SE303.3 Mobile Application Development

Tutorial No. 1

Answer the following questions

1) What are the main components of Mobile Computing Systems?

Mobile networking/communication

- Ad hoc networks, infrastructure networks
- Communication properties, protocols and data formats
- Technologies

Mobile hardware

- Mobile devices
- Device components

Mobile software

- Operating systems
- Mobile applications

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2) Explain the following terms in relation to Mobile Computing

a. Smart homes

- Cellular communication capabilities
- Combination of internet and Wi-Fi access
- Various Applications (Utility, Games, Business, Service etc.)
- Different sizes and different hardware resources

b. IOT

point-to-point wireless bridges

wireless local area networks

multidirectional wireless cellular systems

satellite communication systems

c. Wearable

- Enabled computing for wearable devices
- Small processing and specific applications
- Health monitoring, Location finding, Alarms & Notifications
- Smart watches, Health measurement devices

d. Cloud based mobile apps

- **Cloud mobile apps** are multiple-platform compatible. ...
- Database integration is seamless.
- Lesser **app** development time.
- Installation is not required.
- Better scalability and reliability.
- Data recovery is easy.
- Costs are low.
- Data storage is secure.

e. Tablets

- Different screen sizes (ex: 7 inch to 13 inch) and hardware
- More portability than laptops or netbooks
- No touch pad or keyboard instead touch screen and virtual keyboard
- Running Mobile OS
- Solid-Sate-Drives, WIFI

f. Ubiquities Computing

Consideration of the human factor and placing of the paradigm in a human, rather than computing, environment

Use of inexpensive processors, thereby reducing memory and storage requirements

Capturing of real-time attributes

Totally connected and constantly available computing devices

Focus on many-to-many relationships, instead of one-to-one, many-to-one or one-to-many in the environment, along with the idea of technology, which is constantly present

Includes local/global, social/personal, public/private and invisible/visible features and considers knowledge creation, as well as information dissemination

Relies on converging Internet, wireless technology and advanced electronics

Increased surveillance and possible restriction and interference in user privacies, as the digital devices are wearable and constantly connected

As technology progresses, the reliability factor of the different equipment used may be impacted

g. E-Readers

- Designed for reading digital and downloadable documents
- Two types of displays LCD or E-Ink

2) What are mobile-web applications

- Web apps load in browsers

Chrome, Safari, or Firefox

- Do not need to be downloaded from app stores like mobile apps
- Doesn't take up storage on the user's device
- Responsive design
- Can run on a webview just setting the URL to web app
- Using HTML, CSS and Java Scripts
- Server side implementation (ASP, JSP)
- A lot of development frameworks

Angular

React

jQuery mobile

.NET MVC

Java JSP

- Advantages

Easy to build

Easy to maintains

Inexpensive option

Consistency among different platforms

Save client device processing power

Application updates are easy and seamless

- Disadvantages

Needs a browser to run

Poor user experience

Much slower than native apps

Web apps are less interactive and intuitive than native apps

Cannot control device utilities

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3) What are native applications

- Most common type of mobile apps
- Built for specific platforms
- Written in languages that the platform accepts

Swift and Objective-C for iOS

Java for native Android

C# and Visual Basic for Windows Phone

- Specific Integrated Development Environment (IDE) for the given operating systems

Android Studio for Android

Eclipse, IntelliJ Idea

Xcode for iOS

AppCode, Atom, Sublime Text, Code Runner

Visual Studio for Windows Phone

- Advantages

Fast and responsive

Distributed in app stores

More interactive, intuitive and run much smoother in terms of user input and output

Flow is more natural as they have specific UI standards for each platform

Inbuilt security implementation support

More stable application

Exact measure of hardware usage

- Disadvantages

Experience in multiple development language is required

More expensive

Application updates requires for fixes

Consistency issue can be occurred for multiple OS apps

4) What is vehicular networks

Vehicular networks have emerged as a result of advancements in wireless technologies, ad-hoc networking, and the automobile industry. These networks are formed among moving vehicles, roadside units (RSUs), and pedestrians that carry communication devices. Vehicular networks can be deployed in rural, urban, and highway environments. There are three main scenarios for vehicular communication: vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and vehicle-to-pedestrian (V2P) .

With the advancements in communication technologies, several promising applications are emerging for vehicular networks. These are mainly related to infotainment, active road safety, and traffic management. These applications impose different service requirements in terms of latency, throughput, and reliability on the network.

6) Discuss the main components of a cellular networks

Any phone connects to the network via an RBS (Radio Base Station) at a corner of the corresponding cell which in turn connects to the Mobile switching center (MSC). The MSC provides a connection to the public switched telephone network (PSTN). The link from a phone to the RBS is called an uplink while the other way is termed downlink.

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7) List down and explain the features of mobile operating systems

- Network scanning
- Interface selection
- Interface control
- Energy monitoring
- Power saving control
- Low-level memory management
- Persistent storage
- Context sensing/ location sensing

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8) Compare and contrast Android and IOS

Similarities Between iOS and Android

Some of the similarities between iOS and Android are as follows:

- The basic functions in iOS and Android are alike. Both the iOS and Android phones have calling, messaging, web browsing, video chat, maps, voice commands etc.
- The user interfaces of iOS and Android have a lot of similarities. Both of these support swiping, tapping, pinch and zoom etc on their phone screens.
- There is a status bar on both the iOS and Android devices and it offers similar information such as battery life, time, app notifications, wifi etc.
- 4G cellular network can be enjoyed on both the iOS and Android devices. This is very important as cellular network is crucial for internet surfing.
- Privacy settings are paramount in both iOS and Android. Users are presented with app permissions as this lessens the risk of data leakage.

Differences Between iOS and Android

Some of the differences between iOS and Android are as follows:

- iOS is a closed system whereas Android is more open. Users have barely any system permissions in iOS but in Android, users can customize their phones easily.
- Android software is available for many manufacturers such as Samsung, LG etc. and this may lead to some quality problems in the cheaper phones. However, iOS is strictly controlled by Apple and there is no quality problem as there are few models.
- The Android applications are obtained from Google Play while iOS applications are available in the Apple app store.
- Integration with other devices is better in Apple iOS as compared to Google Android.
- There are different voice assistants for iOS and Android namely Siri and Google Assistant. Google assistant is much more powerful than Siri.
- The running speed of iOS devices remains consistent with time. In contrast to this, the performance of Android devices may decline over time.

9) What is the local storage

Write in mobile internal memory,[Mobile memory divide into four main aspects-> Cloud Memory, Internal Local storage basically SQLite ,preferred memory , RAM and file storage].So local storage is last forever until clear the cache in mobile.

10) What is meant by session storage

It is short term storage, it stored in the RAM, usually we use it wisely in android, in array list we never load hole array to the mobile UI application , we usually using a ArrayAdapter class for load array which matching with the screen size and render/load array details.

If we close the app all the stored item in the application will gone, so we normally load from session storage and store it on internal database that specified to each application by developer.

11) What is meant by sensor networks

Mobile wireless sensor networks (MWSNs) play a vital role in today's real-world applications in which the sensor nodes are mobile. MWSNs are much more versatile than static WSNs as the sensor nodes can be deployed in any scenario and cope with rapid topology changes. Mobile sensor nodes consist of a microcontroller, various sensors (i.e., light, temperature, humidity, pressure, mobility, etc.), a radio transceiver, and that is powered by a battery.

Use for different purposes but in basically in mobile sensor network, it's got data from inbuilt hardware sensors to the application. Sensors in modern mobile examples are like Fingerprint (Fingerprint struct, ultrasonic), accelerometer, gyro, proximity, compass, barometer

12) What are the challenges of mobile application development

- System condition and environment changes rapidly
- Unreliable network

Bandwidth and latency vary rapidly

- Unreliable devices

Devices may join and leave the network frequently

- Resource limitation

Processing power, Memory

- Power limitation

Battery power

- Heterogeneous Nature of Network
- Security
- Usability

Recovering from Errors

13) Discuss the advantages of using mobile applications for small and medium enterprises

Improve Customer Engagement
Taking your Brand to a New Level
Value Creation for Customers
Create a Direct Marketing Channel
Stay Ahead with Mobile Apps

14) What is meant by network bandwidth

- Data transfer within a unit time
- Depends on networking types
- Depends on technologies

GSM, 3G and 4G

- Upload bandwidth and download bandwidth

network bandwidth is defined as the maximum transfer **throughput** capacity of a **network**. It's a measure of how much data can be sent and received at a time.

15) Discuss the web-native continuum in relation to mobile application development approaches

- Mobile application development platform

A toolkit for development of applications for mobile devices

May or may not be platform dependent

- Cordova
- Ionic
- React Native
- Xamarin
- Framework7
- Mobile Angular UI
- Kendo UI

- Advantages

Easy to build

Easy to maintains

Cheaper than native

Consistency among different platforms

No browser requirements

Device hardware API access like storage, camera, etc.

- Disadvantages

Slower than native apps

Poor user experience

Less interactive than native apps

Tutorial No. 2

1) What are the specific Integrated Development Environment (IDE) for the given operating systems.

- Android

Android SDK, Android Studio

- Windows Phone

Visual studio, Expression blend for Windows Phone

- iOS

iOS SDK, iOS Dev Program

- BlackBerry OS

Eclipse, BB java-plugin

- Symbian OS

Qt SDK, Java, Web runtime, flash lite

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2) Discuss android hardware relevant features

Android devices can include still/video cameras, touchscreens, GPS, accelerometers, gyroscopes, barometers, magnetometers, dedicated gaming controls, proximity and pressure sensors, thermometers, accelerated 2D bit blits (with hardware orientation, scaling, pixel format conversion) and accelerated 3D graphics.

3) Compare and contrast the web mobile application development and native mobile application development

Technical Aspects	Web App	Hybrid App	Native App
Programming Language(s)	Web technologies- JavaScript HTML, CSS	Web technologies- JavaScript, HTML, CSS	Native only: Java or Kotlin - Android, Swift or Objective C- iOS
Frameworks & Tools	MeteorJS, React, AngularJS	PhoneGap & Apache Cordova, React Native, Xamarin, Ionic, Native JS, TypeScript. Uses 3rd party APIs and plugins, libraries (may be unreliable)	OS provides APIs. Access to native tools supported by the system
User Interface (UX/UI Design)	Common for all platforms. Limited customization	Follows guidelines from Apple and Google. Uses highly similar design interface to a native app. Cross-platform app design. Limited customization possibilities	Follows guidelines from Apple and Google. Completely platform-specific UI. Native app design - rich, customizable, great visual effects and animation possible
Platforms	Multiple	Multiple	Native Android, iOS platforms are covered separately *(also in case of Win Phone and Blackberry)*
App Stores Distribution	No stores	Google Play Store, Apple's App Store, Windows store *(if guidelines met)*	Google Play Store, Apple's App Store, Windows store
Updates & Support	Support for 1 platform	Support for 1 platform. Constant updates from the app store. Can be updated without a market.	Requires support for several platforms simultaneously. Need to update the whole app for changes. Code is updated via the app market.
Performance	Slower	Moderate response	Faster based on embedded connection with OS and the device
App Ecosystem	Limited	Limited to the framework and to available 3rd party services	SDKs and other tools for any technical implementation
Feature Set	Limited. Some of the device APIs can be used (e.g. geolocation)	Moderate access. Some APIs are closed for hybrid mobile apps (e.g. gyroscope or accelerometer)	Wide access. Any device APIs used. Offers solutions for unique and specific features (VR, AR, IoT, etc.)
Navigation	WebView connects the web content with native app functioning	WebView connects the web content with native app functioning	App has embedded and intuitive navigation
Hardware Capabilities	Minimum access to device hardware	Less access to the device	Uses the capabilities of the mobile device 100%
Internet Access	Necessary to reload the web part	Necessary for a web part renewal	Depends on the app. Can offer offline functionality.

4) What is hybrid application development?

Hybrid means made of mixed characters or elements. Thus, a hybrid app is one of the categories within cross-platform app development. Its main advantage is a quicker app launch with minimum expenses. Other variants of such types of apps include mobile web apps, PWAs (progressive web apps), and responsive mobile websites.

Hybrid applications work across different platforms. Hybrid mobile apps which are created for an Apple iPhone will also operate on an Android smartphone. Therefore, a hybrid app is a combination of a native and a web app. It is characterized as a website at its center and a native app as its external sheath.

The distinct difference between a native vs hybrid app is that the latter is developed with the help of HTML, CSS, and JavaScript. Then it is given a thin native shell with WebView to access the native app system functionality.

5) What are the development frameworks for hybrid mobile application development?

- Cordova
- Ionic
- React Native
- Xamarin
- Framework7
- Mobile Angular UI
- Kendo UI

6) What are the factors to be considered in selecting a mobile application development approach

Development Costs, Cash Allocation, Expertise of Resources (Developers), Development Timeline, Launch Time to the Market, App Monetization, Market Trends

Non-technical aspects	Web App	Hybrid App	Native App
Development Costs	Minimum due to single code base	Moderate	Higher than development for multiple platforms
Cash Allocation	In one flow	In one flow	Separately for each platform.
Expertise of Resources (Developers)	Moderate expertise	Moderate expertise	High expertise as necessary to learn different languages per platform
Development Timeline	Short	Moderate	Longer timeline (from 3-6 months for MVP)
Launch Time to the Market	The fastest to launch on the market due to the single code base and minimum customization	Depends on the hybrid app frameworks (e.g. Xamarin iOS and Android need more time for launch due to the increase in custom code)	Usually requires prolonged time before launch based on the number of platforms, or addition of more developers to the project
App Monetization	Mostly via advertisement and/or subscription	Multiple app monetization options: -in-app ads -content -freemium model (feature upgrades) -via subscription -partnership -from downloads	Multiple app monetization options: -in-app ads -content -freemium model (feature upgrades) -via subscription -partnership -from downloads More here: How Do Free Apps Make Money in 2018
Market Trends	Around 15% of time is spent on websites or mobile websites	Users spend more than 80% of their time on their mobile devices	Users spend more than 80% of their time on their mobile devices

7) Discuss the main phases in mobile application development life cycle

The Discovery Phase
The Design Phase
The Development and Testing Phase
The Deployment Phase
Maintenance and Updates Phase

8) Discuss the advantages of following the major design guidelines in mobile application development

Upgrade the User Experience

Upgrade the app performance

It is better to security related scenarios.

9) What is meant by localization? Why it is important

An android application can run on many devices in many different regions. In order to make your application more interactive, your application should handle text, numbers, files e. t .c in ways appropriate to the locales where your application will be used.

The main advantage is if you want something to change you can do it by going to one certain location

In other hand the changing text/ language also can do it from here

10) Explain the following terms in relation to android development

a. Intent

An Intent provides a facility for performing late runtime binding between the code in different applications. Its most significant use is in the launching of activities, where it can be thought of as the glue between activities. It is basically a passive data structure holding an abstract description of an action to be performed.

b. Activity

An activity is a single, focused thing that the user can do. Almost all activities interact with the user, so the Activity class takes care of creating a window for you in which you can place your UI with setContentView(View).

c. Services

A Service is an application component that can perform long-running operations in the background. It does not provide a user interface. Once started, a service might continue running for some time, even after the user switches to another application. Additionally, a component can bind to a service to interact with it and even perform inter process communication (IPC). For example, a service can handle network transactions, play music, perform file I/O, or interact with a content provider, all from the background.

d. Broadcast receivers

Android apps can send or receive broadcast messages from the Android system and other Android apps, like the publish-subscribe design pattern. These broadcasts are sent when an event of interest occurs. For example, the Android system sends broadcasts when various system events occur, such as when the system boots up or the device starts charging. Apps can also send custom broadcasts, for example, to notify other apps of something that they might be interested in (for example, some new data has been downloaded).

Apps can register to receive specific broadcasts. When a broadcast is sent, the system automatically routes broadcasts to apps that have subscribed to receive that broadcast.

10) What is Android Manifest XML file

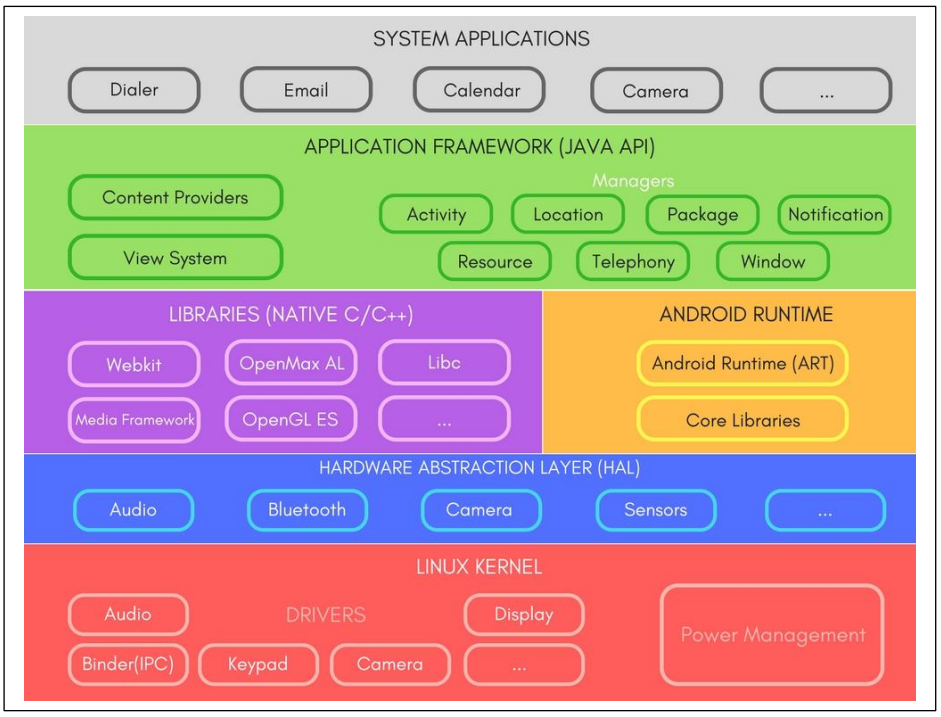
The app's package name declaration

The components of the app, which include all activities, services, broadcast receivers, and content providers. Each component must define basic properties such as the name of its Kotlin or Java class. It can also declare capabilities such as which device configurations it can handle, and intent filters that describe how the component can be started.

The permissions that the app needs in order to access protected parts of the system or other apps. It also declares any permissions that other apps must have if they want to access content from this app.

The hardware and software feature the app requires, which affects which devices can install the app from Google Play.

11) Explain the different layers in android architecture using a proper diagram



- Android Linux Kernel

In 2018 using Linux kernel version 4.4

Contains all low level drivers for various hardware components support

Ashmem

Anonymous **sh**ared **mem**ory

Uses virtual memory

The kernel is allowed to free this shared memory

More viable for low memory devices, because it can discard shared memory units

- Hardware Abstraction Layer (HAL)

Interface to android libraries and core libraries

Abstraction layer to hide hardware implementations

- Android Runtime

Core libraries

Provides most of the functionality available in the core libraries of the Java programming language

Designed to run apps in a constrained environment that has limited muscle power in terms of battery, processing and memory

Since Android 5.0, each app runs in its own process within its own instance of ART virtual machine, which makes process management more crucial

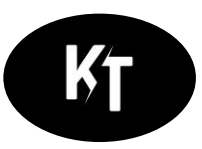
Relies on the Linux kernel for underlying functionality (e.g. Threading, Low-level memory)

ART is capable of both

Ahead-of-time (AOT) and

Just-in-time (JIT) compilation

Efficient garbage collection



- Application Framework

It is a collection of APIs written in Java, which gives developers access to the complete feature set of Androids OS

Developers have full access to the same framework APIs used by the core applications, so that they can enhance more in terms of functionalities of their application

Enables and simplify the reuse of core components

- Android Libraries

Exposed to developers through Android Application Framework

Contains C/C++ libraries used by components of Android Systems

With operating system updates library changes and new libraries will introduce

SQLite Library used for data storage and light in terms of mobile memory footprints and task execution.

WebKit Library mainly provides Web Browsing engine and a lot of more related features.

The surface manager library is responsible for rendering windows and drawing surfaces of various apps on the screen

The media framework library provides media codecs for audio and video

- The Free Type Library is used for rendering fonts

13) What is meant

a. Emulator

An **Android emulator** is an **Android** Virtual Device (AVD) that represents a specific **Android** device. You can use an **Android emulator** as a target platform to run and test your **Android** applications on your PC.

b. USB Debugging

USB Debugging allows an Android device to communicate with a computer running the Android SDK to use advanced operations.

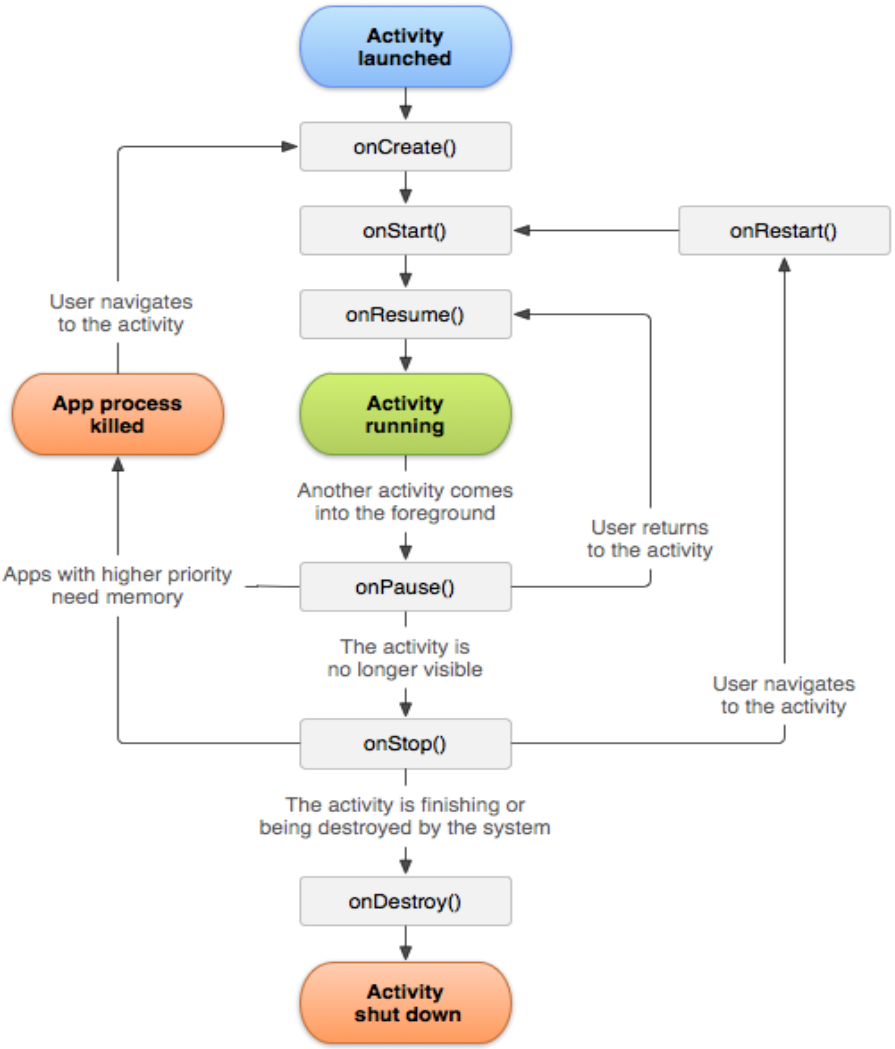
When you develop Android apps, you have to install the Android Software Developer Kit (SDK) on your computer. An SDK gives developers the tools they need to create apps for a certain platform.

c. Minimum SDK

The **min sdk version** is the earliest release of the Android SDK that your application can run on. Usually this is because of a problem with the earlier APIs, lacking functionality, or some other behavioral issue

d. Android Studio: IDE that we use to create native android applications.

14) Explain the Activity life-cycle in android development in details



15) Discuss the importance of the Application Framework layer described in android architecture

- The componentization of the framework allows developers to use it in a piece-by-piece fashion. This results in better allocation of developers based on their expertise, reduction in errors, and a lower cost of development.
- Code and design reusability helps in the usage of tested components, which increases the quality.
- Extensibility for customizing the framework to implement business requirements.
- Simplicity is achieved by the encapsulation feature, which helps control components access and provide data security.
- Better code maintenance because all the base code is centralized in a single location.
- In addition to the code, the predefined interactions between different classes form a template to reduce the development effort. This provides a better beginning for software development and aids in rapid application development.