

1.5.10 Key components to augmented reality devices

- Camera: RunAway displaying the live feed from the android camera is the reality in augmented reality. The camera data is available by using the APIs available within the android.hardware.Camera package.

- Sensor: Sensor data is often important to AR implementations. For example, knowing the orientation of the phone is usually very useful when trying to keep data synchronized with the camera feed.

  1. Accelerometer: accelerometer, a dynamic sensor capable of a vast range of sensing. Accelerometers are available measure acceleration in one, two, or three orthogonal axes[14].
  2. Orientation: knowing the orientation of the phone is usually very useful when trying to keep data synchronized with the camera feed[14].
  3. Location(GPS): (Global locationing System) receiver records signals from Geo-satellites to allow location of the device anywhere on the globe[14].
  4. Digital compass: The digital compass that's usually based on a sensor called magnetometer provides mobile phones with a simple orientation in relation to the Earth's magnetic field. As a result, your phone always knows which way is North so it can auto rotate your digital maps depending on your physical orientation[14].
  5. geomagnetic field sensor: the geomagnetic field sensor lets you monitor changes in the earth's magnetic field[14].

Uses the device's accelerometer and magnetometer to orient a compass.

1.5.11 The Difference Between virtual reality and augmented reality

While seemingly similar, augmented reality and virtual reality are very distinct technologies.

Virtual reality (VR): immerses users in a fully artificial digital environment. Is a sort of computer technology that replicates an environment (real or imagined) and simulates a user's physical presence and environment by primarily appealing to their vision and hearing. Virtual reality is typically achieved through the use of a headset.

But, augmented reality (AR) overlays virtual objects on the real-world environment.

1.6 Similar applications

The following are examples of some similar applications:

1. Third eye

   This application is about creating an AR localization application based on using smart devices location sensors.

2. PPU GO

   Is a free to play, location based augmented reality game developed by Eng. Mohammad Jabari on Palestine Polytechnic University.

   The game utilizes the player's mobile device's GPS ability to locate, and capture virtual treasure, which appear on the screen as if they were at the same real world location as the player.

3. Pokemon Go

   is a free to play, location based augmented reality game developed by Niantic for iOS and Android devices. The game was the result of a collaboration between Niantic and Nintendo, by way of The Pokémon Company, and was initially released in selected countries in July 2016. The game utilizes the player's mobile device's GPS ability to locate, capture, battle, and train virtual creatures, called Pokémon, which appear on the screen as if they were at the same real world location as the player. The game features a freemium business model and supports in-app purchases for additional in-game items[18].

1.7 Technology to be used:

1. Android Development SDK.

2. Augmented Reality (AR).

3. Android device camera.

4. Smart-phone sensors.

5. Google map API's.

6. GPS.

7. Wi-Fi.

8. Web server.

9. Laravel php7.

1.8 Motivation

Our motivation for this project stems from the fact that people spend a lot of time playing games.

Using mobile phones for long hours leads to laziness and boredom, and to solve this problem, we decided to make an augmented reality game which will make individuals have to move, run and jump.

1.9 Objectives

The project achieves the following objectives:

1. To boost excitement and suspense for the users of smart phone devices especially in games.

2. To develop a sport augmented reality game that will help the users interact with game.

3. Using augmented reality on smart devices, user can feel more excited and suspense.

4. Develop an outdoor game the free mobile users from sitting for long time.

1.10 Methodology

The methodology that will be followed in developing this application is system development life cycle.

The project use android development language to build an application that reinforce the reality of the environment surrounding the users by using Augmented Reality technology. The procedural steps of the project begins with planning, analysis, and design, implementation, testing and maintenance of the system. As shown in figure below:
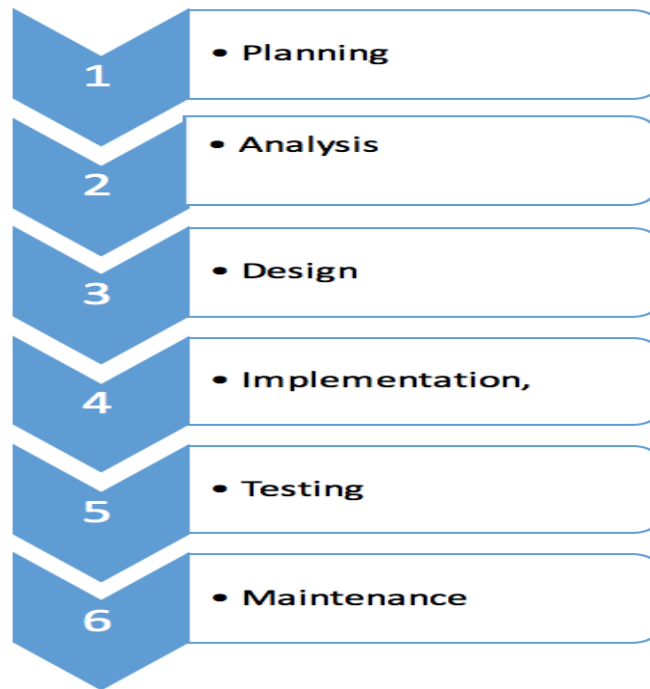
Figure 2: Methodology

1.11   Project Time-Line

1.11.1   Tasks Time-Line table

The following table shows the time needed by the teamwork to accomplish the project:

Task Number	Task Name	Duration(Weeks)
Task 1	Planning	2
Task 2	collecting information	2
Task 3	System Analysis	2
Task 4	Describe System Requirement	2
Task 5	Data Analysis	2
Task 6	Behavioral Analysis	2
Task 7	Database Design	2
Task 8	User interface Design	1
Task 9	Coding	10
Task 10	Testing	4
Task 11	Documentation	24

Table 1: Time-Line

1.11.2   Gantt chart

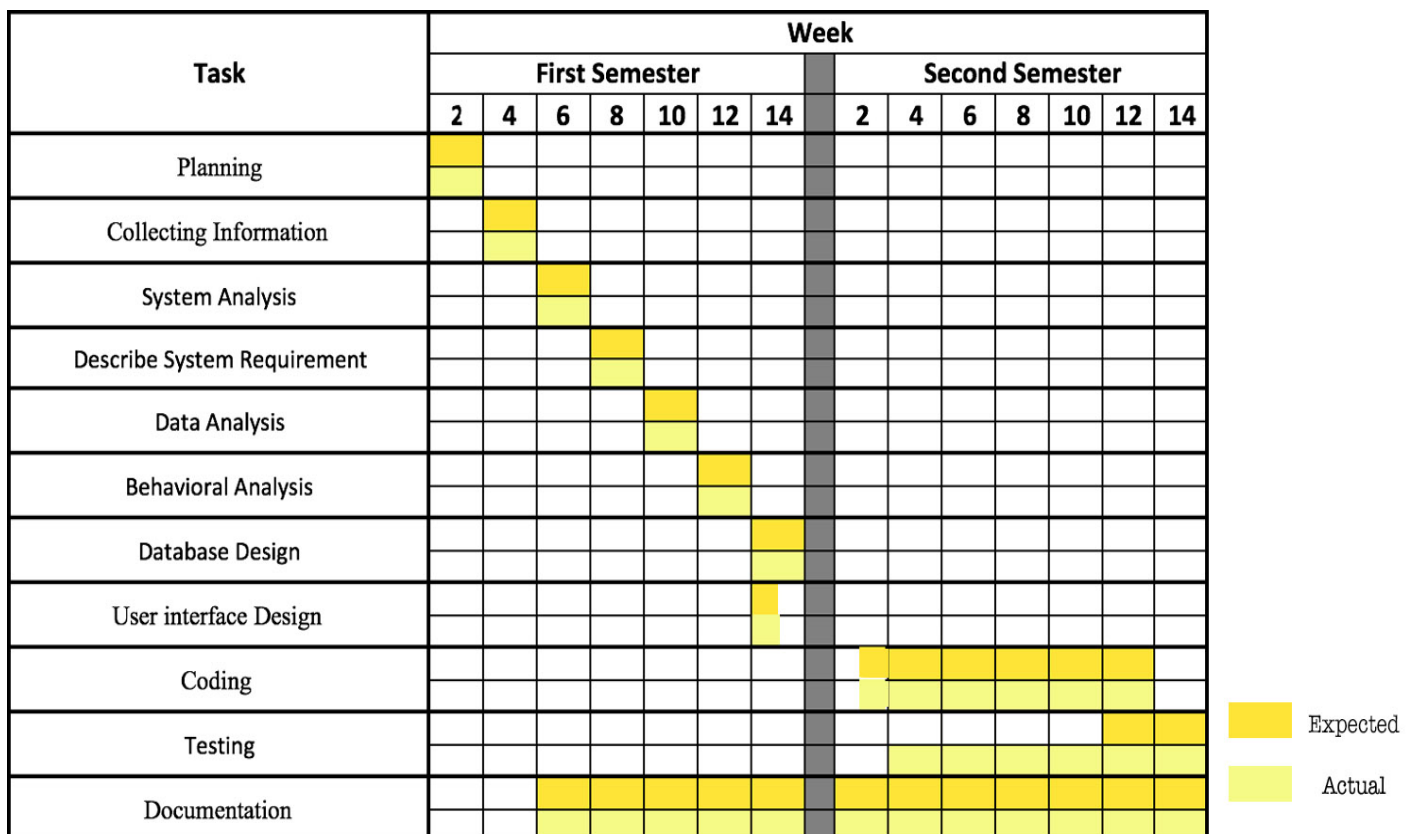**The following chart shows the time needed by the teamwork to accomplish the project:**

Figure 3: Gantt Chart

2 System Analysis

2.1 Over view of the chapter

This section will contain the current system analysis of the project, game Scenario, system actors, system requirement as functional and non functional requirements, use-case, Data analysis, and Behavioral analysis.

2.2 Game Scenario

Omar have a long time between his lectures and feels bored, he decide to playing RunAway game in PPU. He open the game then the coins start appear overlay on his mobile screen, then he start moving to collect coins, his score increased, then he see the box and get it each box increase his score 39 coins, he still collect coins and on his way he gets a magnet, the coins around him by twenty meters attract automatically for one minute, and his score rises. When he walking he faces some baffles he should jump or avoid it to keep moving, on another way he faces another baffle and he doesn't skip it, so the game ended, and the result of game score appear in the screen. after that he started another game to have fun.

2.3 System Actors

1. Admin

   - Add game objects.
   - Delete game objects.
   - Update game objects characteristics.
   - Delete users.
   - Update user information.
   - Update admin account information.
   - Show all game objects on the map.

2. Player

   - Register: enable player to create account to playing a game.
   - Login: enable player to enter his account and start playing.
   - Logout: enable player to exit from his current account.
   - Get location: RunAway detect the current location of the player using GPS sensor to display game object near around him.
   - Start game: allow player to start playing.
   - End game: allow player to end the game.
   - Resume game: allow player to pause the game.
   - Open game again: allow player to reopen the game after pause it.
   - Acquire game object : enable player to collect game objects(coin, magnet, box).
   - Display result of game: show the result of game and his scour.
   - Attract coins by magnet: collect coins that on 20 meters away from the player.
   - Skip baffles: player must jumps or avoids the baffle, if he skip it the number of baffles increasing, if doesn't skip it the game will end.

3. GPS

   - Detect player location.

4. Camera

   - Acquire game object: when the player get the game object, it will disappear on the screen, and number of game object increase.
   - the camera used to display game object overlay on the screen.

5. Sensor

- Attract coins by magnet: collect coins that on 20 meters away from the player, the score will rise automatically.
- Skip baffles: check when baffle location equal player location, player must jumps or he can avoids the baffle, if he skip it the number of baffles increasing. The measurement of jump is done using accelerometer sensor.
- Acquire game object: using orientation and magnetic sensor detect the direction of camera

2.4 System Requirements

2.4.1 Functional Requirement

1. RunAway application detect the current location of the player by using GPS.

2. RunAway application detect the current direction of the player's mobile phone camera by orientation and Magnetic field sensors.

3. RunAway application get JSON array of game objects and all their characteristics and locations as latitude and longitude from web application.

4. RunAway application display game objects to the player as an overlay over the camera capture feed.

5. The Game objects (view) will be changed according to the current location and direction of the mobile phone camera.

6. RunAway makes sound effects when the user got any game object.

7. The game must keep track of the player's score.

8. The game show to the player his score when he playing.

9. The game show to the player each game result and what he got of game objects around him.

10. The game show to the player his high score when he open the game if he played on previous time or zero if he play to the first time.

11. The locations of the game objects are controlled by a web application.

2.4.2 Non-Functional Requirement

1. Performance (Response time): the system should interact with the user quickly, so the user should not wait a long time before the game object appear, and the response from the web is fast.

2. Portability: all users who has a smart phone with android and GPS tracker can use this application.

3. Simple user interface: the user interface is designed to be simple, and clear.

4. Easy to use and remember: easy usability of the application and its' interface very simple and clear.

5. Compatibility: the application should run on android operating system efficient.

6. Reliability: the system should provide the correct result.
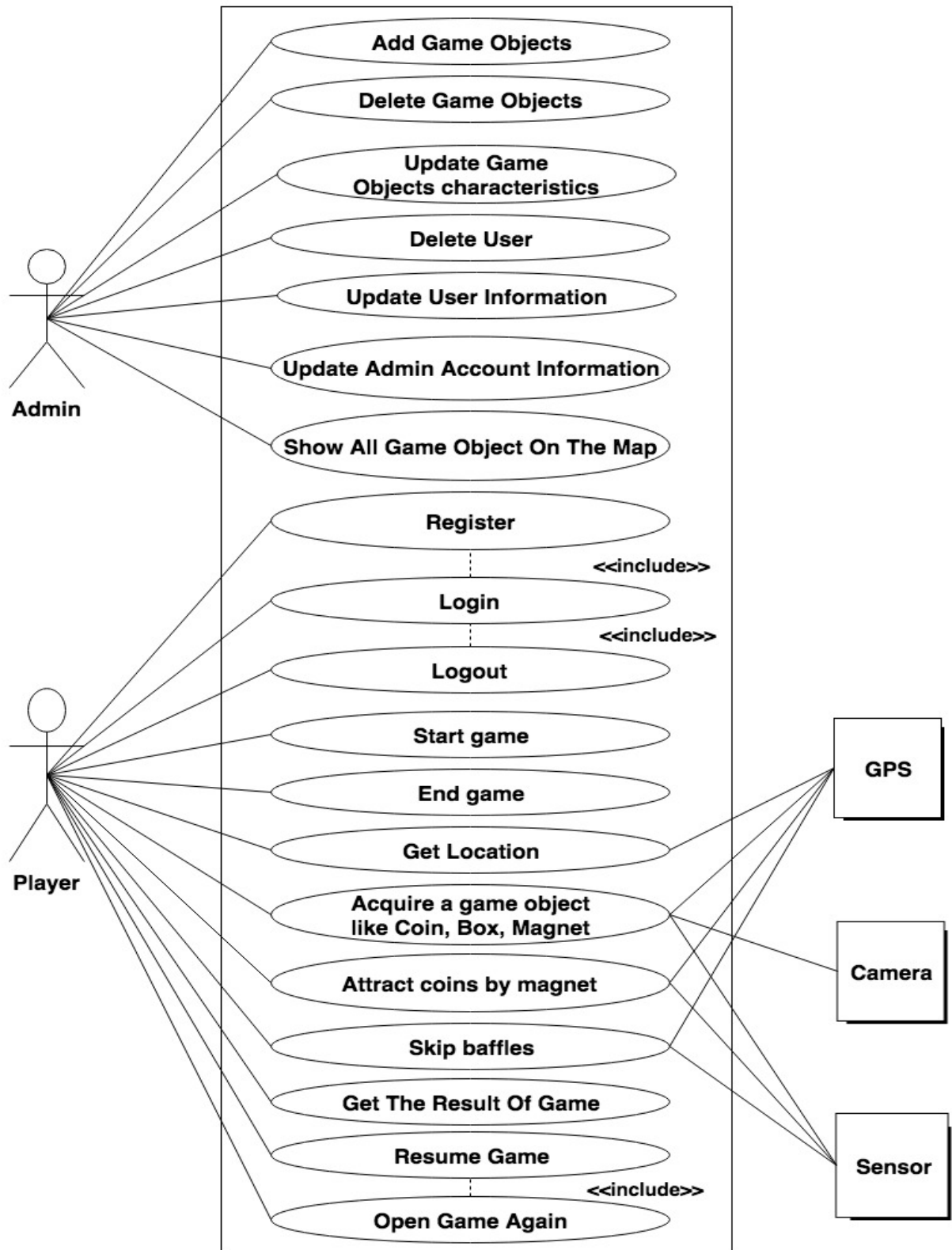
2.4.3   Use case

Figure 4: Use case

2.5 Data analysis

2.5.1 Class diagram (Android side)

+ FoundAble
fields
- ID:String
- Count:String
- type:int
- Timer:int
- Height:String
- Width:String
- Number:int
- CoinsCounter:String
- location:Location
- active:int
constructors
methods
+ getID():String
+ setID(ID:String):void
+ getCount():String
+ setCount(count:String):void
+ getLocation():Location
+ setLocation(location:Location):void
+ getLatitude():String
+ getLongitude():String
+ getType():Type
+ setType(type:int):void
+ getTypeString():String
+ getTimer():int
+ setTimer(timer:int):void
+ getHeight():String
+ setHeight(height:String):void
+ getWidth():String
+ setWidth(width:String):void
+ getNumber():int
+ setNumber(number:int):void
+ getCoinsCounter():String
+ setCoinsCounter(coinsCounter:String):void
+ isActive():boolean
+ setActive(active:int):void

+ StopDialog extends Dialog
fields
+ c:Activity
+ d:Dialog
- resume:Button
~ open_again:Button
~ end_game:Button
constructors
+ StopDialog(cActivity)
methods
onCreate(savedInstanceState:Bundle):void

+ LoginActivity extends AppCompatActivity
fields
~ user_name:EditText
~ password:EditText
constructors
methods
onCreate(savedInstanceState:Bundle):void
+ login(view:View):void

+ StartActivity extends AppCompatActivity
fields
constructors
methods
onCreate(savedInstanceState:Bundle):void
+ sign_in(view:View):void
+ sign_up(view:View):void
+ onBackPressed():void

+ loading extends PermissionsActivity
fields
constructors
methods
onCreate(savedInstanceState:Bundle):void
onStart():void
+ onPermissionsGranted(requestCode:int):void
# onActivityResult(requestCode:int, resultCode:int, data:Intent):void
+ showSettingAlert():void

+ CameraActivity extends SensorActivity implements SensorEventListener
fields
+ final MAX_DEGREE_TO_SHOW:int
+ final MAX_DISTANCE_TO_SHOW:int
+ final MAX_DISTANCE_TO_TAKE:int
+ final MAX_DISTANCE_TO_TAKE_USING_MAGNET:int
+ final MAX_DISTANCE_TO_GAME_OVER:int
+ final DEFAULT_MAGNET_TIME:int
+ final REFRESH_DELAY:int
+ final MAX_SIZE:int
+ final MIN_SIZE:int
+ final MAX_TIME:int
+ status_game:short
~ mCamera:Camera
~ frameLayout:FrameLayout
~ show_camera:showCamera
~ coins_count:TextView
~ magnets_count:TextView
~ boxs_count:TextView
~ nearest:TextView
~ rest_time:TextView
~ allFoundAbles:RelativeLayout
~ all_places:List<FoundAble>
~ TimerCaller:Handler
~ magnet:int
~ rest_time_int:int
~ waiting:int
~ tokenBoxs:ArrayList<FoundAble>
~ tokenCoins:ArrayList<FoundAble>
~ tokenMagnet:ArrayList<FoundAble>
~ tokenBaffle:ArrayList<FoundAble>
~ mp:MediaPlayer
~ game_id:String
~ ShakePhone:boolean
~ MagnetsTimer:Runnable
~ dialog:ProgressDialog
~ inGame:boolean
~ startLocation:Location
~ GameOverTimer:Runnable
constructors
methods
+ compareItem(x:long, y:long):int
+ onBackPressed():void
# onCreate(savedInstanceState:Bundle):void
+ stop_game(view:View):void
# onRestart():void
~ GameOver(manually:Boolean):void
~ DataChanged(MyDegrees:int, MyLocation:Location):void
+ convertDpToPixel(dp:float):int
~ GetGameID():void
~ GetAllObject():void
~ ShowPlaces(response:String):void
~ getMayInt(key:String, jsonObject:JSONObject):int

+ PermissionsActivity extends AppCompatActivity
fields
- mErrorString:SparseIntArray
constructors
methods
onCreate(savedInstanceState:Bundle):void
+ onPermissionsGranted(requestCode:int):void
+ requestAppPermissions(requestedPermissions:String[], stringId:int, requestCode:int):void
+ onRequestPermissionsResult(requestCode:int, permissions:String[], grantResults:int[]):void

+ SensorActivity extends AppCompatActivity implements SensorEventListener LocationListener
fields
+ final NA:String
+ final FIXED:String
- final LOCATION_MIN_TIME:int
- final LOCATION_MIN_DISTANCE:int
- gravity:float[]
- geomagnetic:float[]
- rotation:float[]
- orientation:float[]
- smoothed:float[]
- sensorManager:SensorManager
- sensorGravity:Sensor
- sensorMagnetic:Sensor
- locationManager:LocationManager
- currentLocation:Location
- geomagneticField:GeomagneticField
- bearing:double
- R:float[]
- I:float[]
constructors
methods
onCreate(savedInstanceState:Bundle):void
onStart():void
onStop():void
~ getPlaceDegrees(me:Location, place:Location):double
+ onLocationChanged(location:Location):void
+ getCurrentLocation():Location
+ onStatusChanged(provider:String, status:int, extras:Bundle):void
+ onProviderEnabled(provider:String):void
+ onProviderDisabled(provider:String):void
+ onSensorChanged(event:SensorEvent):void
+ getDifferent(alpha:double, beta:double):double
~ DataChanged(dir:int, currentLocation:Location):void
+ onAccuracyChanged(sensor:Sensor, accuracy:int):void

+ showCamera extends SurfaceView implements SurfaceHolder.Callback
fields
~ camera:Camera
~ holder:SurfaceHolder
constructors
+ showCamera(context:Context, camera:Camera)
methods
+ surfaceCreated(holder:SurfaceHolder):void
+ surfaceChanged(holder:SurfaceHolder, format:int, width:int, height:int):void
+ surfaceDestroyed(holder:SurfaceHolder):void

+ StopGameActivity extends AppCompatActivity
fields
constructors
methods
onCreate(savedInstanceState:Bundle):void
+ resume_game(view:View):void
+ end_game(view:View):void
+ open_again(view:View):void

+ RegesterActivity extends AppCompatActivity
fields
~ user_name:EditText
~ email:EditText
~ password:EditText
~ male:RadioButton
~ female:RadioButton
- gender:int
constructors
methods
onCreate(savedInstanceState:Bundle):void
+ sign_up(view:View):void

+ HomeActivity extends AppCompatActivity
fields
constructors
methods
onCreate(savedInstanceState:Bundle):void
+ go_to_ar(view:View):void
+ Logout(view:View):void

+ LowPassFilter
fields
- final ALPHA:float
constructors
- LowPassFilter()
methods
+ filter(input:float[], prev:float[]):float[]

+ GameOverDialog extends DialogFragment
fields
constructors
methods
+ newInstance(showPlayAgain:Boolean, game_id:String, coins:int, boxs:int, magnets:int, baffles:int, content:int, time:String, distance:int):GameOverDialog
+ onStart():void
+ onCreateView(inflater:LayoutInflater, container:ViewGroup, savedInstanceState:Bundle):View

+ Utiles
fields
constructors
methods
+ getEditor(activity:Activity):Editor
+ getData(activity:Activity):SharedPreferences
+ SetHighScore(context:Activity, HighScore:Integer, Time:String, Distance:Integer, GameID:Integer, onSetHighScore:OnSetHighScore):void
+ TakeObjectOnline(id:String, type:String):void
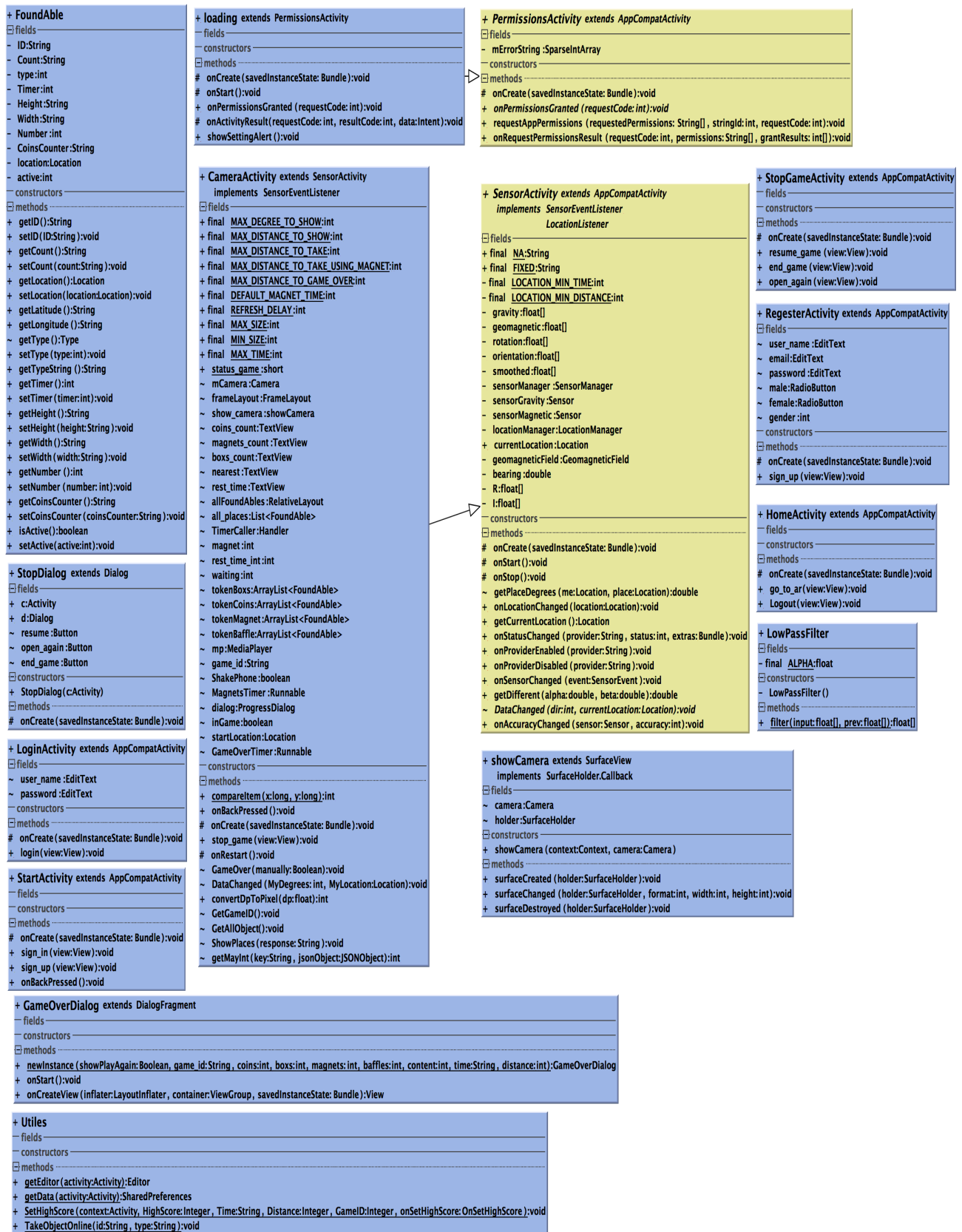
Figure 5: Class diagram Android side

2.6 Behavioral analysis

2.6.1 Sequence diagram
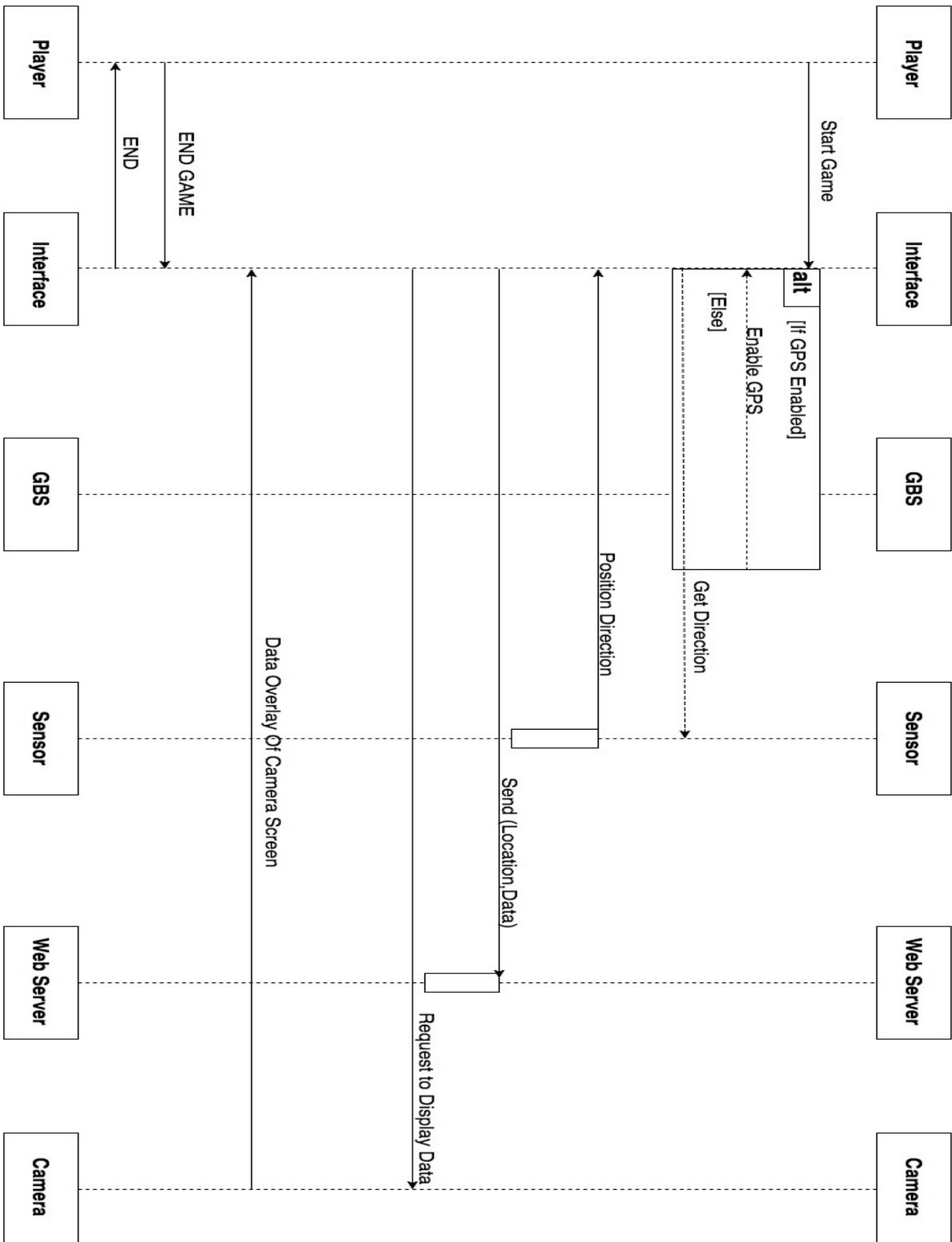

Figure 6: Sequence diagram

3 System design

3.1 Over view of the chapter

This section will contain the current system design of the project, software architecture, database design, and user interface design.

3.2 Software Architecture

3.2.1 Block diagram

As shown from the system block diagram below, the system main components are:

- The Mobile App: the mobile App that runs on the user's android smart-phone. This App will collect information about the location using GPS and the direction of the smart-phone' camera. The returned response from the Server displayed as an overlay on the smart-phone's camera to start a game.

- The Web Server: will receive requests from the mobile App. The Web Server will send a JSON array of game objects. The application will use the camera direction and player location to do some calculation to display the game objects that around him and matches with camera direction. The inferred information will be display overlay on the camera feed.

- Database: the database keeps information about users, and information about game objects like there locations.

- Mobile Camera: the mobile camera is used to display information an overlay.

- Mobile Sensors: mobile sensors as accelerometer, orientation, location(GPS), compass (magnetic field) will be used to determine the acceleration, direction of the smart-phone camera.
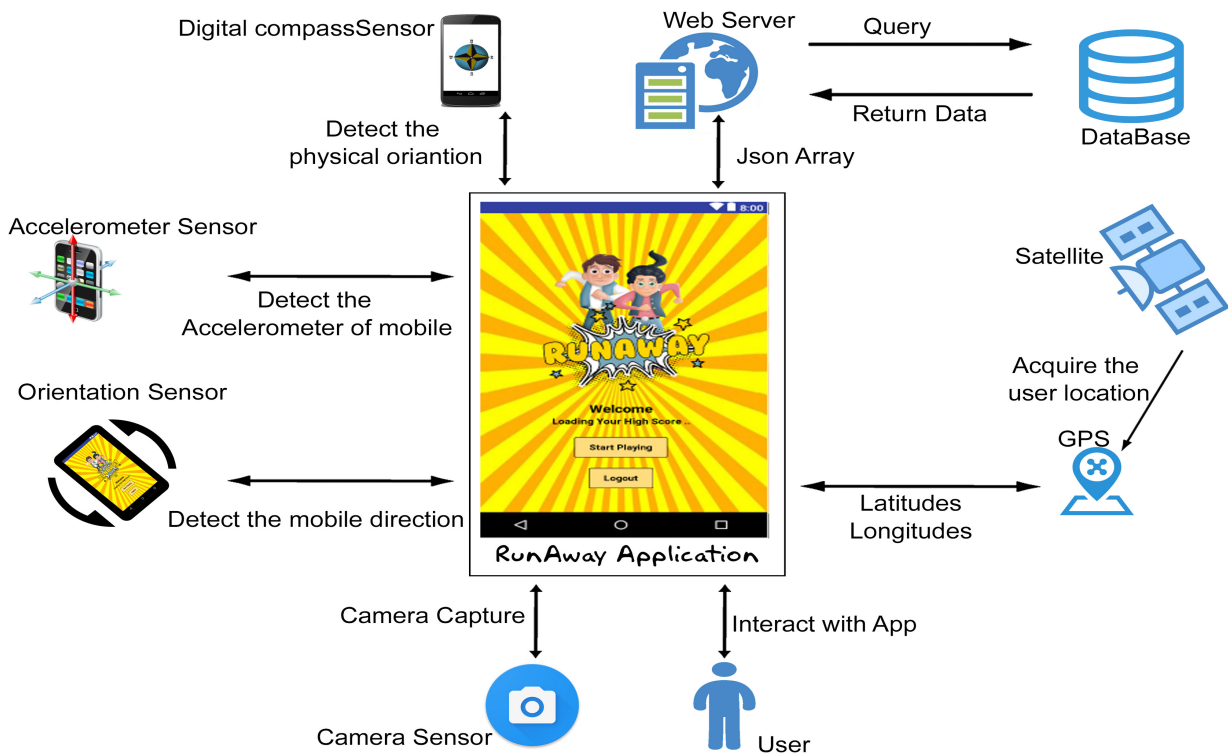
Figure 7: Block diagram

3.3 User interface

3.3.1 Web application interface

This interfaces that allows the admin to control system and he can add, delete, update the game objects and users. Also, he can control admin account setting.
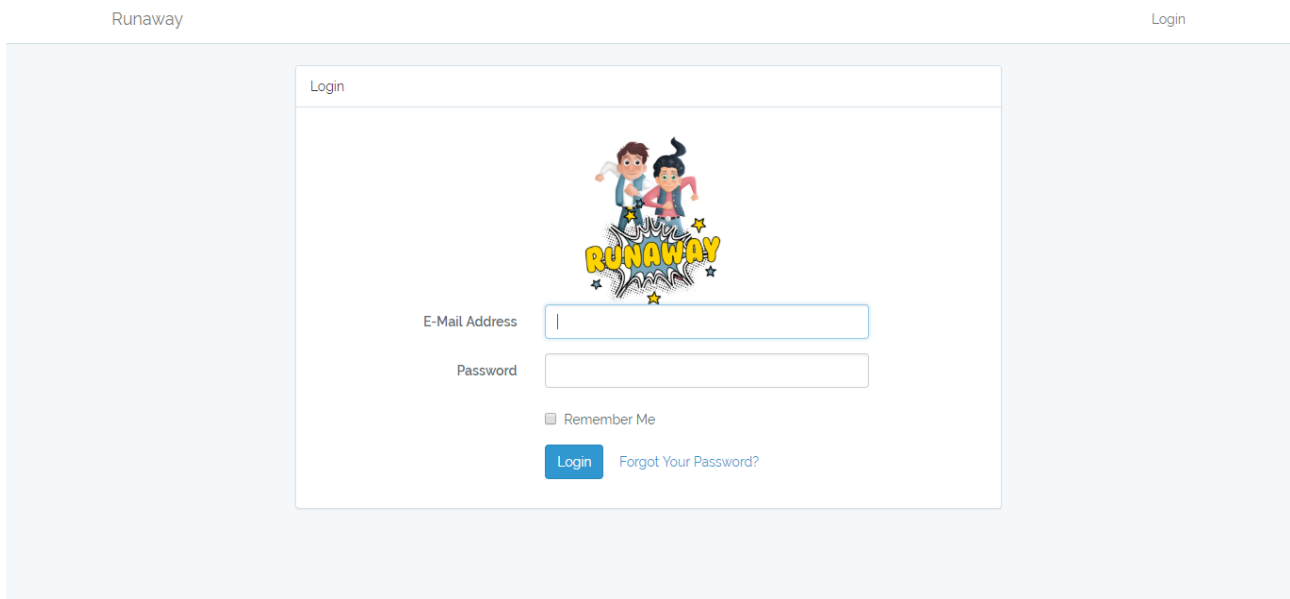
Figure 8: Main web interface
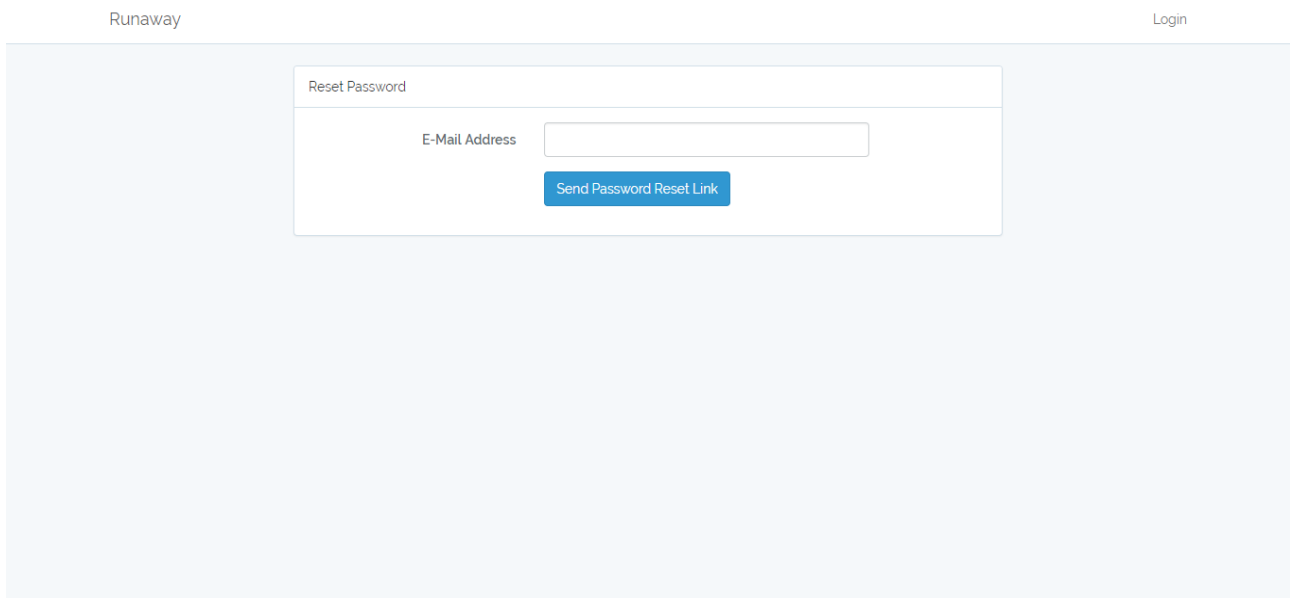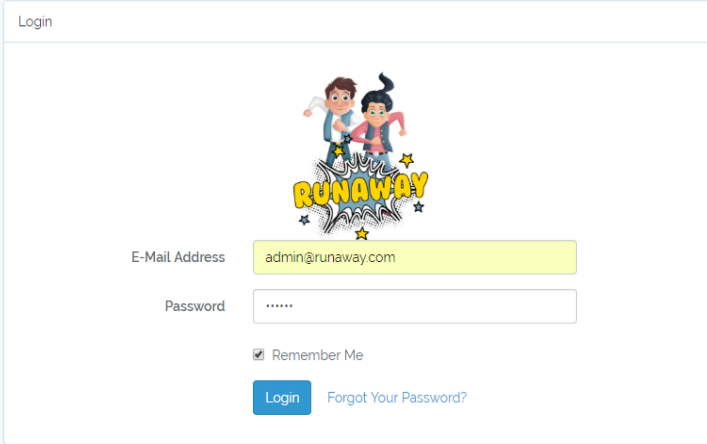
Figure 9: Reset password via email
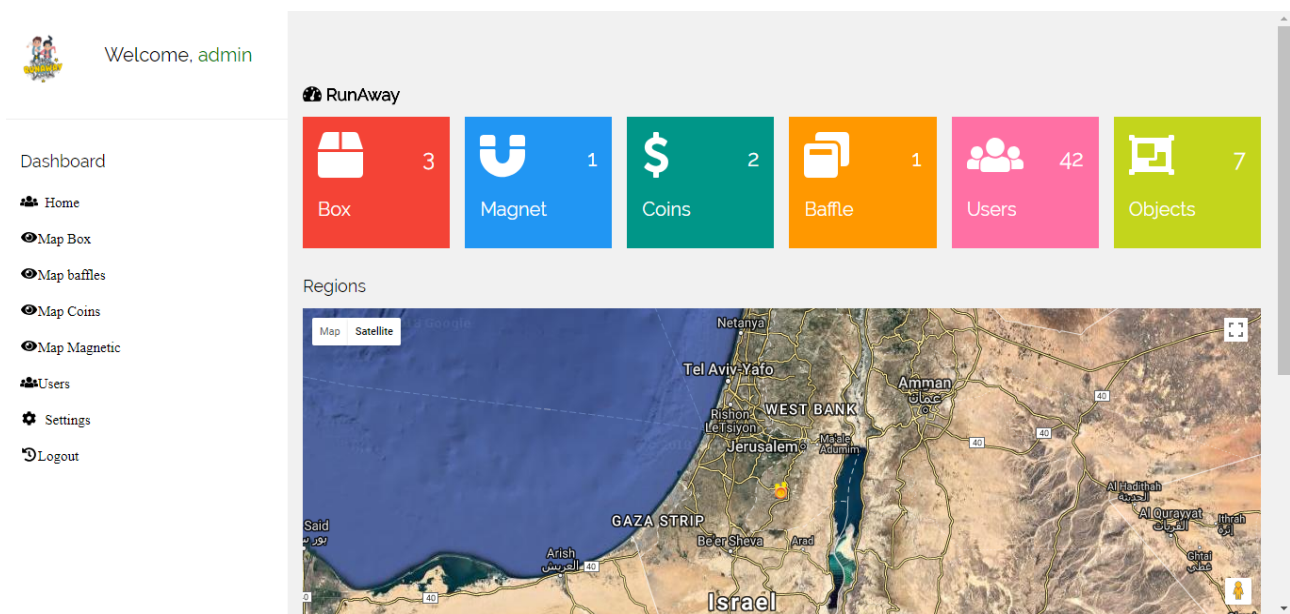
If admin forget the password he must enter admin email to reset the password.

Figure 10: Login interface

Admin must enter the email and password correctly to access the dashboard.

Figure 11: Admin dashboard

Object Type	Lat	Lang
Coin	31.507461111658	35.091323415216
Mang	31.507895851206	35.090897610678
Baf	31.507760344802	35.090773905044
Box	31.507662459074	35.09078171568
Box	31.507269321262	35.091005987709
Box	31.507658073276	35.09078604657
Baf	31.507238269894	35.091122286802
Coin	31.507726459328	35.090949491743
Mang	31.507589579933	35.091223400139

Figure 12: All game objects that added on the map
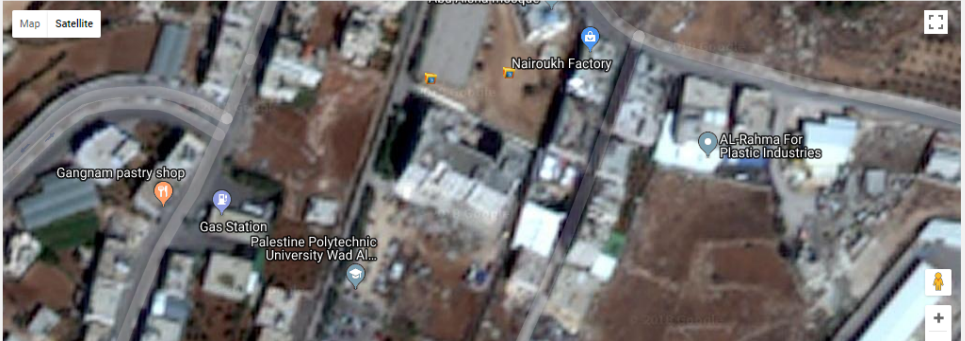
Figure 13: Map boxs
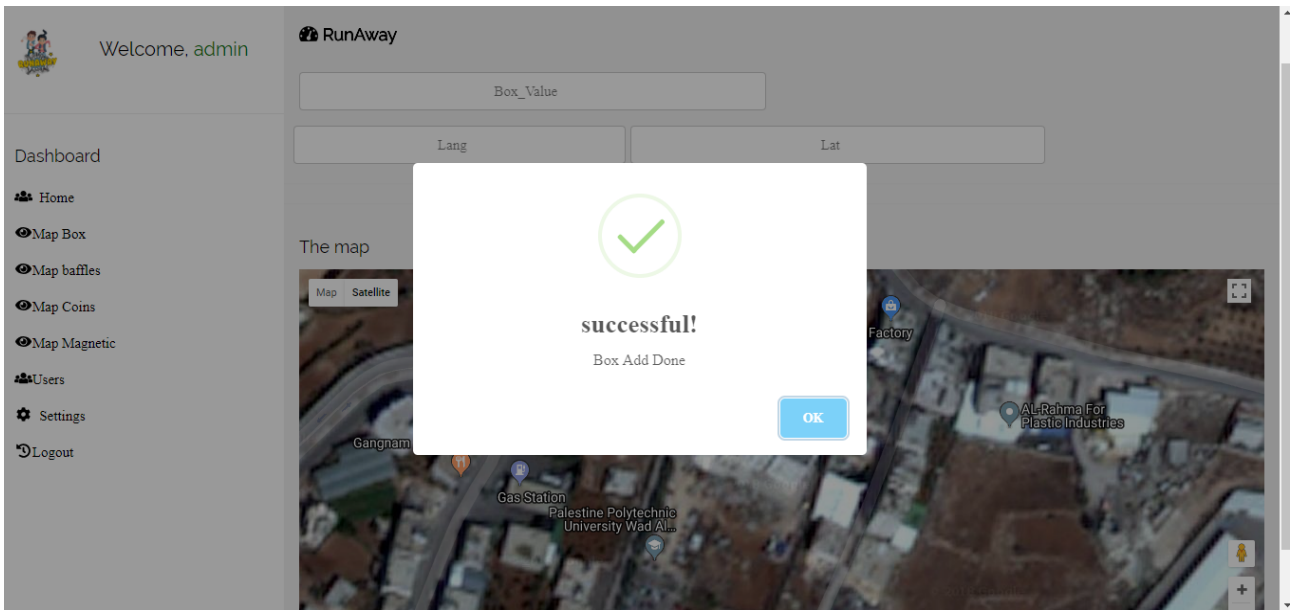
Figure 14: Add box on the map

Admin can click on any point on map to add the box. Alert dialog appear if the box successfully added to DB.
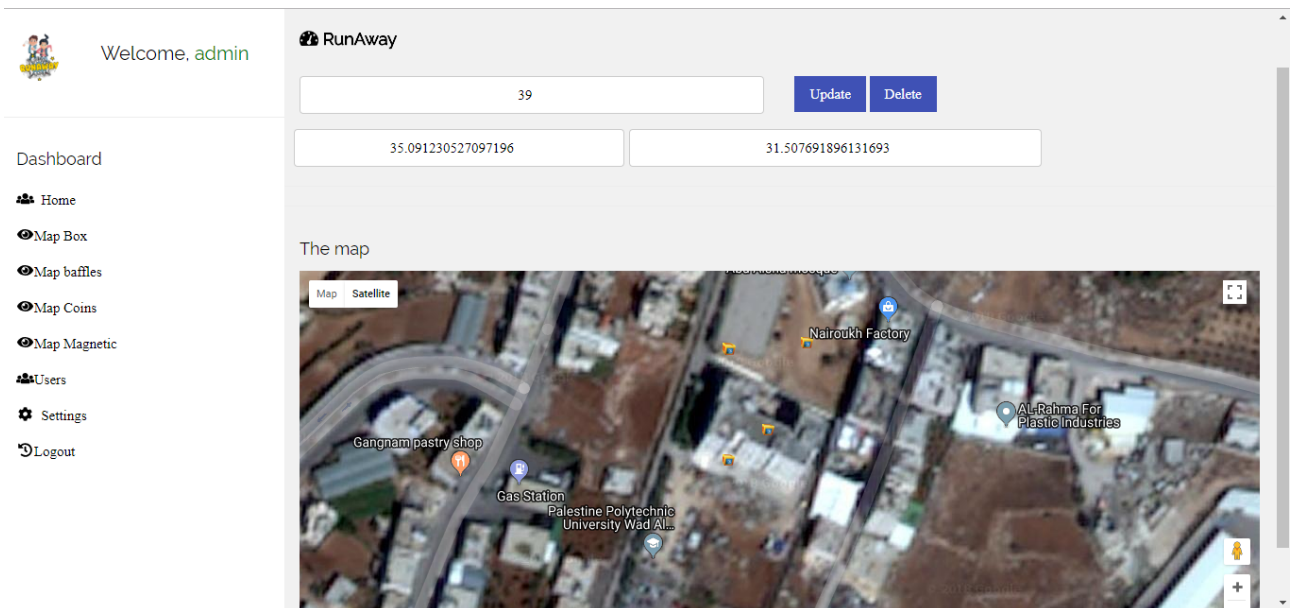
Figure 15: Control boxes

Admin can click on the box that already added if he want to delete or update its characteristics.
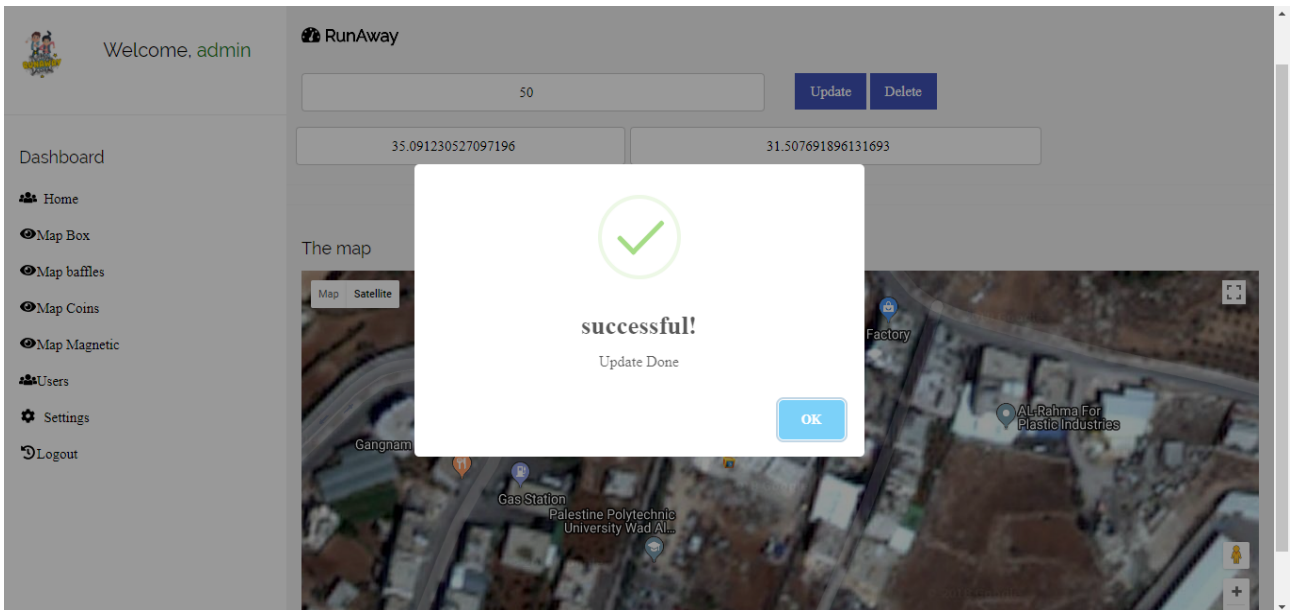
Figure 16: Update box on the map

Admin can update box characteristics. Alert dialog appear if the box successfully updated on DB.
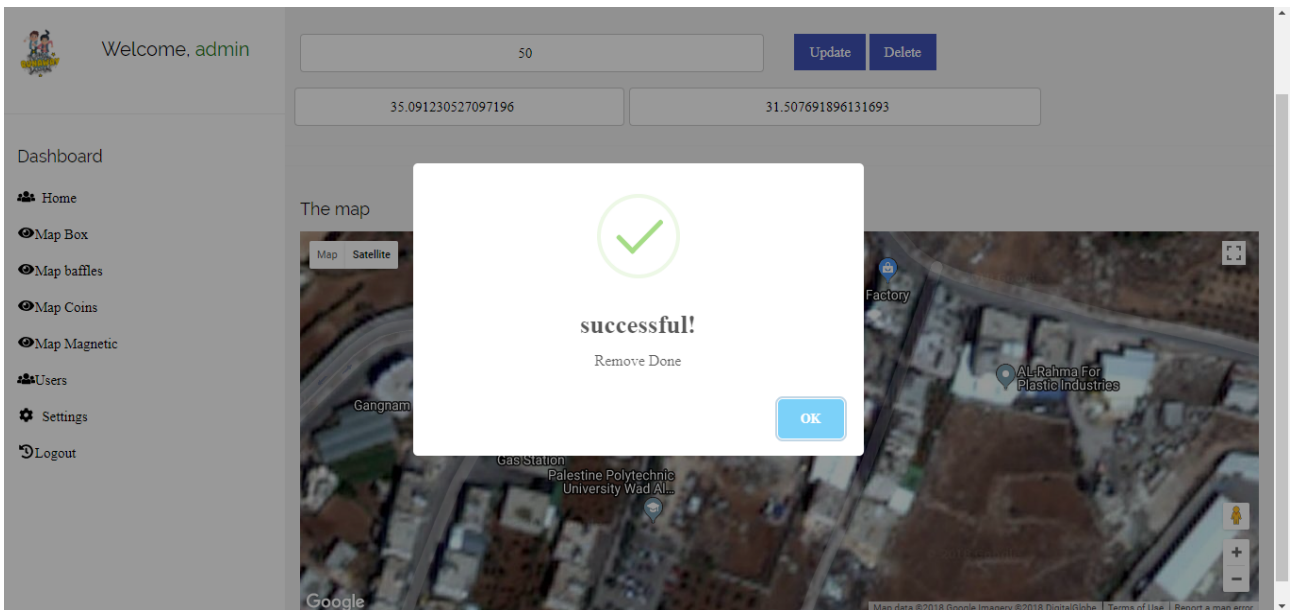
Figure 17: Delete box from the map

Admin can delete box. Alert dialog appear if the box successfully deleted on DB.
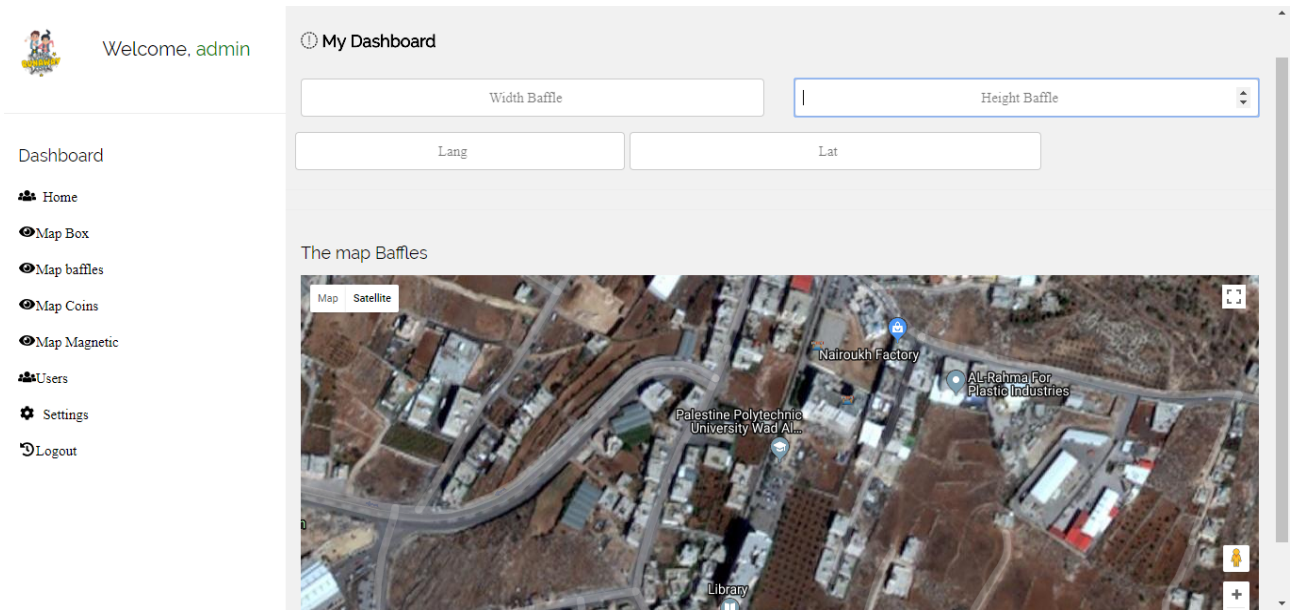
Figure 18: Map baffles

Admin can add, update, delete baffles from this map.
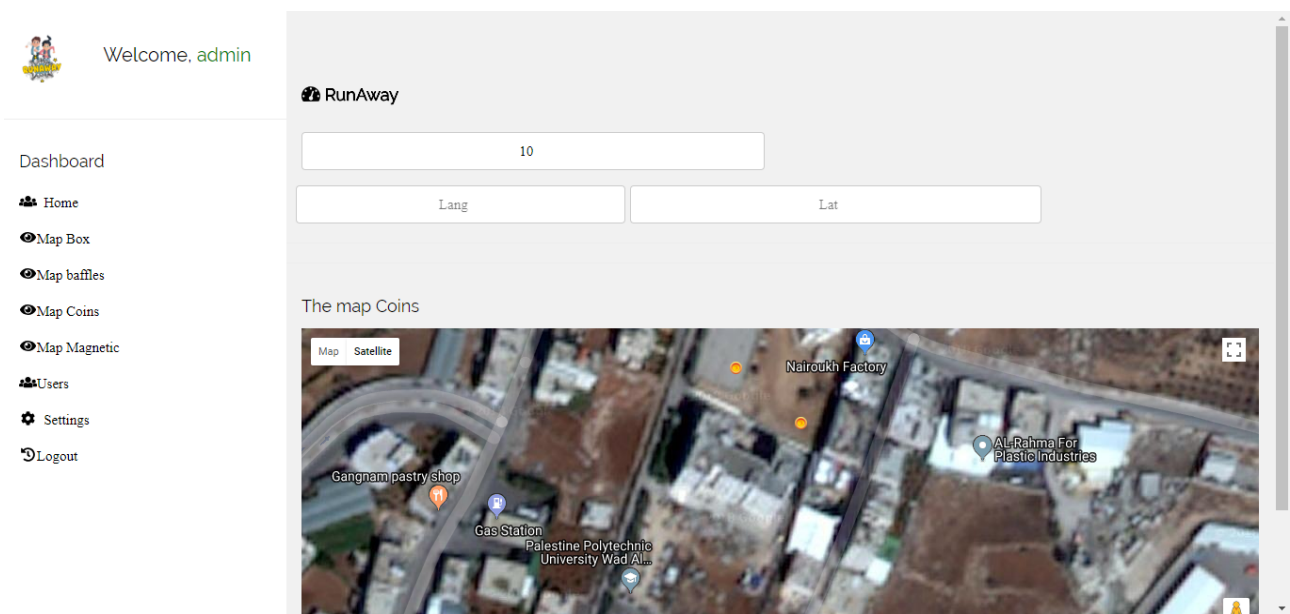
Figure 19: Map coins

Admin can add, update, delete coins from this map.
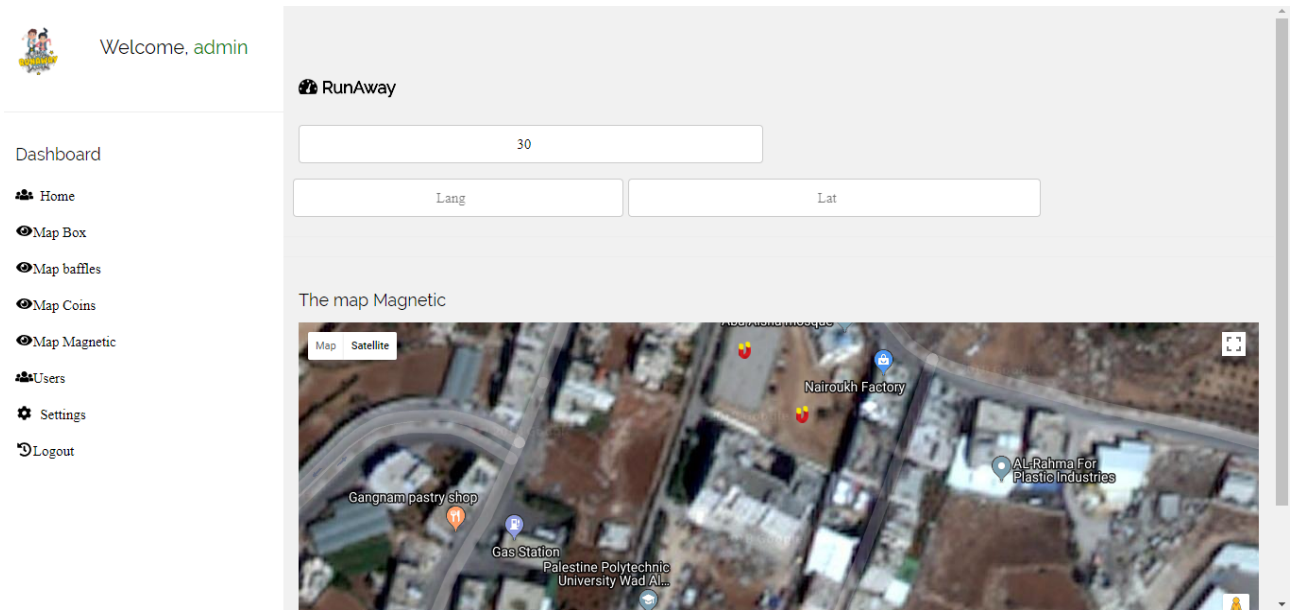
Figure 20: Map magnetic

Admin can add, update, delete magnetic from this map.
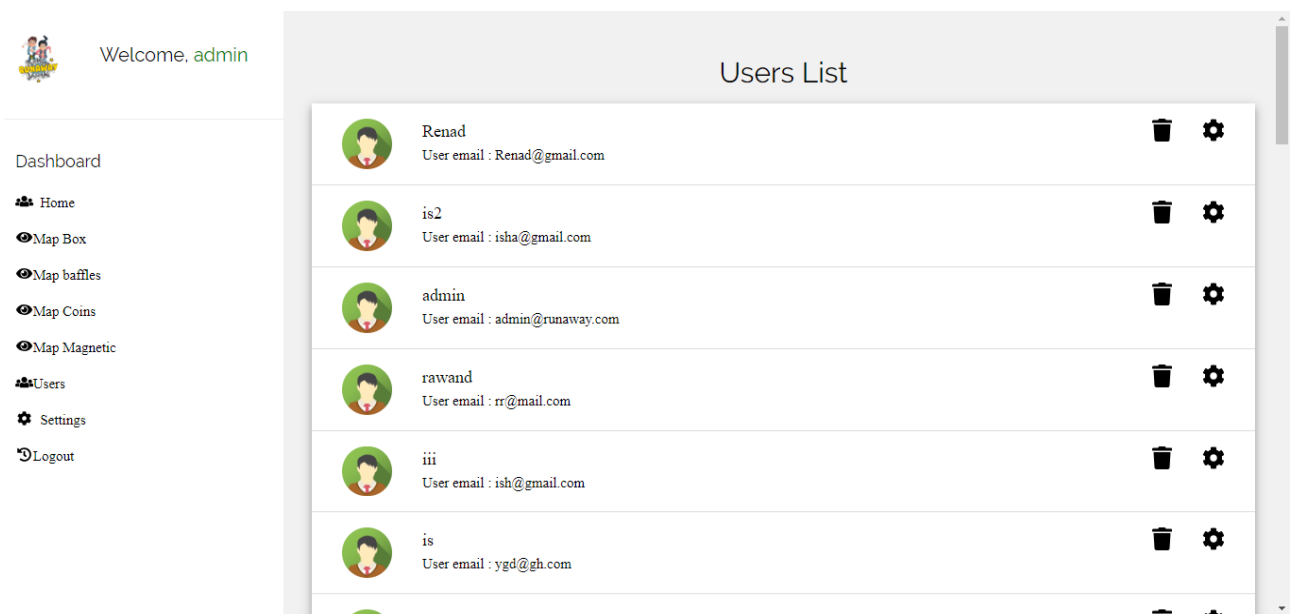
Figure 21: Users list

On this page admin can shows all the users.
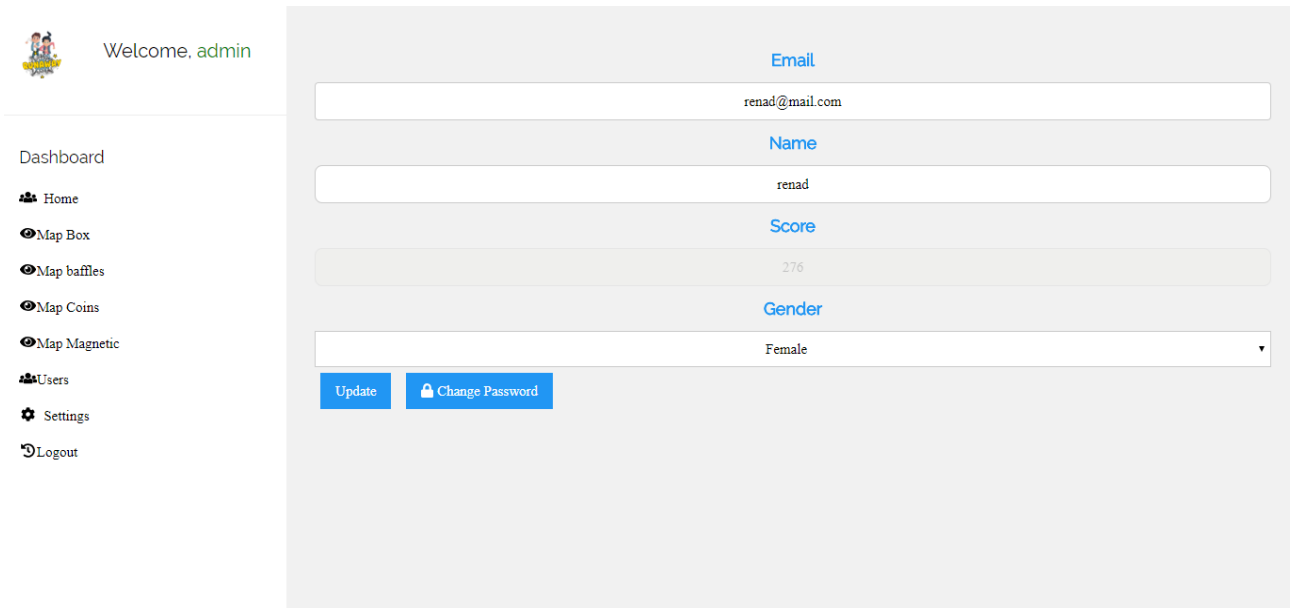
Figure 22: User setting control

On this page admin can shows all the user setting and update or delete his account.
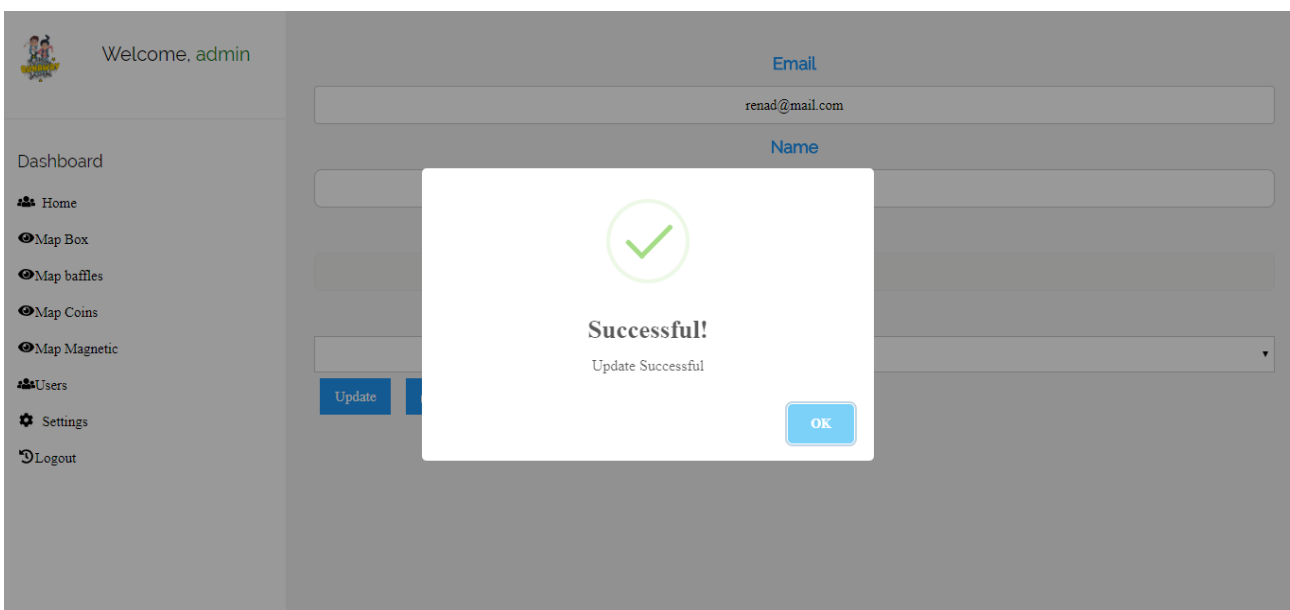
Figure 23: Update user information

Admin can update user information if needed manually. Alert dialog appear if the user account successfully updated on DB.
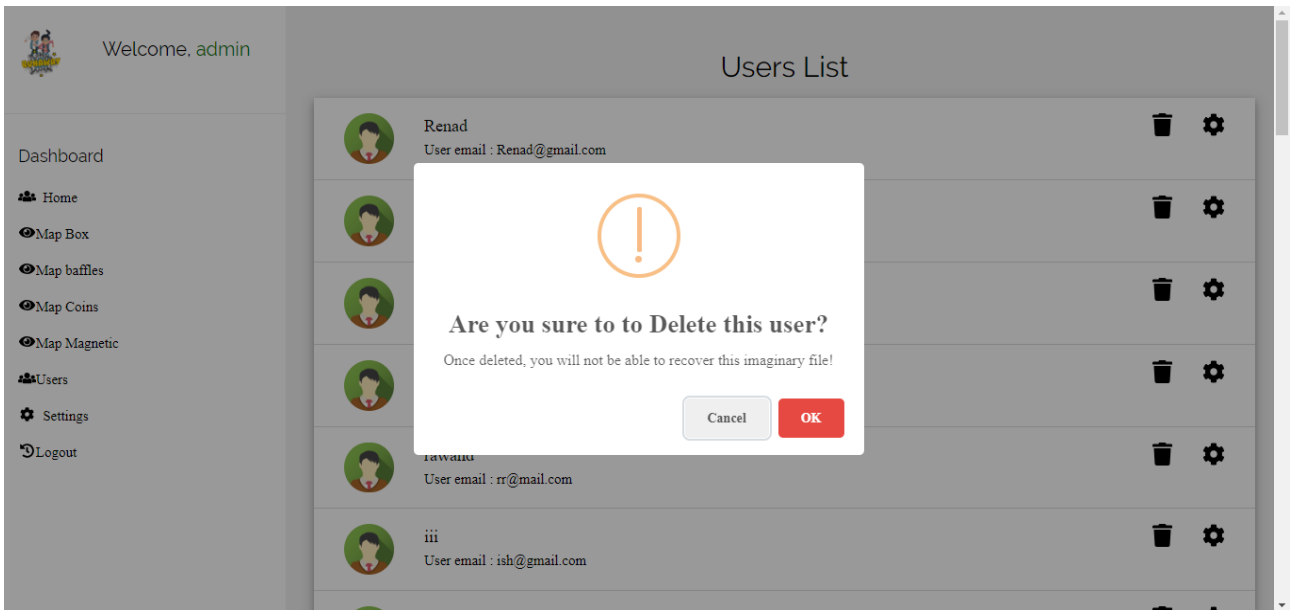
Figure 24: Delete user account

Admin can delete user account if needed. Alert dialog appear to admin to ask if he sure need delete the user.
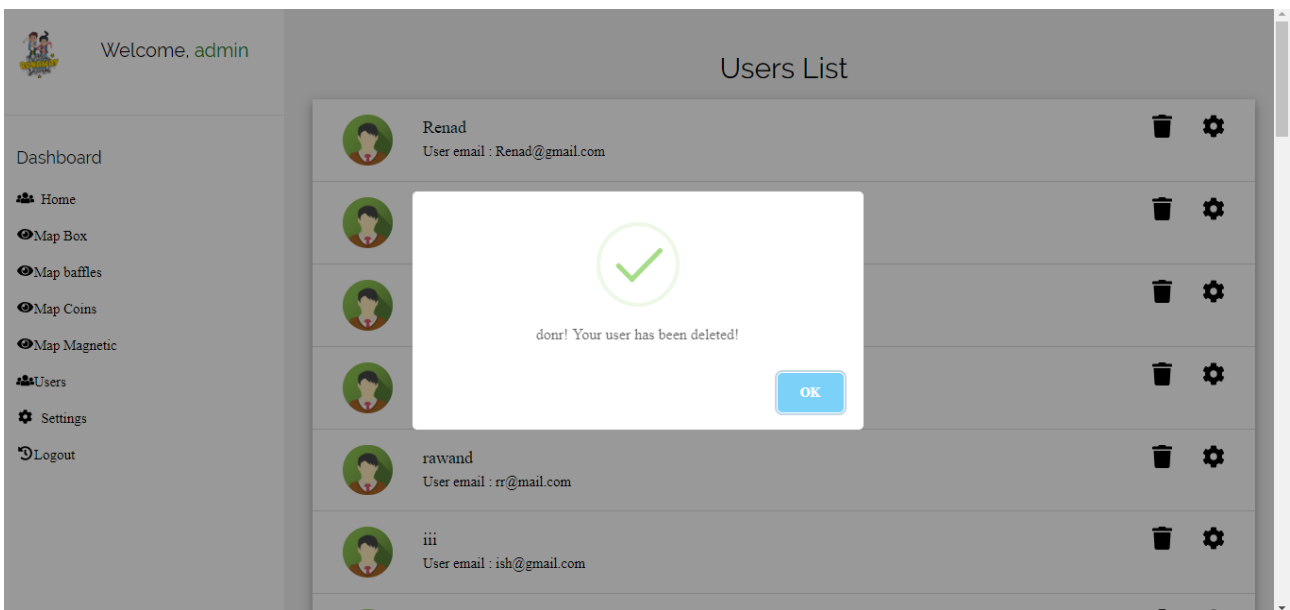
Figure 25: Delete user account

Admin can delete user account if needed. Alert dialog appear if the user account successfully deleted from DB.
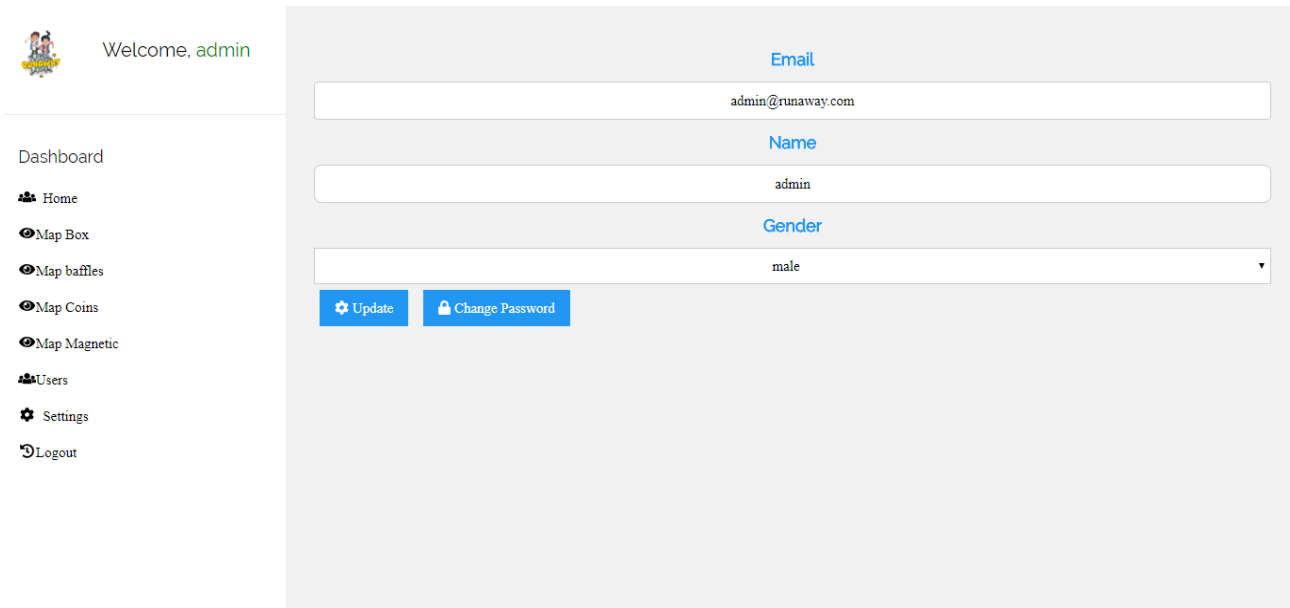
Figure 26: Admin account setting

Admin can control his account information and update it and change the password.
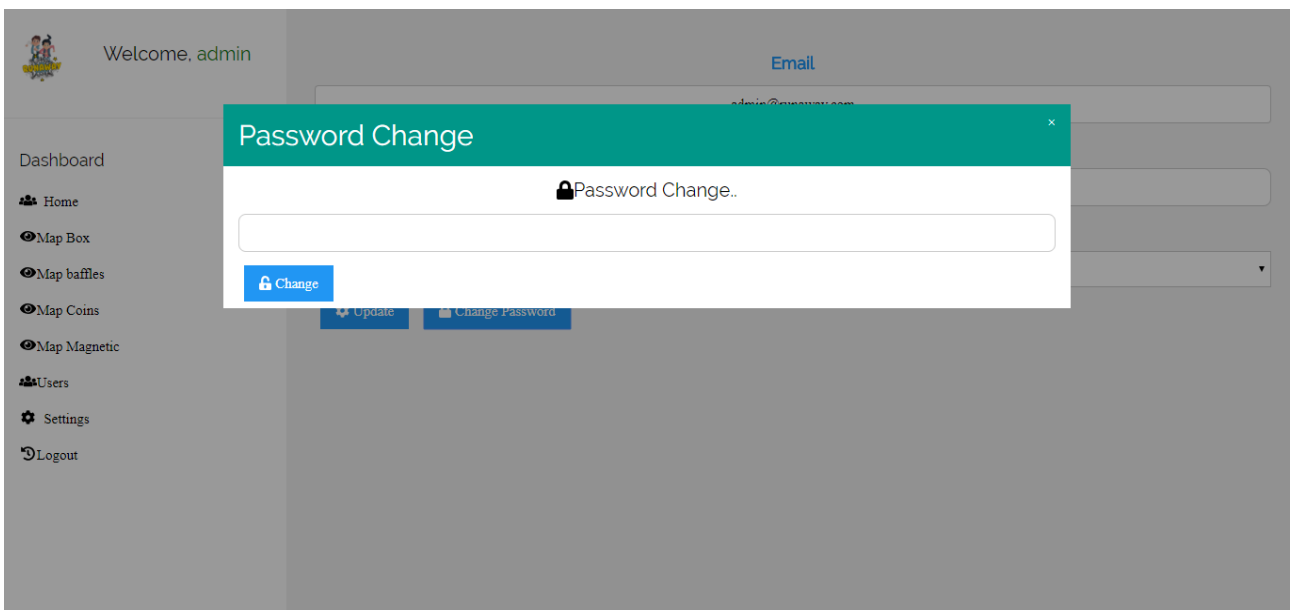
Figure 27: Change admin account password

Admin can change his account password and update it.
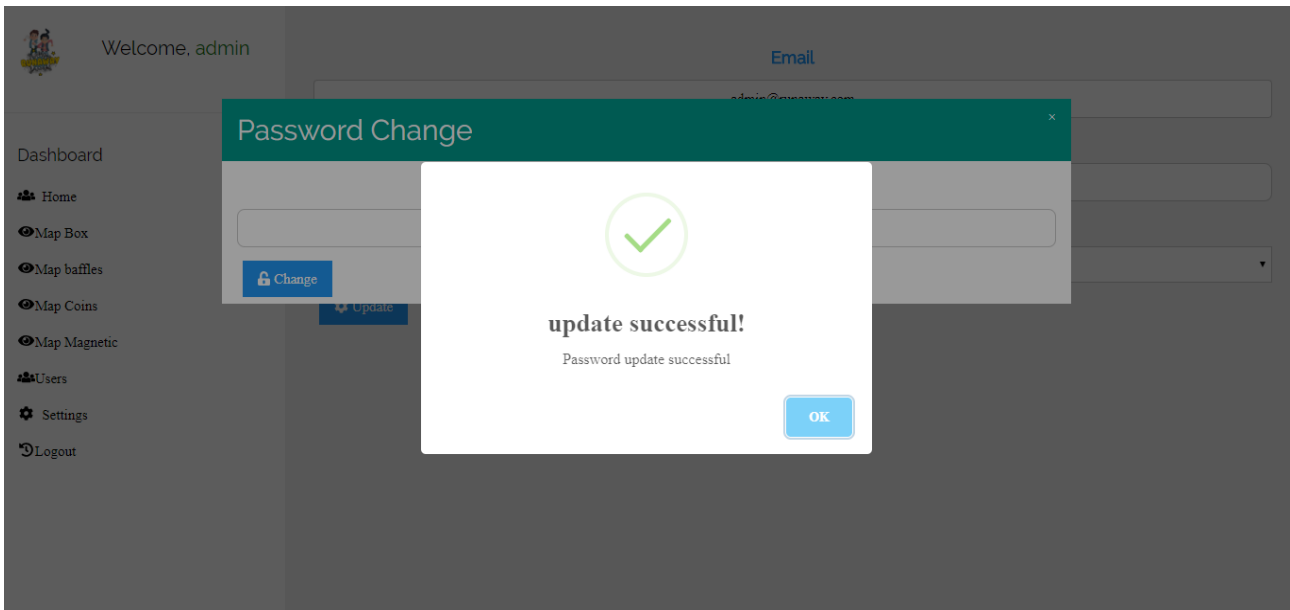
Figure 28: Change admin account password successfully.

Admin change his account password and update. Alert dialog appear if the admin account password successfully updated on DB.

3.3.2 Android application interface

In this section views the interfaces that allows the players to interact with RunAway system and playing.

The first screen shows the first activity when the user open the RunAway application, if user have an account choice sign in, if he doesn't have an account choice sign up. And the second one shows the registration activity when the user choice sign up to create account, the user must fill all his information name, email, gender to detect the player character as a boy or a girl, and password. RunAway put a constraint on data that no field can be null, RunAway validate the email format that contain "@, .com".
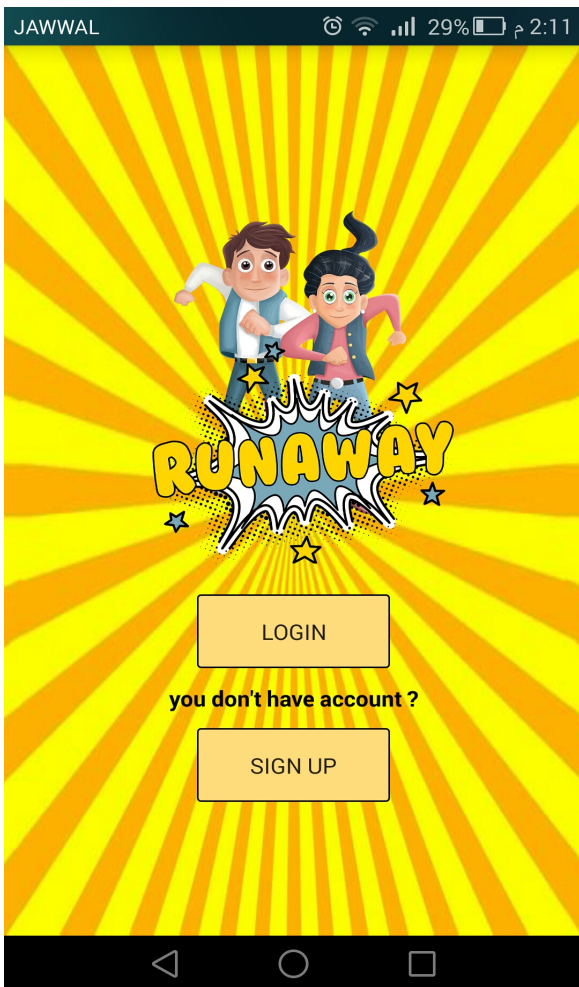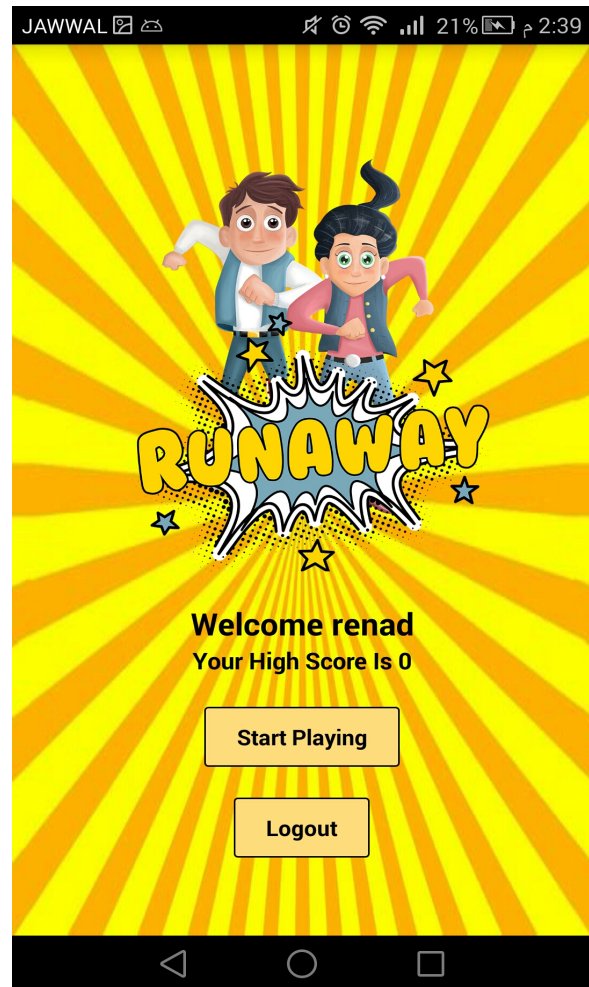

(a) Registration activity

(b) Start activity
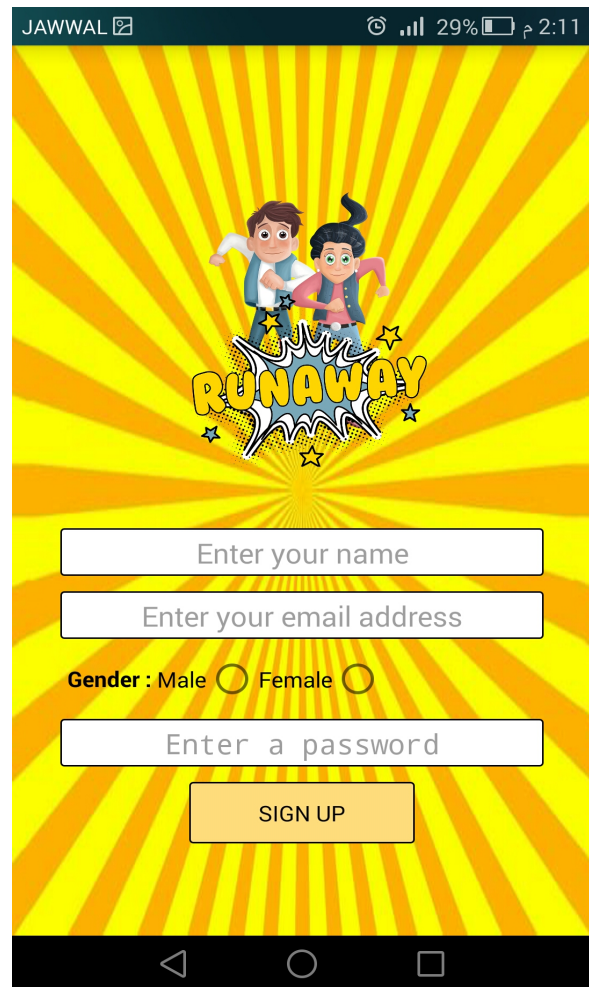
The first screen shows the registration process the player must enter his information. After registration successfully, the application open to the second screen that enable user to know his high scour, player can start playing using start playing button, or logout from the application.
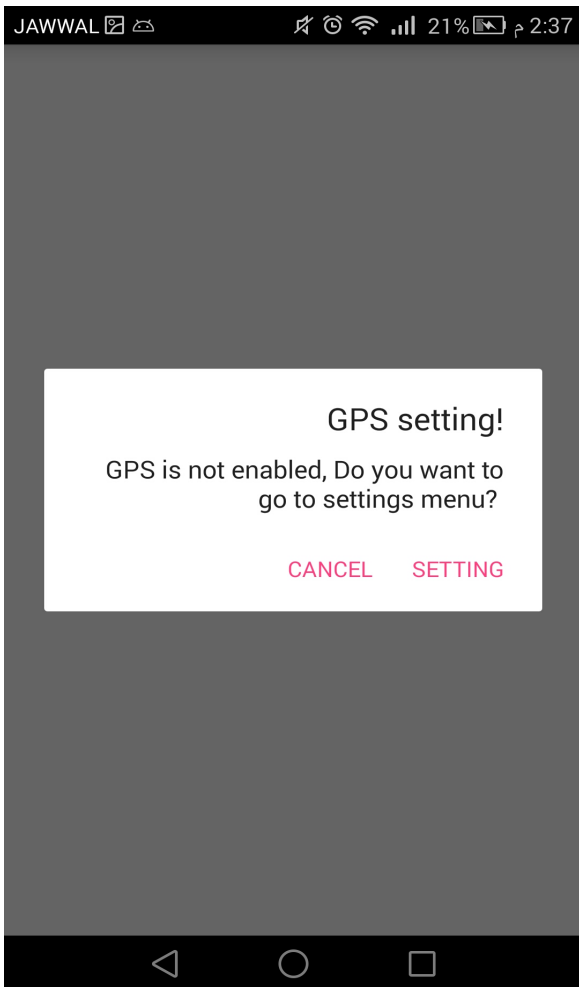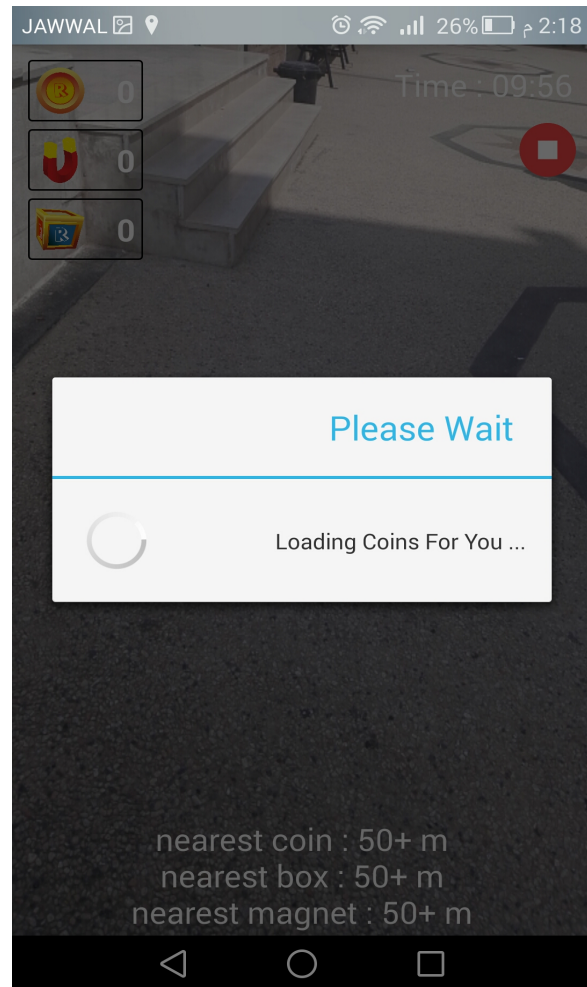

(a) Main activity

(b) Registration activity

The first screen shows the enable GPS dialog to enable user start playing the game, and the second screen when start the game loading the game object that got from the web to display overlay on the camera layout.


(a) Enable GPS dialog

(b) Loading game object activity

The first screen shows the dialog, this dialog appear when the player click on the red circle on the right-top of the screen. The player can end the game before the time out and get the result or he can open it again, and he can resume the game for a period of time and open it to complete the game. On the second screen that the camera feed on black because resume the game. Also, we see the bottom of screen hints of nearest game object to the player in meters.
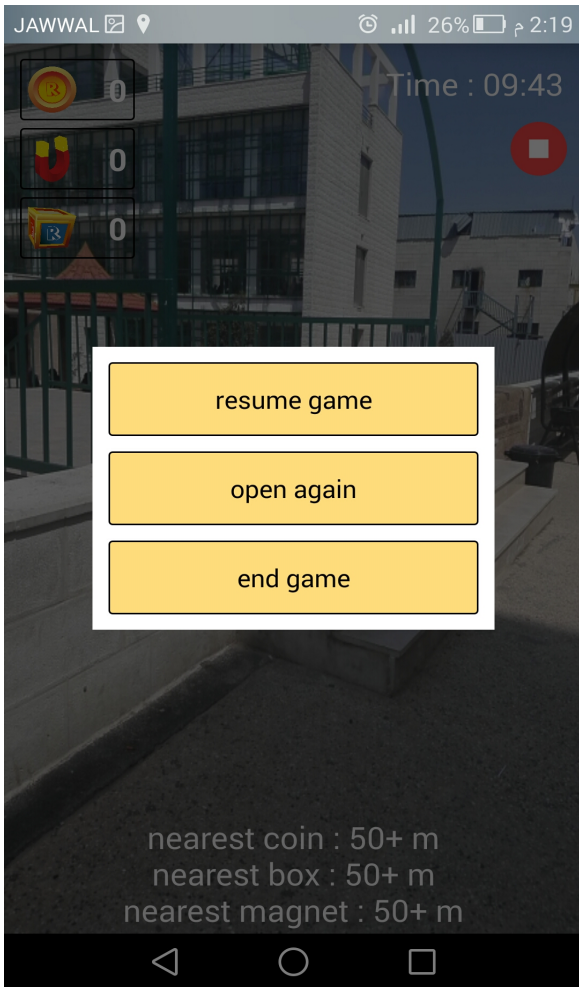

(a) Control game dialog
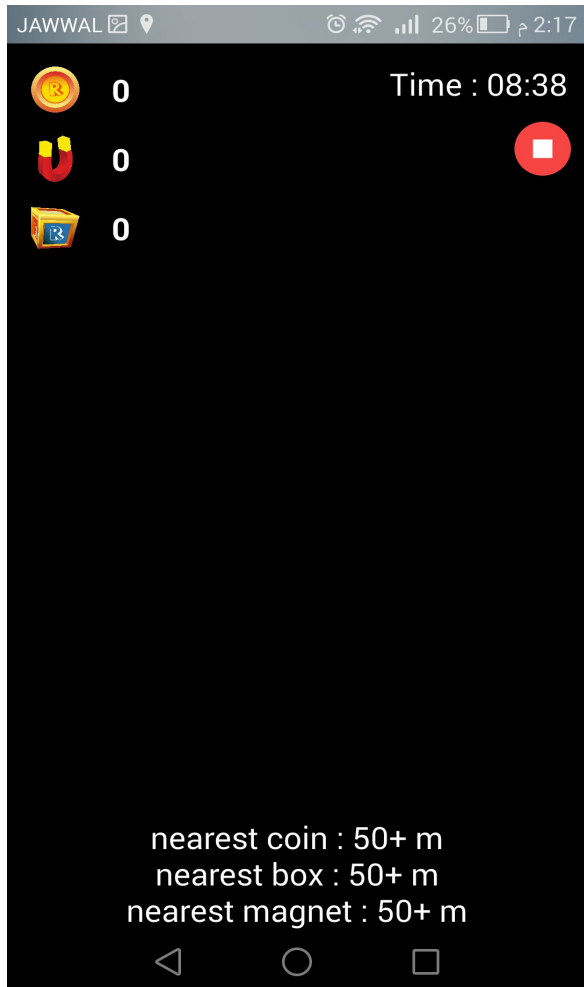
(b) Game resume

The first screen shows the coin that near to the player 31 meters, and the second show the box that near to the player 45 meters each box give the player 39 coins to his score. The time that appear on the top of the screen is the time of game. Each game just 10 minuets and the player can resume or end the game before the 10 minutes ended bu click on the red circle under the time.


(a) Coin view
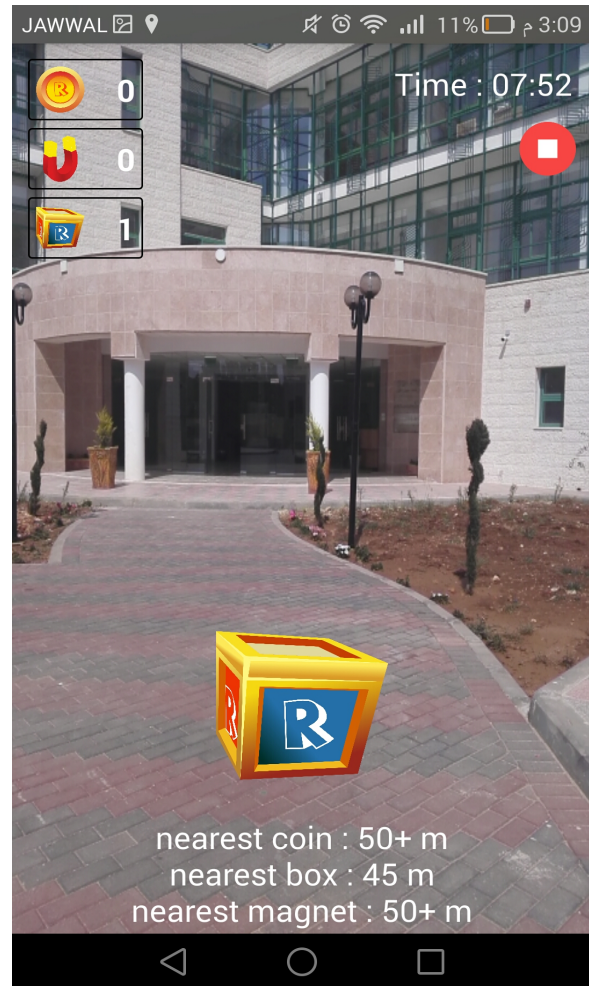
(b) Box view

The first screen shows the magnet that near to the player 54 meters, and the second show the baffle that near to the player. The magnet collect the coins that around the player in 20 meters that is very useful tool when playing because sometimes when the admin add the coin on the map he didn't know the physical area maybe the coin put under the car exc. so the player can got the coins remotely. On the baffle case the player must avoid it or jump to skip it. If he not jump the game will ended.
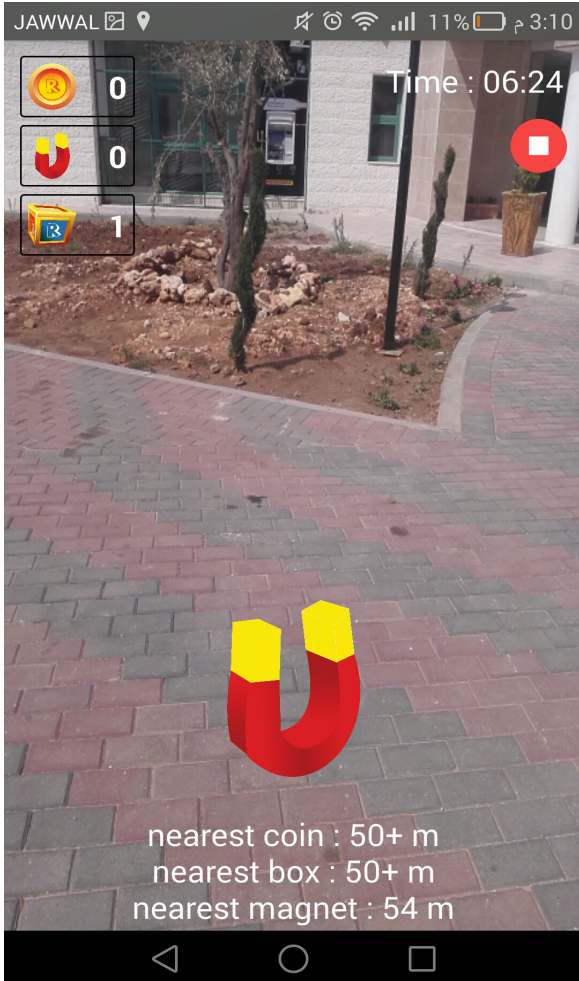

(a) Magnet view
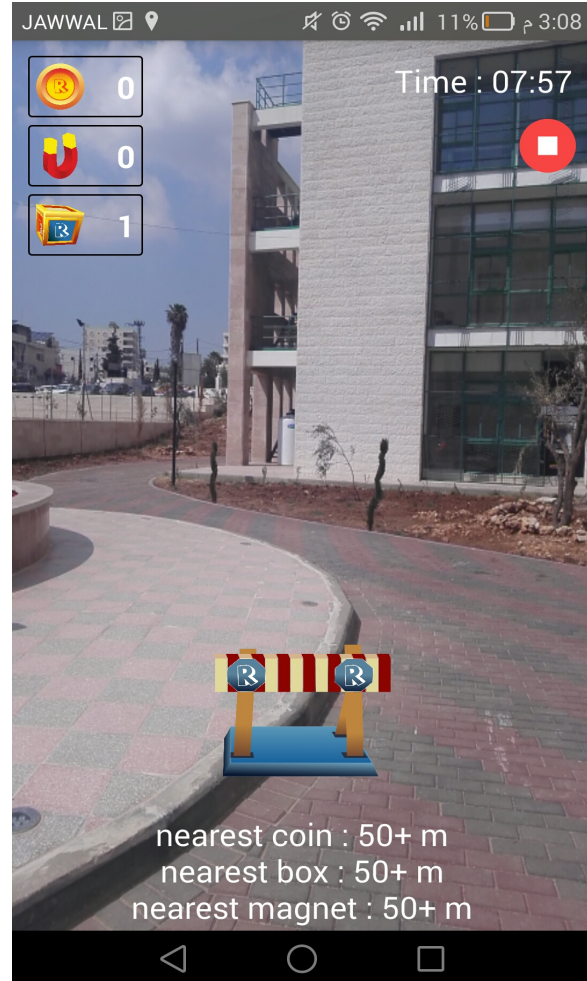
(b) Baffle view

The first screen shows the game result if the player gender is female the player character is girl. And, in the second the game result and the player gender is male the player character is boy. The game ended in three ways: first, if the time out the player played the 10 minuets. Second, if the player doesn't skip the baffle. Third, if the player end the game by click on the end button. The game result dialog appear all the objects the player got when he played the game.
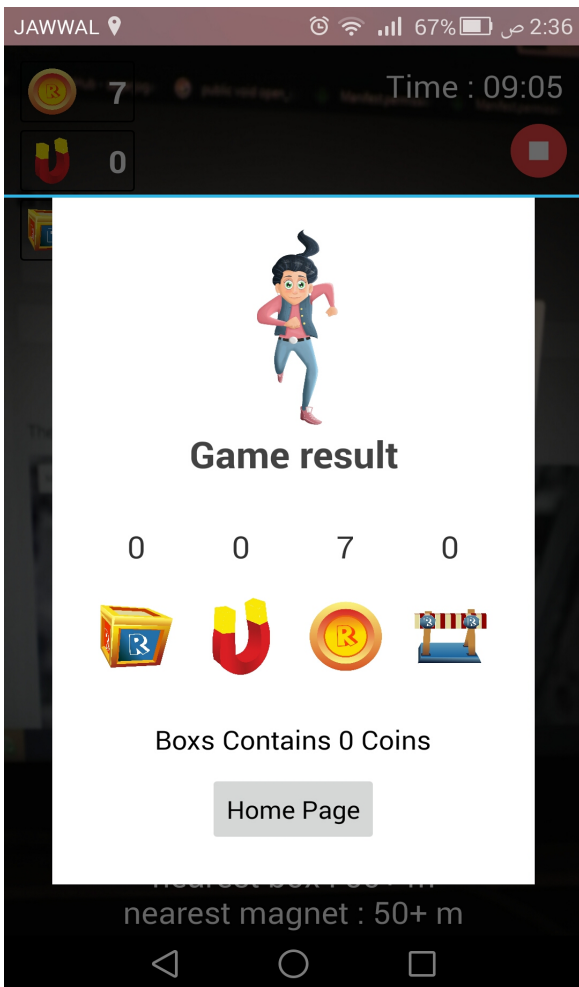
(a) Game result dialog
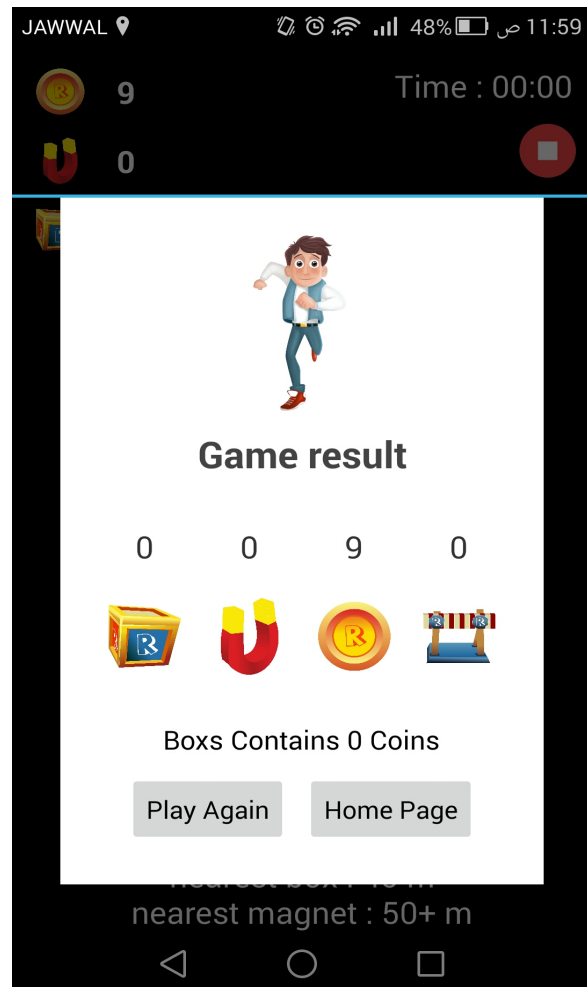
(b) Game result dialog

4 Implementation

4.1 System diagram

Figure 36: RunAway system diagram

As shown through the RunAway system diagram, RunAway application send a request to the web server to get array of game object that store on the DB, the web retrieve the game object from the DB and send it to application as JSON array. The samrtphone has many sensors, RunAway use GPS sensor to detect the player location and to make some calculation to calculate the distance between the player and the game object around him, and RunAway use camera sensor to display the game objects overlay. In addition, use the position sensor like: orientation sensor, camposs, and magnetic field sensor to detect direction of the camera and decide which of game objects appear on the screen.

4.2 Android side

4.2.1 System component

- Smartphone: Today, smartphones largely fulfill their users' needs for a telephone, digital camera and video camera, GPS navigation. Typical smartphones will include one or more of the following sensors: magnetometer, proximity sensor, barometer, gyroscope, or accelerometer. Smart-phones also provide some remarkable features such as Web Access, GPS navigation, reading qr codes, and Compass. Smart-phones have built-in sensors that measure motion, and orientation. These sensors are capable of providing raw data with high precision and accuracy, and are useful if you want to monitor three-dimensional device movement or positioning, or you want to monitor changes in the ambient environment near a device[10].

The sensors we used in our project:

- Camera

One of the most important features of smartphones is the camera, the base components that form a camera are the sensor, and the lens. Without both of these crucial parts, they're typically packaged together into a single unit.

The Android framework includes support for various cameras and camera features available on devices, allowing you to capture pictures and videos in your applications. This document discusses a quick, simple approach to image and video capture and outlines an advanced approach for creating custom camera experiences for your users[14].

The camera is used to Display live feed to the users. The camera data is available by using the APIs available with in the android hardware Camera package. the application uses SurfaceHolder object with the setPreviewDisplay()method in order to provide the augmented reality experience to the users[14].

In the RunAway application we used CameraAPI, we used the Camera class to start/stop the preview. To access the device camera, we declared the CAMERA permission in our Android Manifest.

To access the device camera, we declared the CAMERA permission in our Android Manifest. We also included the ¡uses-feature¿ manifest element to declare camera features used by our application.

```
<uses-permission android:name="android.permission.CAMERA"/>
<uses-feature android:name="android.hardware.camera"/>
<uses-feature android:name="android.hardware.camera.autofocus"/>
```

This Feature is used to declare the use of the camera features. Adding camera features to our manifest causes Google Play to prevent our application from being installed on devices that do not include a camera or do not support the camera features. We used the following steps for creating the custom camera interfaces[14]:

- Create a Preview Class:

Create a camera preview class that extends SurfaceView and implements the SurfaceHolderinterface. This class preview display the live image data coming from a camera. The following code demonstrates the basic camera preview class that is included in a View layout. This class implements SurfaceHolder.Callback in order to capture the callback events for creating and destroying the view, which are needed for assigning the camera preview input.

```java
public class showCamera extends SurfaceView implements SurfaceHolder.Callback{
    Camera camera;
    SurfaceHolder holder;
    public showCamera(Context context, Camera camera) {
        super(context);
        this.camera=camera;
        holder=getHolder();
        holder.addCallback(this);
    }


    @Override
    public void surfaceCreated(SurfaceHolder holder) {
        if (camera== null)return;
        Camera.Parameters params =camera.getParameters();
        //change the orientation of the camera
        if (this.getResources().getConfiguration().orientation != Configuration.ORIENTATION_LANDSCAPE) {
            params.set("orientation","portrait");
            camera.setDisplayOrientation(90);
            params.setRotation(90);
        }else{
            params.set("orientation","landscape");
            camera.setDisplayOrientation(0);
            params.setRotation(0);
        }
        camera.setParameters(params);
        try{
            camera.setPreviewDisplay(holder);
            camera.startPreview();
        }catch (IOException e){
            e.printStackTrace();
        }
    }
}
```

Figure 37: showCamera class

- Placing preview in the layout:

The camera preview class must be placed in the layout of the activity along with other user interface controls. We declared it in the CameraActivity XMLlayout le. This gure shows the layout we used for the preview.

```xml
<FrameLayout
    android:id="@+id/frameLayout1"
    android:layout_width="match_parent"
    android:layout_height="wrap_content">
</FrameLayout>
```

Figure 38: CameraActivity layout

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- Add the preview class in the activity:

In the onCreate method we added this code to set the costumed camera preview.

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_camera);
    frameLayout = findViewById(R.id.frameLayout1);
```

Figure 39: costumed camera preview

- Open the camera:

```
Camera mCamera;
FrameLayout frameLayout;
showCamera show_camera;



mCamera = Camera.open();
show_camera = new showCamera( context: this, mCamera);
frameLayout.addView(show_camera);
```

Figure 40: Open camera

- Wi-Fi

We used the Wi-Fi sensor to connect with the internet.

To access the device Wi-Fi, we declared the INTERNET permission in our Android Manifest.

```
<uses-permission android:name="android.permission.INTERNET"/>
```

- GPS

GPS is used to develop a location-aware application, you can use GPS and Android's Network Location Provider to acquire the user location. Although GPS is most accurate, it only works outdoors, it quickly consumes battery power, and doesn't return the location as quickly as users want. Android's Network Location Provider determines user location using cell tower and Wi-Fi signals, providing location information in a way that works indoors and outdoors, responds faster, and uses less battery power. To obtain the user location in your application, you can use both GPS and the Network Location Provider, or just one. In our application we used Satellites GPS to retrieve the users location because of its accuracy and accuracy is a major matter in our application. In order to use the GPS sensor we used LocationManager to get the last known location, and every 10 seconds the user's location will be fetched.

To access the device GPS, we declared the LOCATION permission in our Android Manifest.

```
<uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION"/>
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
```

```java
sensorManager = (SensorManager) getSystemService(Context.SENSOR_SERVICE);
sensorGravity = sensorManager.getDefaultSensor(Sensor.TYPE_ACCELEROMETER);
sensorMagnetic = sensorManager.getDefaultSensor(Sensor.TYPE_MAGNETIC_FIELD);
// listen to these sensors
sensorManager.registerListener( listener: this, sensorGravity, SensorManager.SENSOR_DELAY_GAME);
sensorManager.registerListener( listener: this, sensorMagnetic, SensorManager.SENSOR_DELAY_GAME);


locationManager = (LocationManager) getSystemService(Context.LOCATION_SERVICE);
if (ActivityCompat.checkSelfPermission( context: this, Manifest.permission.ACCESS_FINE_LOCATION) != PackageManager.PERMISSION_GRANTED) {
    if (Build.VERSION.SDK_INT >= Build.VERSION_CODES.M) {
        requestPermissions(new String[]{Manifest.permission.ACCESS_FINE_LOCATION}, requestCode: 399);
    }
    return;
}
locationManager.requestLocationUpdates(LocationManager.GPS_PROVIDER, LOCATION_MIN_TIME, LOCATION_MIN_DISTANCE, listener: this);
// get last known position
Location gpsLocation = locationManager.getLastKnownLocation(LocationManager.GPS_PROVIDER);
if (gpsLocation != null) {
    currentLocation = gpsLocation;
} else {
    // try with network provider
    Location networkLocation = locationManager.getLastKnownLocation(LocationManager.NETWORK_PROVIDER);
    if (networkLocation != null) {
        currentLocation = networkLocation;
    } else {
        // Fix a position
        currentLocation = new Location(FIXED);
        currentLocation.setAltitude(1);
        currentLocation.setLatitude(0);
        currentLocation.setLongitude(0);
```

Figure 41: Method to get location from GPS sensor

- Orientation sensor

The orientation sensor is a composite sensor, generated from a combination of the accelerometer and the magnometer. The orientation sensor is used to calculate the 26 bearing of the device so that the user is able to see changes on the screen in relation to the device movement. In order to use the orientation sensor we must do the following : 1.the activity must implement the SensorEventListener class. 2.Override onSensorChanged method we used the SensorEvent value of 0.

4.2.2   Used technology

- Android operating System

Android is an open source, Linux-based software stack created for a wide array of devices and form factors it also provides many services that include support for security, virtual memory, multitasking, and threads—all features of modern day operating systems[5].

The major components of the Android platform are:

1. The Linux Kernel.

2. Hardware Abstraction Layer.

3. Libraries and Android Runtime.

4. Application Framework.

5. Applications.

- Android studio

Android studio is one of the fastest tools for building apps on every type of android device. We used it because it provides world-class code editing, debugging, performance tooling, exible build system, and an instant build/deploy system all allow developers to focus on building unique and high quality apps. Android Studio comes bundled with:

1. Android SDK tools.

2. Android platform tools.

3. Latest android platform.

4. Latest android system image for emulator.

- JAVA programming language

JAVA programming language is one of the most popular, and powerful programming languages. We used java because it's easy to use, write, compile, and learn.

- Libraries

Volley is an HTTP library that makes networking for Android apps easier and faster[15]   .

We decided to use volley because it oers the following advantages:

1. Automatic scheduling of network requests.

2. Multiple concurrent network connections.

3. ransparent disk and memory response caching with standard HTTP cache coherence.

4. Support for request prioritization.

5. Cancellation request API. You can cancel a single request, or you can set blocks or scopes of requests to cancel.

6. Ease of customization, for example, for retry and backoff.

7. Strong ordering that makes it easy to correctly populate your UI with data fetched asynchronously from the network.

8. Debugging and tracing tools.

```
dependencies {

    implementation 'com.mcxiaoke.volley:library-aar:1.0.0'


RequestQueue queue = Volley.newRequestQueue(getBaseContext());

StringRequest stringRequest = new StringRequest(Request.Method.POST, url: "http://35.196.249.249/api_mobile/Registration",

    new Response.Listener<String>() {
```
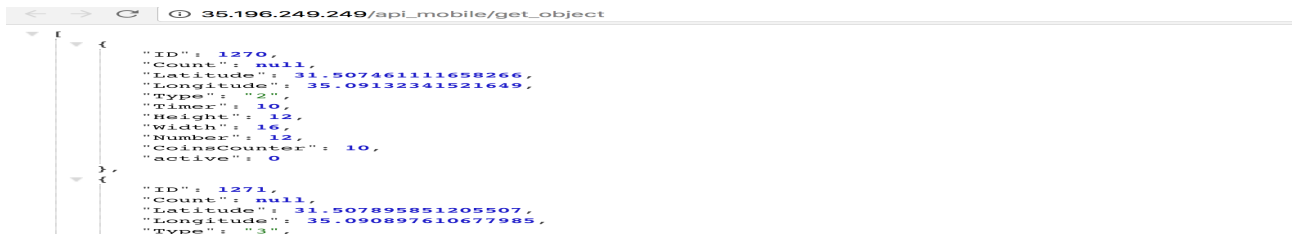
We added Volley Library to RunAway Project by using the following code under dependencies section in build.gradle le:

- JSON

JavaScript Object Notation. JSON is a syntax for storing and exchanging data. Is text, written with JavaScript object notation[13].

RunAway retreve a JSON array from the web server like this:

4.3 Server side

We have been developing a website using PHP framework called. Laravel in our project, to design the admin interface for accessing the tables in the Database through a Website , where Admin can add, delete and modify fields.

4.3.1 Laravel

Laravel is a web application framework with expressive, elegant syntax. Laravel attempts to take the pain out of development by easing common tasks used in the majority of web projects, such as authentication, routing, sessions, and caching.

Laravel aims to make the development process a pleasing one for the developer without sacrificing application functionality. Happy developers make the best code. To this end, we've attempted to combine the very best of what we have seen in other web frameworks.

Laravel is accessible, yet powerful, providing powerful tools needed for large, robust applications.

A superb inversion of control container, expressive migration system, and tightly integrated unit testing support give you the tools you need to build any application with which you are tasked[21].

1. **Why we development laravel in our project?**

    Laravel is a modern, robust, feature-rich and open source PHP framework for rapid web development and is used largely to provide structure and business logic for web applications. Here are a few benefits of developing web apps with its help:

    - Faster, more parallel development
    - Build the API once, use for multiple frontends
    - Faster, more parallel development
    - Easier to add functionality later on
    - Cleaner and more robust code

2. **laravel uses in the project**

    - code for edit user

```php
protected function edit_user($id){
    $user = DB::table('users')->where('id','=',$id)->get();
    $user_count = DB::table('users')->where('id','=',$id)->count();
     if($user_count != 1){

        dd( ...args: 'not found');
    }


    if($user[0]->active  == '0' ){
        dd( ...args: 'this user has been deleted');
        }
```

Figure 42: Show Example For Laravel Code

4.3.2 JSON

JSON.(JavaScript Object Notation) is a lightweight data-interchange format, It is easy for humans to read and write, It is easy for machines to parse and generate, It is based on a subset of the, JavaScript Programming Language[19].

1. **JSON is built on two structures**

    - A collection of name/value pairs. In various languages, this is realized as an.object, record, struct, dictionary, hash table, keyed list, or associative array.
    - An ordered list of values. In most languages, this is realized as an.array, vector, list, or sequence.

2. **We used JSON in our project**

    - code to read, and retrieve data as JSON array from the web server.

4.3.3 W3.CSs

W3.CSS is a Cascading Style Sheet (CSS) developed by.w3schools.com. It helps in creating faster, beautiful, and responsive websites. It is inspired from Google Material Design. We used w3.css in our project to to manage all properties like add coin , box , magtic , baffle , and manage user details and control all about project[25].

```
←  →  C    ⓘ 35.196.249.249/api_mobile/get_object

▼ [
  ▼ {
        "ID": 1270,
        "Count": null,
        "Latitude": 31.507461111658266,
        "Longitude": 35.09132341521649,
        "Type": "2",
        "Timer": 10,
        "Height": 12,
        "Width": 16,
        "Number": 12,
        "CoinsCounter": 10,
        "active": 0
    },
  ▼ {
        "ID": 1271,
        "Count": null,
        "Latitude": 31.507895851205507,
        "Longitude": 35.090897610677985,
        "Type": "3",
```

Figure 43: Show Example For JSON Code
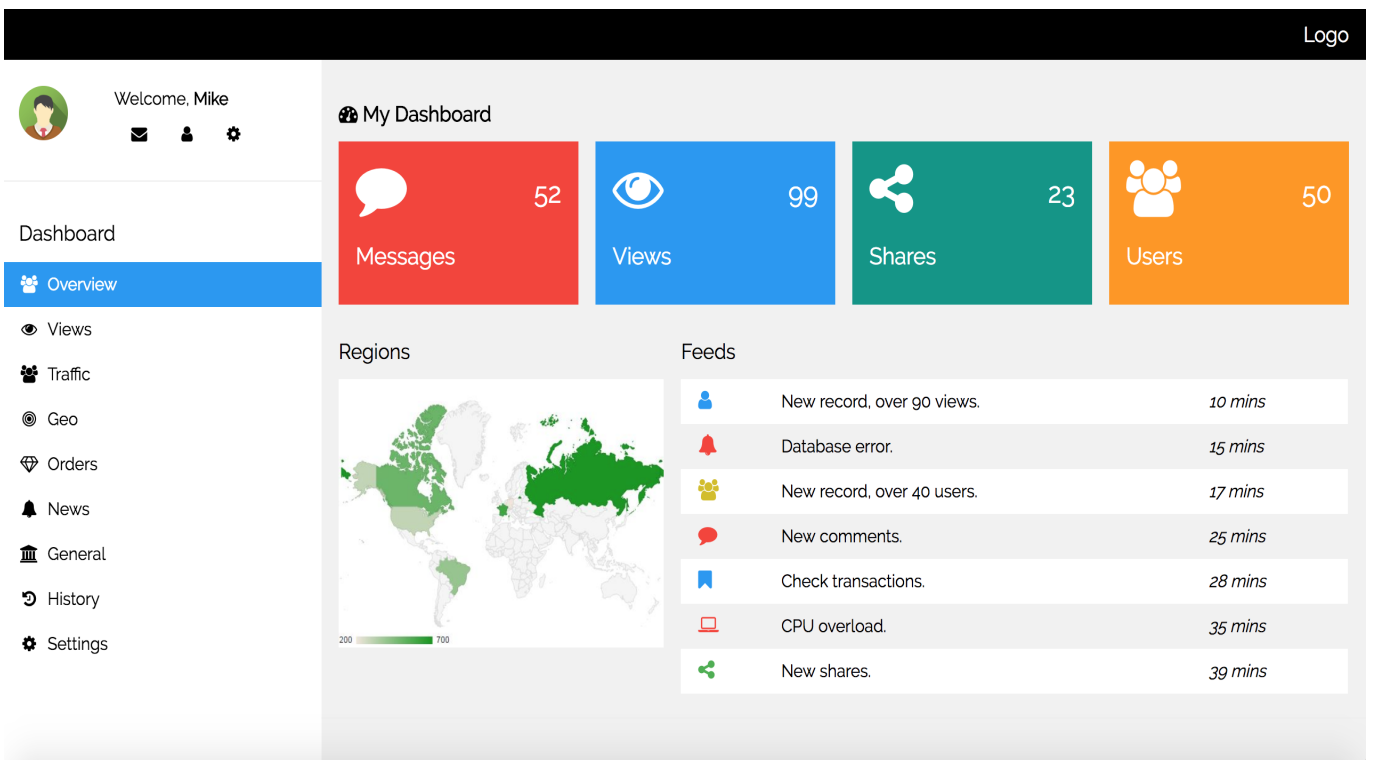
Figure 44: Templeate that we use it to specify our Dashboard[28]

4.3.4 MySQL

MySQL.is a freely available open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL). MySQL provides cross-platform support, wide range of interfaces for application programming and has many stored procedures like triggers and cursors that helps in managing the database. SQL is the most popular language for adding, accessing and managing content in a database. It is most noted for its quick processing, proven reliability, ease and flexibility of use[22].

1. Uses

   MySQL can be used for a variety of applications, but is most commonly found on Web servers. A website that uses MySQL may include Web pages that access information from a database. These pages are often referred to as "dynamic," meaning the content of each page is generated from a database as the page loads. Websites that use dynamic Web pages are often referred to as database-driven websites.

2. **Why we used it in the project?**

   MySQL is a fast, reliable and stable open source database management system (RDMS – Relational Database Management System). There are several reasons why MySQL is popular for web application use, Web 2.0, Saas, ISV and open source projects such as LAMP. It helps users save time and money[17].

   - MySQL allows multiple users to access to a variety of databases.
   - Its SQL interpreter, Management components, GUI database viewers, stored procedures, cross-platform support, multiple CPU usage, client server system.
   - MySQL can also be easily managed using visual web tools such as phpMyAdmin.
   - Supports large number of embedded applications which makes MySql very flexi-ble.
   - Allows transactions to be rolled back, commit and crash recovery.

3. **Code to Update Object**


```php
public function update_object(Request $request){
    // box
    if($request->type=='1'){

        $data = DB::table('gameobjects')
            ->where('ID','=',$request->id)
            ->where('Type','=',$request->type)
            ->update([
                'Number'=>$request->data,
            ]);
    }
}
```

Figure 45: Code to Update Object

4.3.5 Javascript

JavaScript.(JS) is a lightweight, interpreted compiled programming language and cross-platform. Most well-known as the scripting language for Web pages, It can be used to control web pages on the client side of the browser, server-side programs, and even mobile applications.

JavaScript contains a standard library of objects, such as Array, Date, and Math, and a core set of language elements such as operators, control structures, and statements.

JavaScript is very popular and adopted universally by every web browser for its support which allows dynamic content to get execute in a webpage[16].

1. **Uses of JavaScript** An HTML page is a static one and without JavaScript it would be static still. JavaScript can make the website more interactive and user- friendliness of JavaScript helps easy navigation of the website and helps designers to guide the visitors with additional information or guide them through walkthroughs. Visual effects can also be achieved with JavaScript. JavaScript can be used effectively to create special effects like rollover for images.

- The purpose of JavaScript language in RunAway application, is to manipulate the web page elements and to make it dynamic.
- Extract latitude and longitude from Google map and place it in input field; in order to send it to the database.

2. **Code for Use JS**

```
<script type="text/javascript">
    var map;
    var marker;
    var markers = [];
    var box = [
        @foreach($objects as $object)
            @if($object->Type=="1")
        ['{{$object->ID}}', {{$object->Latitude}}, {{$object->Longitude}}, {{$object->Type}}],
            @endif
            @endforeach
    ]
```

Figure 46: Code for Use JS

4.3.6 jQuery

jQuery is a concise and fast JavaScript library that can be used to simplify event handling, HTML document traversing, Ajax interactions and animation for speedy website development. jQuery simplifies the HTML's client-side scripting, thus simplifying Web 2.0 applications development.

jQuery is a free, open-source and dual-licensed library under the GNU General Public License. It is considered one of the favorite JavaScript (JS) libraries available today. As of 2012, it is used by more than half of the Web's top sites[24].

1. **Uses of jQuery** jQuery is very compact and well written JavaScript code that increases the productivity of the developer by enabling them to achieve critical UI functionality by writing very small amount of code.

   - It helps to improve the performance of the application
   - It helps to develop most browser compatible web page
   - It helps to implement UI related critical functionality without writing hundreds of lines of codes
   - It is extensible – jQuery can be extended to implement customized behavior
   - It is fast

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2. **code for Get object**

```
$.ajax({
    url: 'get_object/box',
    type: 'post',
    data: {id: box[i][0]},
    dataType: 'JSON',
    success: function (data) {

        console.log(data);
    }
});
```

Figure 47: code to use jq

4.3.7 Google Maps APIs

Google APIs is a set of application programming interfaces (APIs) developed by.Google.which allow communication with.Google Services.and their integration to other services.

The Google Maps APIs give developers several ways of embedding Google Maps into web pages or retrieving data from Google Maps, and allow for either simple use or extensive customization.

1. **The purpose of using google map in RunAway application ?**

   - To add object we need to show application
   - To show all object we already add it and manage ,update and delete it

2. **Use google map**

```
function initialize() {
    var mapOptions = {
        center: {lat: 31.506656, lng: 35.090349},
        zoom: 17,
        mapTypeId: google.maps.MapTypeId.HYBRID

    };
    var map = new google.maps.Map(document.getElementById("googleMap"),
        mapOptions);
```

Figure 48: use of google map code

4.3.8 Google Cloud Platform

Google Cloud Platform is one of the most important Cloud Computing services currently available. Started in April 2008 with the release of the PaaS platform Google App Engine, it has quickly grown, adding the critical IaaS (Infrastructure as a Service) Google Compute Engine[20].

1. **Google Cloud Hosting provide**

   - Better Pricing Than Competitors
   - Private Global Fiber Network
   - Live Migration of Virtual Machines
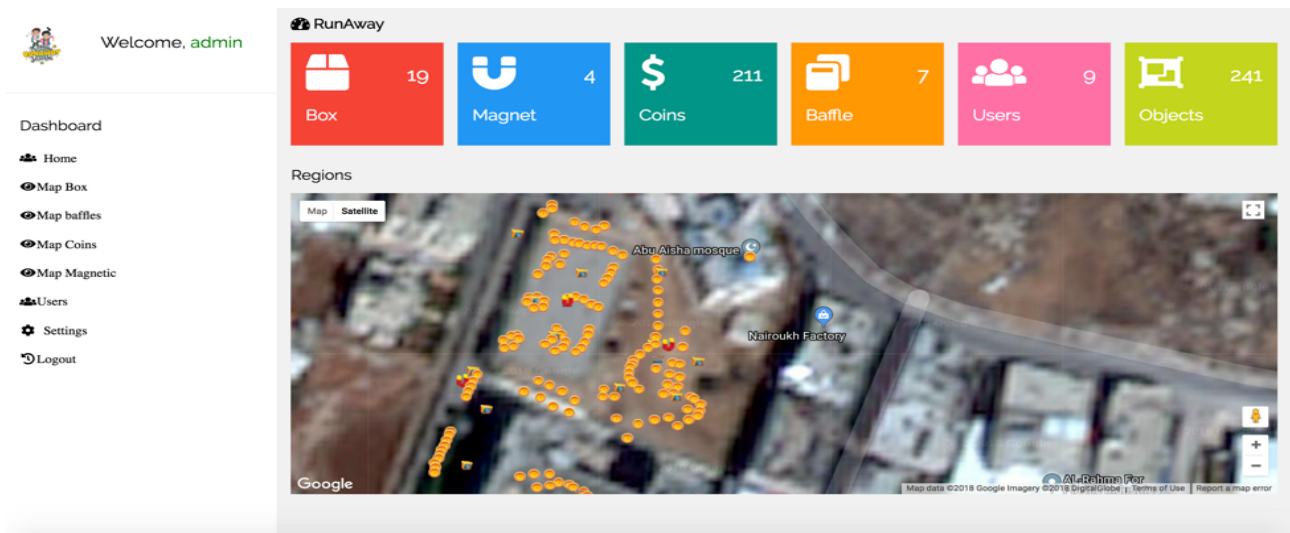
Figure 49: use of google map

- Improved Performance
- Flexibility
- Powerful tools
- State of the Art Security
- Dedication to Continued Expansion
- Redundant Backups

2. **The purpose of using google platform in runaway application**

   - Web hosting will always be secure.
   - Own our server
   - Own all servers and locate them in the highest quality data centers, so no one without our knowledge can shut down or reload any server with your data.
   - Utilize dedicated connections to ensure we can provide enough bandwidth for all users.

3. **Server details**

   - Os : Ubuntu
   - Server mode : apache
   - Cpu : 1shared vCPU
   - Ram : 1.7GB
   - Hard Disk : 20 GB
   - Bandwidth : unlimited
   - Traffic Allow : HTTP,HTTPS
   - SSH ACCESS

5 Testing

5.1 Over view of the chapter

This chapter shows the actions and steps to get start with RunAway application and get into each activity. Also, explains the results that appears to the user. In this testing we ensured that a perfectly working system with fewer errors is delivered to the customer. We indicated that the system is easy to handle and work with, user friendly with pleasant working environment. In addition, it could be used to perform transactions in an ecient way. We also came across some bugs which were xed right away. We interacted with some feedback and suggestions to give better performance and acceptance. Finally, the overall achievement of this project was satisfying and considered that all the objectives of the project have been met.

5.2 Web testing

5.2.1 Postman

1. **What is Postman?**

   Postman is a powerful HTTP client for testing web services. Created by Abhinav Asthana, a programmer and designer based in Bangalore, India, Postman makes it easy to test, develop and document APIs by allowing users to quickly put together both simple and complex HTTP requests[26].

2. **Why We Use Postman in Our Project?**

   - Easy-to-use Interface
   - History / Auto complete
   - Easy organization
   - Response Viewer
   - Test editor and runner

3. **We used Postman for?**

   We used Postman for testing web services and all APIs For example :

   - for testing login
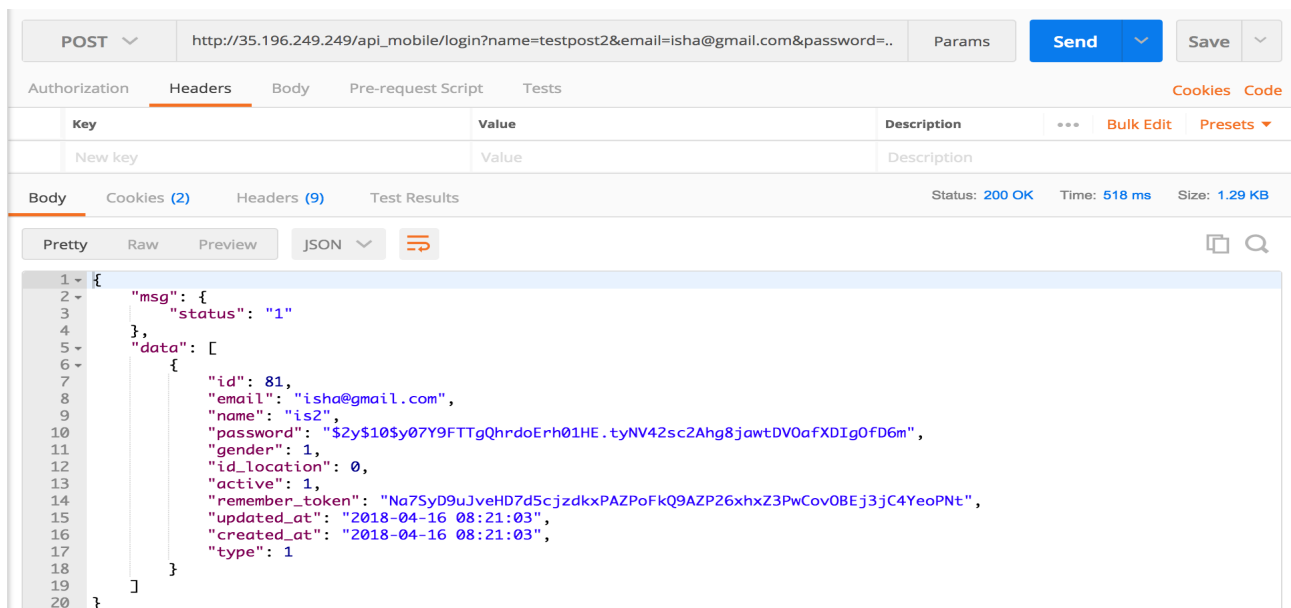
Figure 50: We Test This api for login with correct information "http://35.196.249.249/api$_m obile/login?name = testpost2email = isha@gmail.compassword = 123123$"
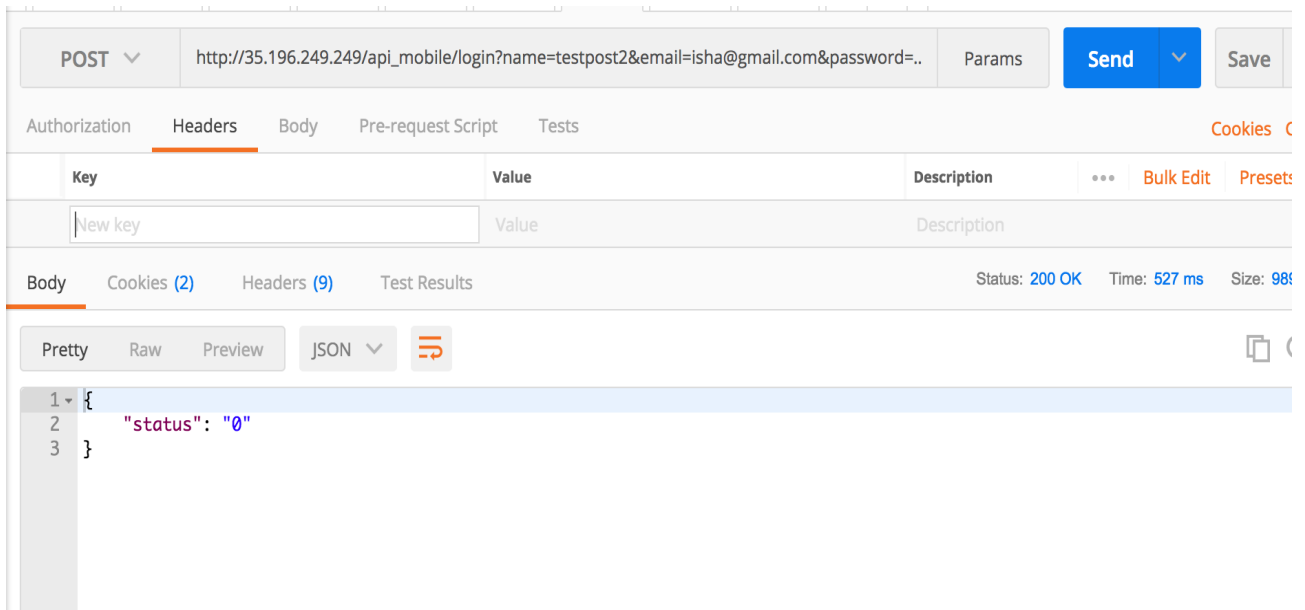
Figure 51: We Test This api for login with correct information "http://35.196.249.249/api$_m$obile/login?name = testpost2email = isha@gmail.compassword = 1231234"
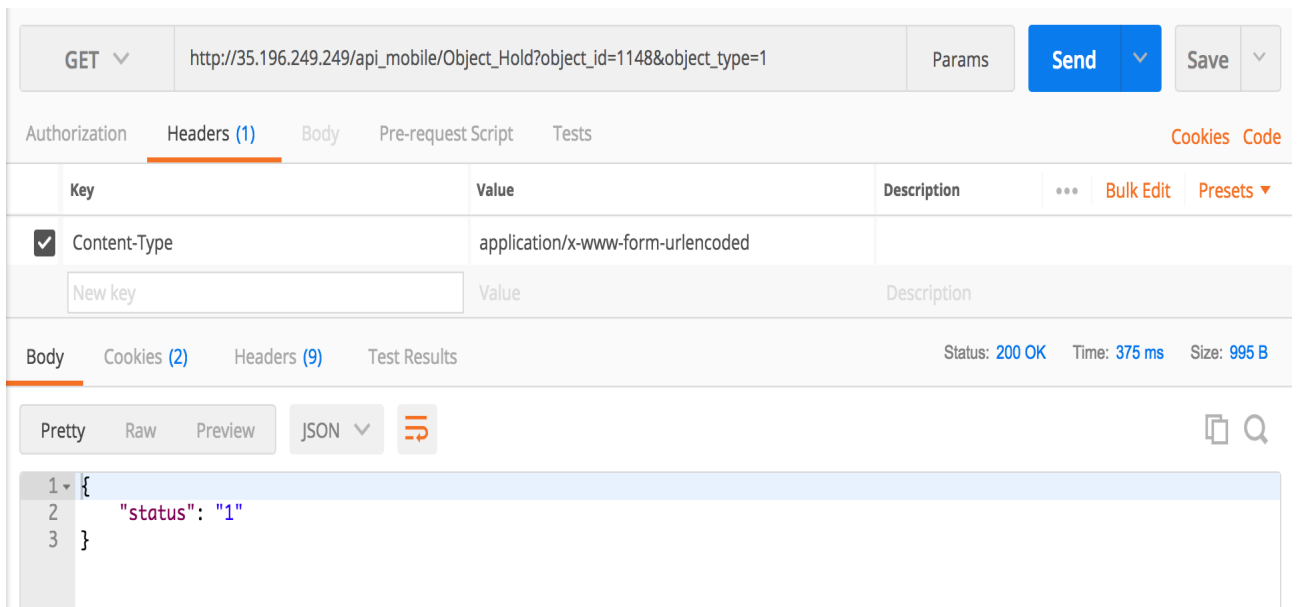
Figure 52: We Test This api when user hold any object the active state change to 1 "http://35.196.249.249/api$_m$obile/Object$_H$old?object$_i$d = 1148object$_t$ype = 1"

- for testing hold object

Login

E-Mail Address   Renad@gmail.com

Password   ••••••

☐ Remember Me

Login   Forgot Your Password?

Accesses Denied

Login

E-Mail Address   admin@runaway.com

These credentials do not match our records.

Password

☐ Remember Me

Login   Forgot Your Password?
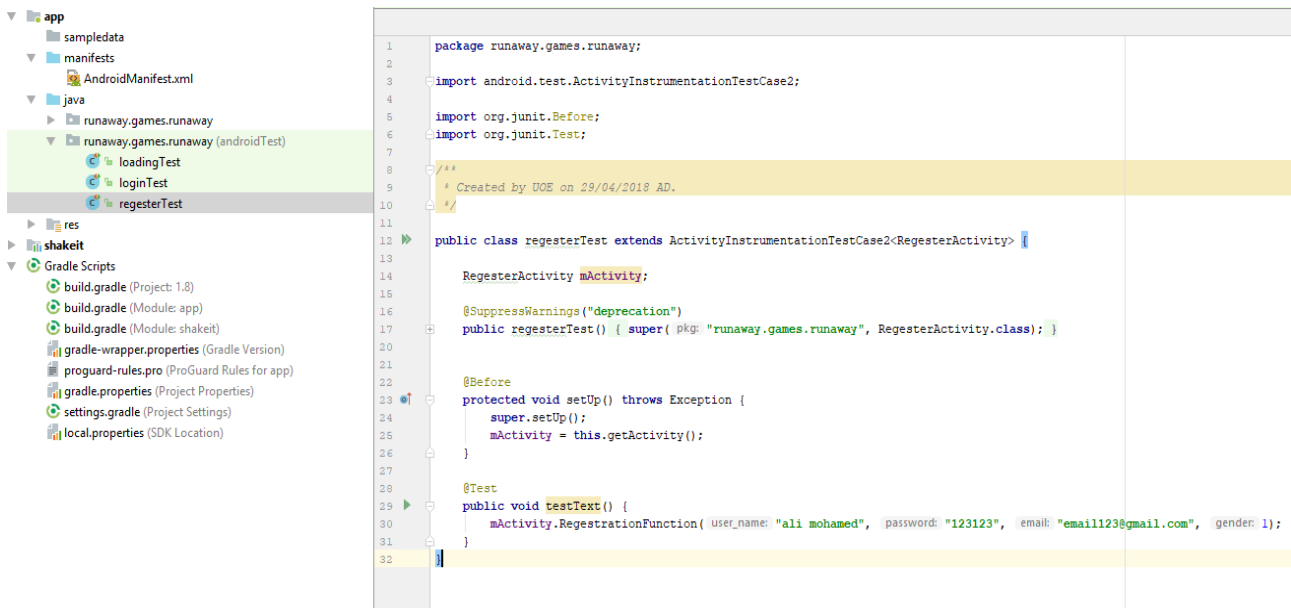
The first screenshot shows if someone try to access the web application from his account, the login is fail because, only admin can login to the website. The second screenshot appear when anyone can try to login except the admin. On the other hand, the third screenshot appear when the admin change his account password as we explained in chapter 3.

5.3   Android testing

" Unit testing: is a level of software testing where individual units/ components of a software are tested. The purpose is to validate that each unit of the software performs as designed. A unit is the smallest testable part of any software. It usually has one or a few inputs and usually a single output. In procedural programming, a unit may be an individual program, function, procedure, etc. In object-oriented programming, the smallest unit is a method, which may belong to a base/ super class, abstract class or derived/ child class[**26**].

We makes on RunAway project a unit testing by code for two activities: registration activity and login activity.

5.3.1   Registration test

5.3.2   Login test

To have the ability to use RunAway Application you have to download it from Play Store for free. After accepting the permissions that shows places and actions that the application will access, then the application will be downloaded successfully. The application needs to be connected to Wi-Fi, GPS, and camera in order to see the desired result and work well. Also, you have to be certain that your device supports GPS and Orientation sensors. Except for that you won't be able to use the application well and see the features that it supports.
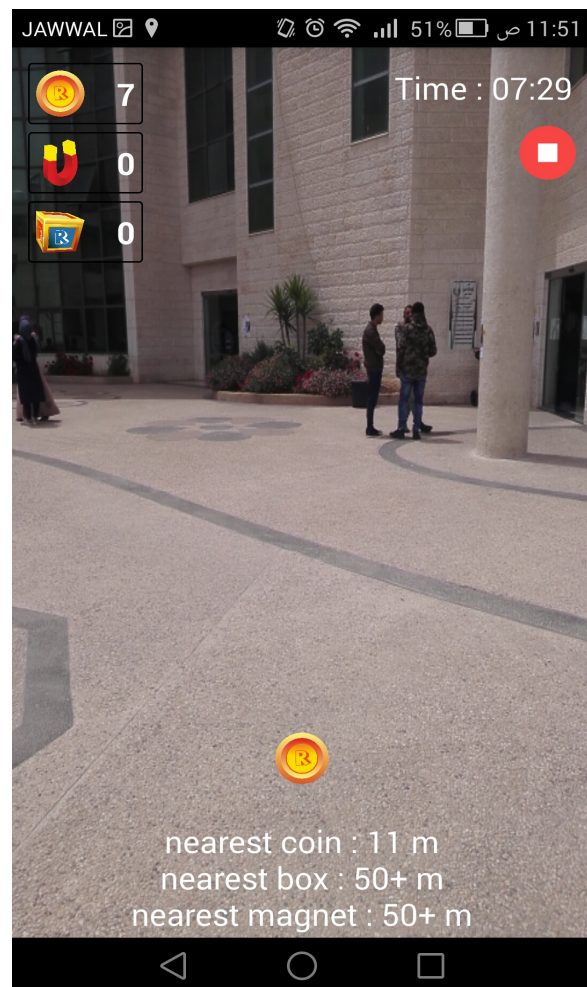
We makes on RunAway project a unit testing for every level and tasks. We testing the project tasks on Palestine Polytechnic University.

First activity testing enable the GPS and we show a short toast message that print the longitude and latitude from the GPS sensor.

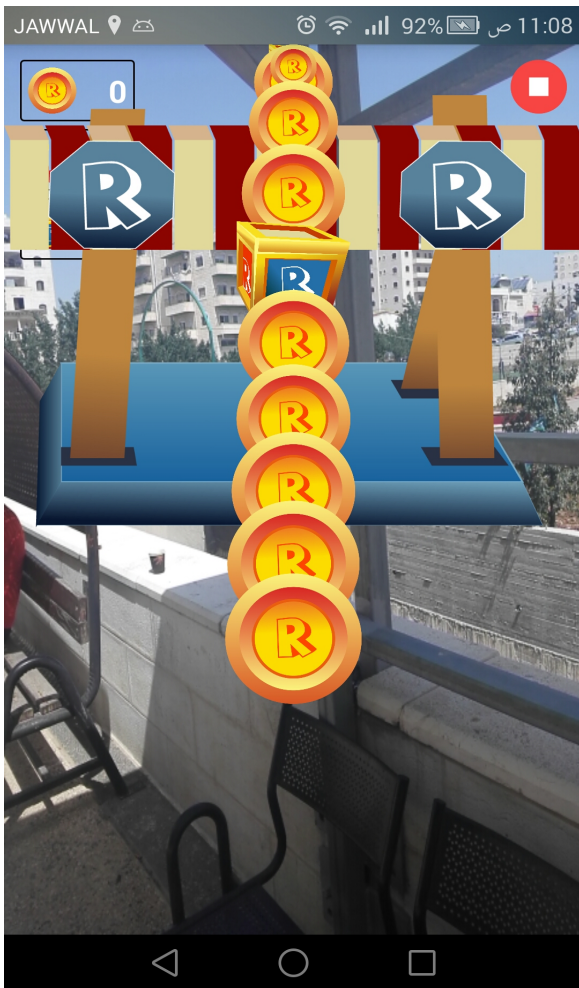Second activity testing enable open the camera layout.
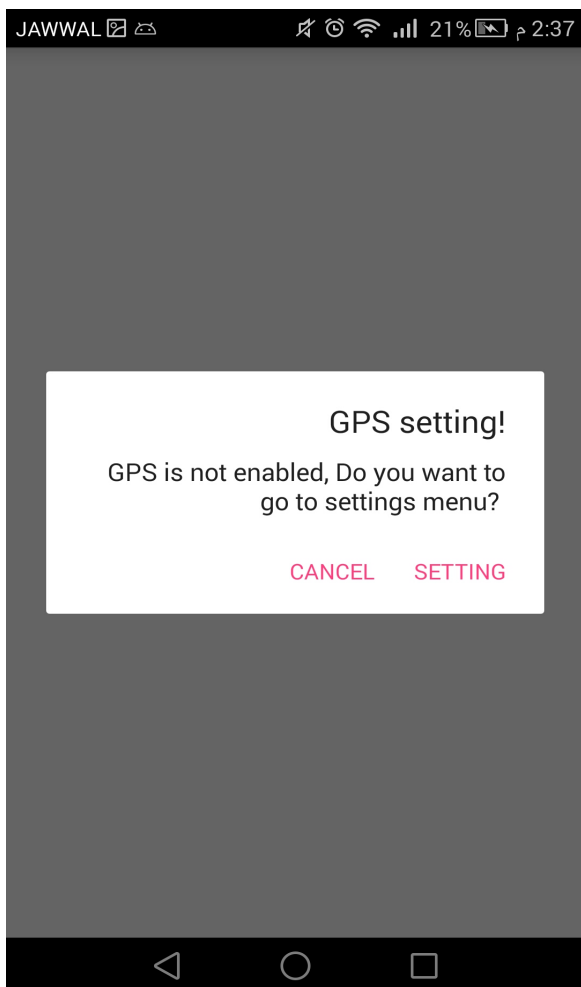
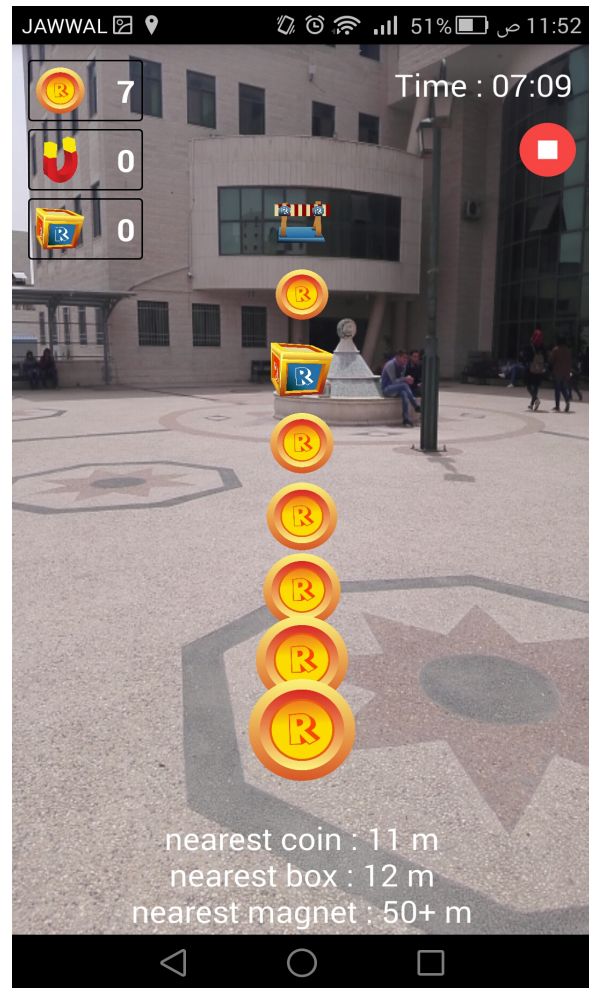

(a) Camera test layout (b) Start activity

The big challenges in our project that enable to control the dimensions of the game objects to show the nearest larger than the distant object. We solve this problem by some of calculations on android studio.

(a) Game object size test

(b) Solve the size problem

Testing the registration and login without fill the information.

(a)

(b)

6 Conclusion and Future work

6.1 Conclusion

In conclusion RunAway application was developed to help and benet large number of users who spend a lot of time using mobile without moving to interact with the surrounding area by using their own smartphones and playing a fun game that encourage movement. RunAway enable you to collect many types of game object that around you like: coins, boxes, magnets, and baffle to skip it. On the other hand, this application has interfaces which are simple, easy to use and has quick response time. Moreover, it oers accurate information in detecting the location of the user and reliability in displaying the correct game objects around and nearest of the player.

" Augmented Reality is a technology that has changed the face of smartphone apps and gaming. AR adds digital images and data to amplify views of the real world, giving users more information about their environments. This step is beyond virtual reality, which attempts to simulate reality. AR apps are growing at a tremendous speed as they give businesses a different edge which attracts the customers[6]."

6.2 Challenges

- Lack of prior knowledge of programming AR games. The learning taken a lot of time and effort.
- Control the dimensions of the game objects to show the nearest larger than the distant object.
- The data is got from the GPS is not accurately 100% have a +- 5 meters.
- The absence of a gyroscope sensor in Samsung devices J.
- The bad quality of the internet.

6.3 Recommendations

- Not spending too much time playing because the use of mobile phones in general for a long time hurts the eyes and health especially for young children.
- Pay attention while walking and running while you playing the game.

6.4 Marketing plan

- RunAway is free to play in Google play store to create a large audience base.
- The player can buy a player character and game object RunAway store in future.
- Include banner for ads.
- The RunAway application owner can sell the application to a specific company like: park, school, exc..

6.5 Future work

Our plan for the future is to improve the system:

- Enable a group of players to make group on the game application and playing together.
- Create RunAway game store. That will enable the players to buy a player character and game objects.
- Improve the system to add more game objects and make it more fun and interaction with players.

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