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(тема)

Виконав:
студент 2 курсу, групи СШМ-20-2
Тучков Д.Г.
(прізвище, ініціали)

Спеціальність 122 Комп'ютерні науки
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Керівник проф. Терзіян В.Я.
(посада, прізвище, ініціали)

Допускається до захисту

Зав. кафедри _____
(підпис)

В.О. Філатов
(прізвище, ініціали)

2022 р.

Харківський національний університет радіоелектроніки

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(повна назва)

ЗАТВЕРДЖУЮ:
Зав. кафедри _____
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« _____ » _____ 20 ____ р.

ЗАВДАННЯ
НА КВАЛІФІКАЦІЙНУ РОБОТУ

студентові Тучков Денис Геннадійович
(прізвище, ім'я, по батькові)

1. Тема роботи Кишеньковий психотерапевт на основі емоційного інтелекту

затверджена наказом університету від 24 березня 20 22 р. № 414 Ст

2. Термін подання студентом роботи до екзаменаційної комісії 12 травня 20 22 р.

3. Вихідні дані до роботи електронні ресурси за обраною тематикою, дані від експерту в обраній галузі, мінімальні вимоги до функціональності програми, загальні вимоги до архітектури системи

4. Перелік питань, що потрібно опрацювати в роботі аналіз предметної області, формування вимог до програмної системи, архітектура та проектування програмного забезпечення, прийняті програмні рішення, тестування розробленого програмного забезпечення, висновки, перелік джерел посилання

5. Перелік графічного матеріалу із зазначенням креслеників, схем, плакатів, комп'ютерних ілюстрацій (п.5 включається до завдання за рішенням випускової кафедри) Figure 1.1, 1.2 – Appearance of applications; Figure 3.1 – Sequence diagram; Figure 3.2 – Usage scenario diagram; Figure 3.3 – Demonstration Android Navigation Component; Figure 3.4 – MVVM Android; Figure 3.5 – Color palette of the mobile application; Figure 3.6 – Mobile application page design (light theme); Figure 3.7 – Mobile application page design (dark theme); Figure 4.1 – Robert Plutchik's wheel of emotions; Figure 4.2 – Emotion tab; Figure 4.3 – Details screen; Figure 4.4 – History tab with information; Figure 4.5 – History tab without information; Figure 4.6 – Example of adapter creation code; Figure 4.7 – Example of swipe configuration code for items; Figure 4.8 – Statistics tab without information.

6. Консультанти розділів роботи (п.6 включається до завдання за наявності консультантів згідно з наказом, зазначеним у п.1)

Найменування розділу	Консультант (посада, прізвище, ім'я, по батькові)	Позначка консультанта про виконання розділу	
		підпис	дата

КАЛЕНДАРНИЙ ПЛАН

№	Назва етапів роботи	Терміни виконання етапів роботи	Примітка
1	Аналіз предметної галузі	28.03 – 30.03.2022	Виконано
2	Огляд існуючих рішень, вибір придатних аналогів	31.03 – 02.04.2022	Виконано
3	Проектування та розробка програми	03.04 – 23.04.2022	Виконано
4	Тестування та дослідна експлуатація програми	24.04 – 25.04.2022	Виконано
5	Написання пояснювальної записки	25.04 – 27.04.2022	Виконано
6	Підготовка презентації	28.04.2022	Виконано
7	Підготовка доповіді	29.04.2022	Виконано
8	Перевірка роботи на плагіат	02.05.2022	Виконано
9	Рецензування та проходження нормоконтролю	09.05.2022	Виконано
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Студент _____
(підпис)

Керівник роботи _____
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РЕФЕРАТ

Пояснювальна записка: 53 с., 24 рис., 2 дод., 10 джерел.

АНАЛІЗ, ЕМОЦІЇ, ІНТЕЛЕКТ, КОНТРОЛЮВАННЯ, МОБІЛЬНИЙ ДОДАТОК, РЕЗУЛЬТАТ, РОЗВИТОК, СТАТИСТИКА.

Об'єкт дослідження – система для допомоги користувачам самопізнавати себе, а точніше своїх емоцій.

Предмет дослідження – методи та моделі розвитку емоційного інтелекту.

Мета роботи – розробка таких компонентів системи: мобільний додаток.

Методи дослідження – аналіз існуючих систем та додатків для роботи з психологічним станом людини, програмна реалізація самостійної системи роботи, тобто додатку. Методи розробки базуються на технологіях Kotlin, Java, Android.

У результаті роботи здійснено програмну реалізацію всіх компонентів системи для направлення і порозуміння в емоціях самого користувача.

ABSTRACT

Explanatory note: 53 page, 24 figures, 2 addition, 10 sources.

**ANALYSIS, CONTROL, DEVELOPMENT, EMOTIONS,
INTELLEGENCE, MOBILE APP, RESULT, STATISTICS.**

The object of research is a system to help users to know themselves, or rather their emotions.

The subject of research – methods and models of emotional intelligence.

The purpose of the work is to develop the following components of the system: mobile application.

Research methods – analysis of existing systems and applications for working with the psychological state of man, software implementation of an independent system of work, ie applications. Development methods are based on Kotlin, Java, Android technologies.

As a result of work the program realization of all components is carried out systems for directing and understanding the emotions of the user.

CONTENTS

Introduction.....	7
1 Subject area analysis.....	8
1.1 Analysis of the subject area.....	8
1.2 Identifying problems and updating solutions.....	13
1.3 Task Formulation.....	16
2 Forming requirements for the software system.....	18
2.1 Functional software requirements.....	18
2.2 Non-functional software requirements.....	19
2.3 Specific requirements.....	19
3 Software architecture and design.....	21
3.1 UML design.....	21
3.2 Description of the main scenarios.....	23
3.3 Software architecture design.....	24
3.4 Create UI / UX system design.....	28
4 Description of software solutions.....	31
5 Testing of the developed software.....	40
Conclusions.....	45
References.....	46
Appendix A Basic requirements for the specification of qualification work.....	47
Appendix B List of qualification work.....	53

INTRODUCTION

Have you heard of the paradox when students who study not well achieve more success than excellent students? For some reason, success in life does not depend on school grades, it does not depend on the development of our diet and the amount of knowledge. This paradox remained a mystery for a long time until Daniel Goleman [1] introduced the concept of emotional intelligence. Emotional intelligence is the ability to be aware of the emotions of themselves and others, to change their actions in accordance with this understanding. Emotional intelligence includes the ability to recognize their emotions and feelings, constructively experience them, understand the feelings and emotions of another person, empathize and empathize with people.

Why is it so important for success, productivity and even well-being? Emotions are the main source of positive or negative feelings that arise spontaneously and subconsciously. Our communications are based on emotional connections and mutual understanding. Developed emotional intelligence base for leadership. However, most people do not give much meaning to this or do not develop at all.

The aim of the work is a mobile application that would allow users to conveniently and effectively learn to understand themselves, their emotions and improve their emotional intelligence.

The scope can be varied, as emotions are felt by everyone on our planet.

The application is designed for use by absolutely any category of people.

1 SUBJECT AREA ANALYSIS

1.1 Analysis of the subject area

Emotional intelligence is the sum of a person's skills and abilities to recognize emotions, understand the intentions, motivations and desires of others and their own, as well as the ability to manage their emotions and the emotions of others to solve practical problems. Refers to flexible skills.

The concept of emotional (social) intelligence emerged as a reaction to the frequent inability of traditional intelligence tests to predict a person's career and life success. This was explained by the fact that successful people are able to interact effectively with other people based on emotional connections and to effectively manage their own emotions, while the accepted concept of intelligence would not include these aspects, and intelligence tests did not assess these abilities.

There are several models of emotional intelligence: the Mayer-Nightingale-Caruso model (ability model), the mixed model, and the social and emotional intelligence (ESI) model of Ruven Bar-On. And now let's look at each of them.

Mayer-Salovei-Caruso model of emotional intelligence (ability model). This model is considered the main one in psychology at the moment, it is usually used to describe the concept of emotional intelligence, although also very popular is based on this model mixed model of Daniel Goleman (see below). The ability model has been criticized by some scholars, including Howard Gardner, for its excessive psychometric bias. Mayer, Salov and Caruso identify only four components of emotional intelligence:

- perception of emotions – the ability to recognize the emotions (facial expressions, gestures, appearance, gait, behavior, voice) of others, as well as identify their own emotions;

- use of emotions to stimulate thinking – the ability of man (mostly unconsciously) to activate his mental process, to awaken creativity, using emotions as a motivating factor;

- understanding emotions – the ability to determine the cause of emotions, recognize the relationship between thoughts and emotions, determine the transition from one emotion to another, predict the development of emotions over time, as well as the ability to interpret emotions in relationships, understand complex (ambivalent, ambiguous) feelings;

- emotion management – the ability to tame, awaken and direct their emotions and the emotions of others to achieve goals. This also includes the ability to take emotions into account when building logical chains, solving various problems, making decisions and choosing their behavior.

Mixed model. The model of emotional intelligence, created by science journalist Daniel Goleman, gained great popularity thanks to his book, sold out in record numbers. At the same time, many scientists point to the lack of scientific nature of this model. The mixed model assumes that emotional intelligence consists of 5 components:

- self-knowledge – the ability to identify their emotions, their motivation in decision-making, learn about their weaknesses and strengths, determine their goals and values;

- self-regulation – the ability to control their emotions, restrain impulses;

- motivation – the ability to strive to achieve a goal for the sake of achieving it;

- empathy – the ability to take into account other people's feelings when making decisions, as well as the ability to empathize with other people;

- social skills – the ability to build relationships with people, manipulate people, push them in the desired direction.

Three questionnaires were developed based on the Goleman model: Emotional Competency Inventory (ECI), Emotional and Social Competency

Inventory (ESCI), Emotional and Social Competency – University Edition (ESCI-U).

Ruven Bar-On's model of social and emotional intelligence (ESI) [2]. Reuven Bar-On was introduced in 1996 at a meeting of the American Psychological Association in Toronto, Canada. The model consists of 15 abilities:

- self-esteem – the ability to understand and evaluate yourself, see your strengths and limitations, strengths and weaknesses, and accept yourself along with your strengths and weaknesses;

- emotional awareness – the ability of a person to recognize the presence of emotions at a particular time, to distinguish their emotions and understand the reasons for their occurrence;

- assertiveness / self-expression – the ability to clearly and constructively express their feelings and thoughts, as well as the ability to mobilize their emotional energy, to show, if necessary, the firmness of beliefs, to stand on their own;

- independence – the ability to rely on yourself and not be emotionally dependent on others;

- empathy is the ability to recognize, realize and understand the feelings of others;

- social responsibility – the ability to identify oneself as a member of a social group, to cooperate constructively with other people, to show care and take responsibility for other people;

- interpersonal relationships – the ability to communicate constructively through verbal and nonverbal communication, the ability to establish and maintain mutually beneficial relationships based on feelings of emotional closeness, the ability to feel free and comfortable in social contacts;

- stress resistance – the ability to effectively manage their emotions, quickly find a way out of the situation;

- control of impulses – the ability to restrain their emotions, to resist temptation;

- assessment of reality – the ability to compare their thoughts and feelings with the objective external reality;
- flexibility – the ability to quickly adjust their feelings, thoughts, ideas and behavior according to changing circumstances;
- problem solving – the ability to identify and formulate a problem, as well as find a potentially effective solution for it;
- self-actualization – the ability to set goals and strive to achieve them, to realize their potential;
- optimism – the ability to maintain hope and a positive attitude even in difficult circumstances;
- happiness / well-being – the ability to feel satisfied with yourself, others and life in general.

So why do you need all these models and concepts, you ask? We feel emotions 24 hours a day, even when we sleep, but only a very small number of people can really control them. These people are experts in emotions, they understand and cope with their feelings, as well as decipher the feelings of others [3]. What are the benefits of this skill? By increasing your emotional intelligence, you will be able to succeed in many areas of your life (from personal to public) and learn to solve problems without attracting unnecessary emotions. In addition, there is a high probability that you will be satisfied with your life, because you will be able to understand what your psychology needs at any time. You will learn to motivate yourself literally on an equal footing – with the help of ordinary thoughts. You will not need external factors to be happy, because you know how to direct your emotions in the direction you want and achieve the desired mood.

Everyone dreams of learning to think clearly. But what does that mean? You will not be able to convey your point of view if you are irritated and angry, because at such moments your consciousness is littered with emotional garbage that prevents you from thinking. If you control your emotions, you can control your mind.

In addition, you probably know the catastrophic consequences of negative emotions. They can deprive you of everything – health, life, money, reputation and happiness. While a person who controls his emotions is healthy and happy, he enjoys life and looks at all problems as new opportunities.

The use of emotional intelligence in life. Whether you like it or not, you feel emotions in any situation: when communicating with a person, in an art gallery, supermarket. That's why you use emotional intelligence every day, the only difference is how high its level is. You and only you decide what emotions and feelings to feel at any given moment. Want to feel offended and annoyed – please. You want to enjoy life and look to the future with optimism – you can achieve this too. You will be calm and balanced if you understand your emotions and begin to control them [4]. But then why understand other people's emotions? Isn't it enough to understand your own and learn to manage them? We communicate with people every day in one form or another, so understanding what a person feels and why is a key moment in building good, harmonious relationships. You may not be a very talented person and have an outstanding intellect, but if you know how to communicate with people and they respect and appreciate you, you will achieve great success.

In order to begin the development of emotional intelligence, you first need to know yourself / self-awareness. Self-awareness is the art of understanding oneself, one's stimuli, motives and subsequent reactions. It is also an important part of what we call self-control. Self-awareness has an inner aspect – how we perceive ourselves; and external – understanding how others see us. But in our reality, we are well aware of and see software that helps people improve their knowledge of foreign languages, mathematics, or other sciences, rather than themselves.

That is why the topic of software that will help to understand your emotions and teach you to adjust / control them is very relevant now and I think in the future until people know their internal system of feelings / emotions.

1.2 Identifying problems and updating solutions

There are currently few mobile apps that follow a similar concept, but let's look at a few.

Among the analogues, I would like to consider «Daylio» – a mobile application that allows the user to keep records of their mood (see Fig. 1.1). You can create a daily record with two taps. Choose your mood and activities. This application also processes data and displays it in statistics, charts and correlations.

I would also like to add that this application is presented for free and for a fee. And the constant reminder of the ability to subscribe is more annoying than informing the user. This is usually interpreted as a bad tone when paid content is imposed. Also, this application does not have a dark theme and the user may be uncomfortable because of this. A dark theme is also needed to help users better perceive information, save battery power (proven if you use a dark theme, you can save 15 to 63% of battery life) and a more concise design. Most users just like the dark theme visual. Dark colors convey the value of premium content: they make the interface more stylish, bring a touch of luxury and wealth.



Figure 1.1 – Appearance of the application «Daylio»

The created record will have very limited functionality and information. Also a big drawback is that the application has only 5 emotions, although according to Plutchik's theory there are 8 [5]. Such as:

- joy. Protective behavior: feelings about violations of personal space, the desire to meet generally accepted standards of behavior, concern for «decent» appearance, politeness, kindness, selflessness, camaraderie. Trust. Protective behavior: camaraderie, desire to be the center of attention, thirst for recognition, optimism, ease, boasting, self-pity, politeness, pathos, easy tolerance of criticism and lack of self-criticism;

- fear. Protective behavior: inertia, passivity, withdrawal, lack of initiative, humility, propensity to depend on someone, avoidance of problematic situations, timidity, forgetfulness, fear of new acquaintances;

- surprise. Protective behavior: impulsiveness, lack of deep interests, suggestibility, inability to complete the work started, rapid change of mood, the ability to easily establish superficial contacts;

- sadness. Protective behavior: suffering from the loss of an imaginary object and loss of self-esteem, finding and correcting their shortcomings, achieving high results in activities, playing sports, collecting, striving for originality;

- disgust. Protective behavior: control, lack of suggestibility, increased critical thinking, pride, selfishness, selfishness, heightened sense of justice, sensitivity to criticism and comments, demanding of themselves and others;

- anger. Protective behavior: impulsiveness, irritability, irritability, demanding of others, protest reactions in response to criticism, lack of guilt;

- expectations. Protective behavior: increased control, which will allow you to learn the emotions of others, a tendency to analysis and introspection, honesty, thoroughness, love of order, foresight, individualism.

This application can keep a diary of mood, not emotions, which is needed to solve the problem of understanding yourself.

Mobile application «Psychology of emotions» (see Fig. 1.2). I position myself as the answer to all questions in the direction of emotions, but this is not true. This application is more of an outdated encyclopedia than the latest approach to solving the problem of the psychological state of the user and the development of his emotional intelligence. I would also like to add that the application is not optimized, the design is outdated and has not been updated for a long time, ie the application is not evolving and can only be used as an example of how not to do.

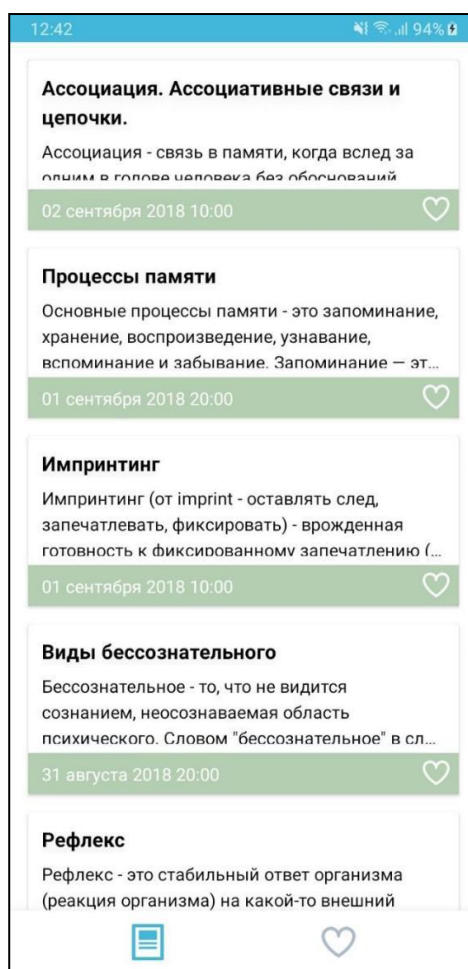


Figure 1.2 – Appearance of the application «Psychology of Emotions»

This application contains dry information that the user is unlikely to be interested in. Since the presentation of information is like a news feed, which is not a mobile application in the field of psychology. The main disadvantage of this application is that it is not fully developed for a mobile device. The information

is presented dryly and incomprehensibly. Also, constant advertising, which appears with some frequency and it is impossible to hide.

As for the information displayed to the user, it is mostly outdated and irrelevant [6].

1.3 Task Formulation

Given the disadvantages and advantages of the above systems, it is necessary to create a mobile application that is a comprehensive and most user-friendly way to solve the problem of understanding their emotions. The system should give the user the following capabilities:

- view the content of pages in Ukrainian, English or Russian;
- view the most important statistics on the main page;
- add emotion that the user is currently experiencing;
- review each of the emotions and its description;
- help in understanding each of the emotions;
- setting up a mobile application;
- view recommendations for using the application.

In addition to accessing information, it is also necessary to modify it, as well as add new data, so the system must be able to edit, delete and add new data for entities such as recording emotions.

The above-mentioned tasks should be implemented as a mobile application with a modern interface and internationalization.

The technical features of the system must be implemented using the technology stack Kotlin, Android, Java 8, as well as many libraries such as Anko, Multidex, AppCompatActivity, LiveData, Room, Android KTX, Coin, Clean Architecture Components, etc.

The appearance of the system should be designed taking into account the optimal and modern technologies of user experience and user interface.

The work consists of four main parts: client, mobile application, record entry and statistics.

The developed application must perform the following functions:

From mobile device customers:

- store user data;
- event settings;
- add a record of emotions;
- formation of statistics.

From clients:

- have an intuitive interface;
- have the means to display data;
- have an interface to interact with the system of adding records;
- have an interface for displaying statistics.

Taking into account the previous requirements, it is necessary to develop flexible software that can be easily scaled in the future. The software product must be reliable and fault tolerant. You need to choose the right stack of technologies and libraries that will improve software development. It is also necessary to model the basic software architecture and select the appropriate design templates.

The main goal of the work is to develop an application that will fully cover all business needs and will have a flexible and easily extensible architecture. It is also necessary to implement the ability to customize the language, dark and light theme to make it convenient for the user to use the application. The software solution needs to be carefully researched, tests prescribed and optimized for those processes that require more effort in time equivalent, this is done to ensure that the application works optimally and there are no delays, some people are very nervous. The software solution needs to be expanded to the maximum version so that every user who has a smartphone on the android platform can improve their psychological state and develop emotional intelligence. And the best development is first self-knowledge and introspection, and only then the study of other people's emotions.

2 FORMING REQUIREMENTS FOR THE SOFTWARE SYSTEM

2.1 Functional software requirements

Clear functional requirements need to be formulated in accordance with transparent and specified behavior for the design and implementation of a software system. The created application should implement the following functionality.

Working with a user profile. The user gives me access to his profile as soon as he launches the mobile application. That is, all data will be stored on a specific device in memory.

The user needs to display the start screens in front of him with an explanation of why this system and how to use it properly. These will be the main parts with brief information so as not to overload the user with unnecessary information.

After going through all the steps of familiarizing yourself with the system, the full version with all the tabs is available to the user. Let's describe each of them:

- emotion – a tab that will display all 8 main emotions of people and the current date and time below. On the elements of emotions there will be 2 pressing elements of the element itself and the acquaintance / description icon. By clicking on the item itself, the user can add an entry after confirming the time, date and emotion. When you click on a date, it can be edited using the system data picker. You can edit it by clicking on the time;

- history – a tab with a list of all entries that the user will add with the display of most of the input parameters. It will be possible to view detailed information on the record by clicking on the item itself. On the details screen, it may be possible to delete or edit an entry so that the user may make a mistake or not fully understand their emotions. Also, the ability to edit or delete the history will only need to swipe;

- statistics – a tab that will form the number of emotions that the user felt. This tab will only be available after a certain number of entries. This tab will display which emotions dominate and which may be suppressed by the user. Recommendations on what to do if the user wishes, what aspects of his emotions prevail and how it is possible to use it to your advantage;

- settings – a tab that will display all possible settings to the user.

All configuration options will be as follows:

- dark or light theme;
- application language;
- reminder of the need to create a record;
- the ability to disable reminders;
- the ability to add multiple reminders;
- ability to clear all user information (records, statistics, configured).

2.2 Non-functional software requirements

The created mobile application must meet the following characteristics:

- the application must be intuitive;
- each screen should not be overloaded with elements and text;
- each of the pages must maintain its status both during operation and when closing. That is, save every click on emotion, settings and so on;
- done UI / UX;
- versatility and adaptability for further development.

2.3 Specific requirements

Mobile version:

- recording a new record / event / emotion;

- reminder to the user of the need to periodically add a record to form a habit and use made sense;
- display the history of these records;
- the ability to edit and delete entries;
- formation of stylistics on emotions that the user added;
- setting up a mobile application for the visual and functional part.

When the product is released and widely distributed, it is likely to help most people understand themselves and their emotions. And when that happens, you will need to move on to the next step in the development of emotional intelligence, but this will be a completely different story, but which can be contained in this mobile application.

Users of this system can be found anywhere in the world. When launching a mobile application and in a situation where the user has not selected a language in the settings, it will be tightened depending on the system.

Users of this system can use at any time of the day, so in its standard state, the mobile application, depending on the system settings, will automatically switch to a dark and light theme. Or the user will choose a theme on the tab with all the settings.

Android software development is the process by which applications are created for devices running the Android operating system. Google states that «Android apps can be written using Kotlin, Java, and C++ languages» using the Android software development kit (SDK), while using other languages is also possible. Some programming languages and tools allow cross-platform app support (i.e. for both Android and iOS). Third party tools, development environments, and language support have also continued to evolve and expand since the initial SDK was released in 2008. The official Android app distribution mechanism to end users is Google Play; it also allows staged gradual app release, as well as distribution of pre-release app versions to testers.

3 SOFTWARE ARCHITECTURE AND DESIGN

3.1 UML design

UML is a graphical description language for object modeling in the field of software development, for business process modeling, system design and mapping of organizational structures.

UML is a broad-based language [7], an open standard that uses graphical notation to create an abstract system model called a UML model. UML was created to define, visualize, design and document, mainly, software systems. UML is not a programming language, but code generation is possible based on UML models.

Advantage and disadvantage of UML design [8]

Disadvantage:

- waste of time;
- the need to know different charts and their notations.

Advantage:

- the ability to look at the task from different points of view;
- other programmers find it easier to understand the essence of the task and how to implement it;
- diagrams are relatively easy to read and quickly get acquainted with their syntax.

One of the most popular features of the system is adding an emotion record. The main function of the system is best possible thanks to the sequence diagram. This is a diagram in which for any set of objects on a single axis shows any specific object and actors. UML activity diagram for implementing the process of adding a record. The chart covers the whole process from the choice of emotion, time and date (see Figure 3.1).

Particular attention is paid to saving the record, because the logic of the system should also update the information on the tabs history and statistics. Cases that lead to errors must also be handled correctly.

For example, if some of the data is not selected or otherwise, the user needs to display it adequately. You will also need to limit the maximum and minimum time from the current one.

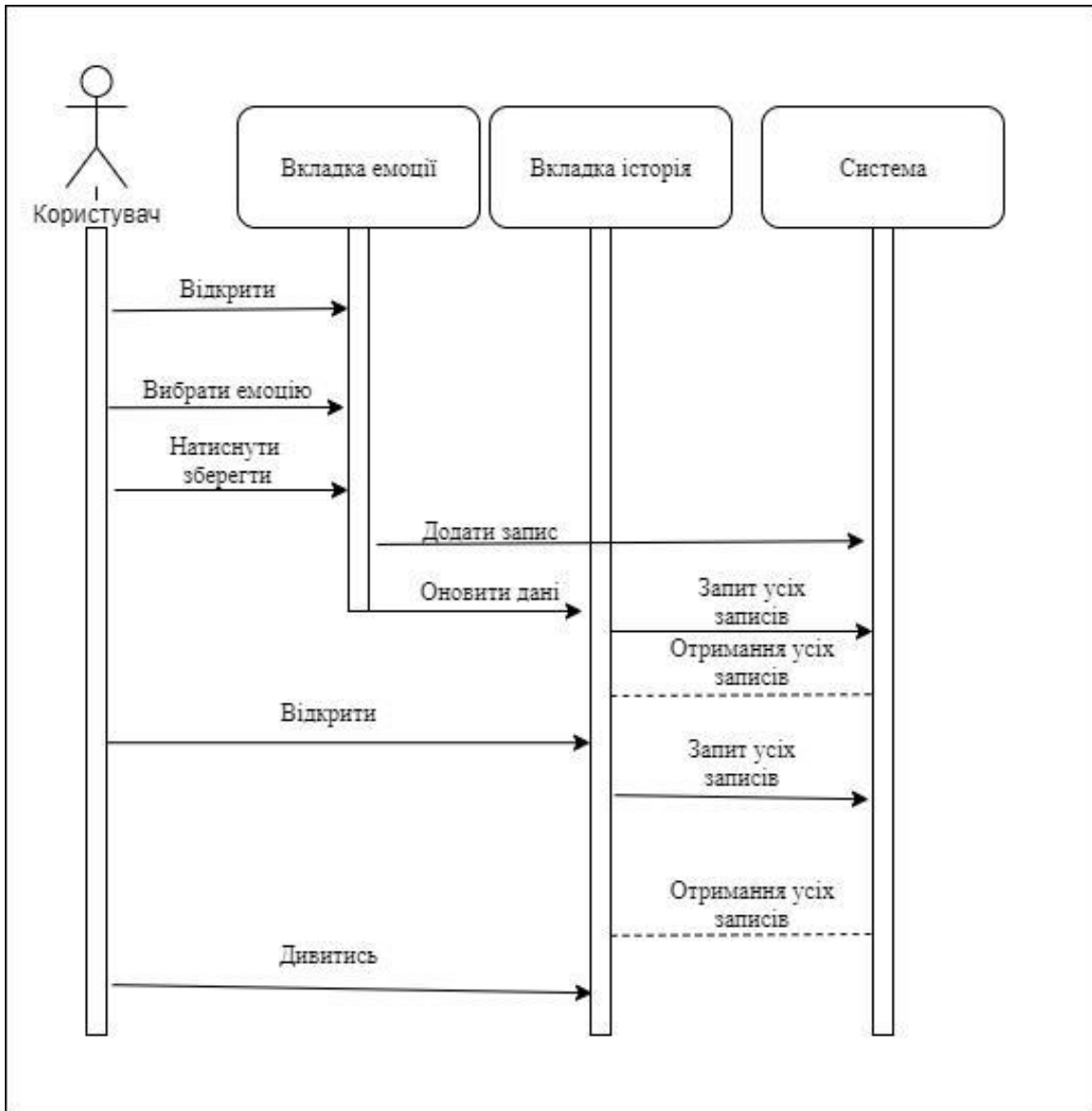


Figure 3.1 – Sequence diagram

When the user adds a record of emotions, he chooses the emotions, time and date, ie enters relevant information. These fields are «emotion», «time» and «date». Then the form of displaying and adding a record sends information to the system that stores it. After adding an entry, the answer is returned or the entry was added. At the end of the work, if the user has changed an existing record, the current state of the record is returned. If he added an entry, it is added last to the list of all entries (history) that have been added.

3.2 Description of the main scenarios

A complete description of the scenarios for using the program for the user of the system is shown in Figure 3.2.

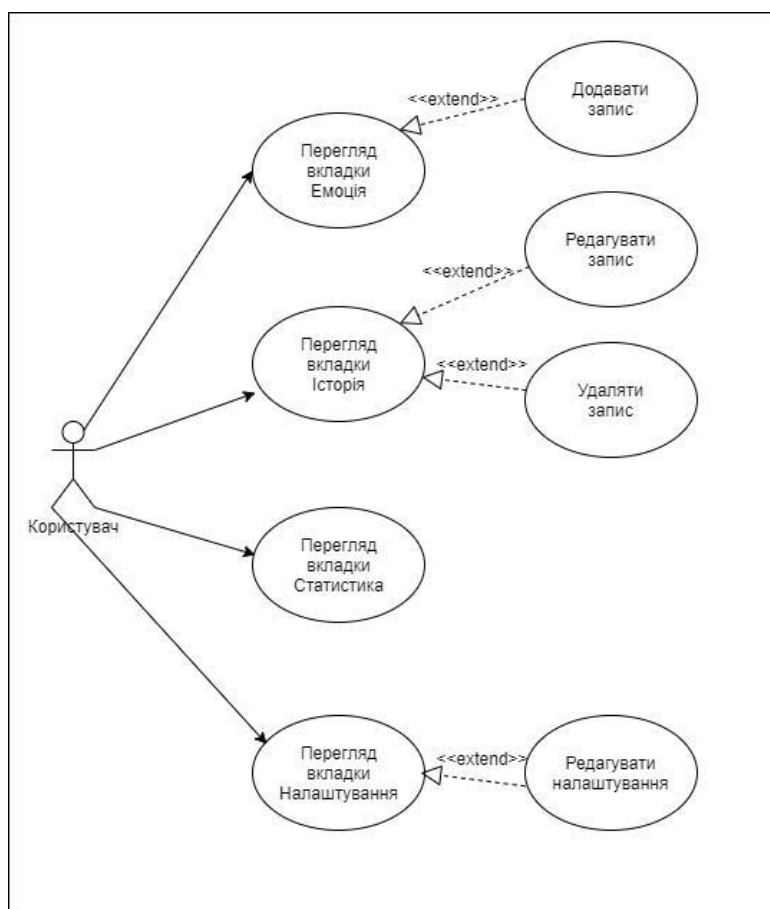


Figure 3.2 – Use case diagram

The user of the system can view the list of entries, as well as a detailed description of each of the following when pressed, can edit or delete. The user can also add a record of their emotions. Make statistics on all the records of emotions that he added. Statistics are information collected from all records and formed for possible adjustments in their perception of themselves. The user can also view the settings. Edit settings such as dark or light theme, mobile app language, settings, add or remove reminders, and more.

3.3 Software architecture design

The software system is a mobile application. Let's look at what technologies and components will be used for development and why each of them. The following components are used: Kotlin [9], Koin, Android Navigation Component, LiveData, Anko, MVVM.

Kotlin is a statically typed, object-oriented programming language running on top of the Java Virtual Machine and developed by JetBrains. It is also compiled in JavaScript and in the executable code of a number of platforms through the LLVM infrastructure. The language is named after the island of Kotlin in the Gulf of Finland, where the city of Kronstadt is located. The authors aimed to create a language more concise and type-safe than Java, and simpler than Scala. The simplification over Scala has also resulted in faster compilation and better language support in the IDE. The language is fully compatible with Java, which allows java developers to gradually move to its use; in particular, in Android the language is built in with Gradle, which allows for the existing android application to implement new features on Kotlin without rewriting the program completely.

Koin is a small library for writing dependency implementations. Without proxy, code generation and introspection. Works as a Service Locator. Uses DSL and Kotlin features. The library itself implies that it will be used in applications written in Kotlin, but also with Java.

Navigation Architecture Component simplifies navigation, and helps visualize the navigation flow of our application. The library provides a number of benefits, including:

- automatic processing of transaction fragments;
- correct processing of the «Up» and «Back» buttons by default;
- default behavior for animation and transitions;
- deep linking як first class operation;
- implementation of navigation templates for the user interface (such as navigation drawer and bottom navigation) with a little extra work;
- safety of types when transmitting information during navigation;
- android studio tools for visualizing and editing navigation flow applications.

The way it will look in the studios can be seen in Figure 3.3.

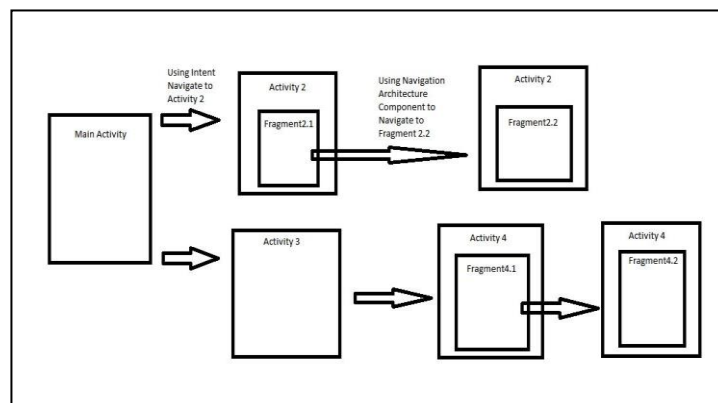


Figure 3.3 – Demonstration of Android Navigation Component

LiveData is an Observer-based data warehouse. This repository can do two things:

- you can put an object in it;
- it is possible to subscribe to it and receive objects that are placed in it.

That is, on the one hand, someone puts the object in storage, and on the other hand, someone signs and receives this object. As an analogy, for example,

the channels in the Telegram. The author writes the post and sends it to the channel, and all subscribers receive this post.

Anko is the official Kotlin library for Android. This is not part of the basic Runtime Kotlin and not a mandatory component, but something like a suitcase of tools.

A key component of Anko is the UI library, which can greatly simplify interface programming. To understand what this is, let's look at how we usually program the program interface. To do this, create an XML file with markup, using a graphical interface or manually place lights and widgets, assign an ID to each widget, then write code that will find these widgets using `findViewById ()` and perform some actions on them (for example, hang on button cap with a pressure handler).

This is a perfectly normal and common method of describing the interface, it is used in many other frameworks, environments and operating systems. But it has many problems: the code in XML is NOT type-safe, it can not be reused, XML is processed on the device itself, so the rendering of the interface is slow. After all, writing and editing XML is just inconvenient, even though Android Studio does everything to speed up the process (I'm silent about the visual editor, it can only be used at the prototyping stage, then have to edit by hand).

Some of these problems can be solved by describing the interface directly in the code.

Android has all the tools for this, but they will not lead you to a bright future, but to hell. The code describing the interface will be very cumbersome, poorly readable and confusing. Instead of a whirlwind, but structured XML, you get an endless series of operations of the form: create an object, call such and such methods, create another and such and such methods, pass these objects to another object's method, and pass the object itself another object and so on tens and hundreds of lines ahead.

MVVM. The client-side mobile application architecture template is known, but what is it and what is it for? A key feature of the MVVM pattern is that no

component (Model, View, ViewModel) knows about the other explicitly (see Figure 3.4). These components interact with each other through the mechanism of data binding (Bindings), which is implemented by means of a system. In this case, changing the data in ViewModel automatically changes the data displayed under View. Similarly, any event or change in the data in the View (pressing a button, entering text, etc.) changes the data in the ViewModel. This allows you to not store explicit links to View in ViewModel and vice versa, as well as keep these components very weakly connected, which is convenient when testing. You will also use Data Binding, a framework from Google that allows you to bind Java code and xml files. At the same time you can completely get rid of the View Java code. Moreover, it eliminates routine calls to change the View. With Data Binding View in xml-markup you can set any properties, which is very convenient and hides some details of the implementation. Data Binding must provide the ability to bind data, ie that when you change the data in the ViewModel, they automatically change in the markup that is displayed. MVVM and Data Binding are very strong and are used very often even on larger projects.

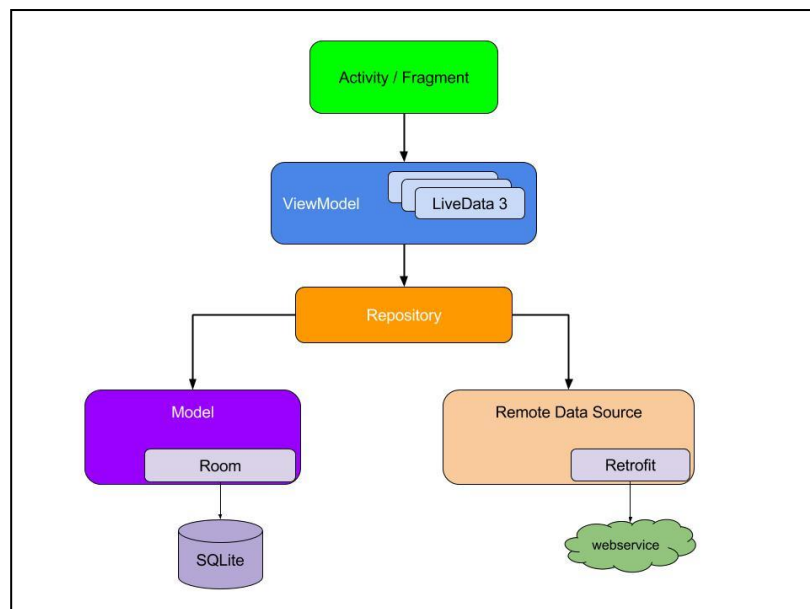


Figure 3.4 – MVVM Android

3.4 Create UI / UX system design

For the correct distinction it is necessary to precisely define the concept of the mentioned terms. UI design is a user interface, and UX is User Experience Design. Accordingly, the first type of web design is determined by the basic appearance (colors, buttons, menus, structure) [10]. The experience of interaction is the initial stage of interface development, which determines the primary structure of the mobile project. He answers the following questions:

- how easy it is for the user to find the necessary information;
- whether it is easy for the user to navigate the site, portal, application or program;
- whether certain elements of the interface cause negative emotions.

The color scheme of the design must be set in advance. The process scheme was chosen for our system, where there are 3 main colors – black, gold and silver (see Fig. 3.5.).



```

<?xml version="1.0" encoding="utf-8"?>
<resources>
  <color name="white">#FFFFFF</color>
  <color name="black">#000000</color>
  <color name="silver">#8E99AB</color>
  <color name="gold">#D1A05A</color>
  <color name="grey">#808080</color>
  <color name="dark">#171A23</color>
  <color name="red">#FF0000</color>
</resources>

```

Figure 3.5 – Color palette of the mobile application

To fully understand the future of the mobile application, you should provide a full screen design. Light theme (see Fig. 3.6.).

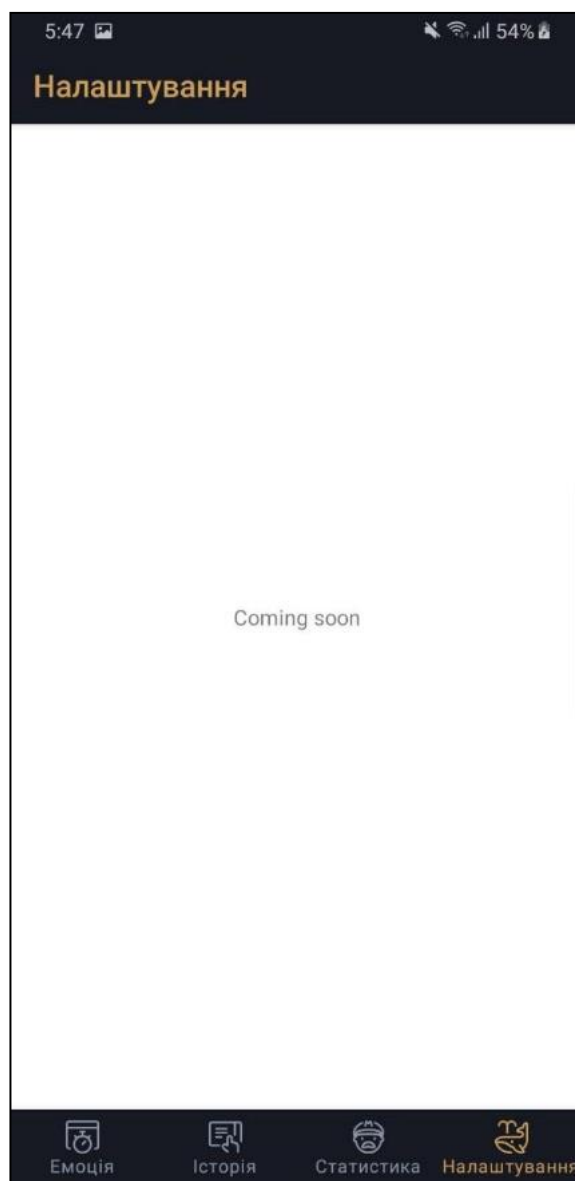


Figure 3.6 – Mobile application page design (light theme)

The design in the light theme is restrained, but all the basic elements are easy to see and understand. That is suitable for all needs. At the same time, the design is not empty, but rather as simple as possible for the user in accordance with the latest trends in UI and UX.

The design of the dark theme will also be given below (see Figure 3.7).

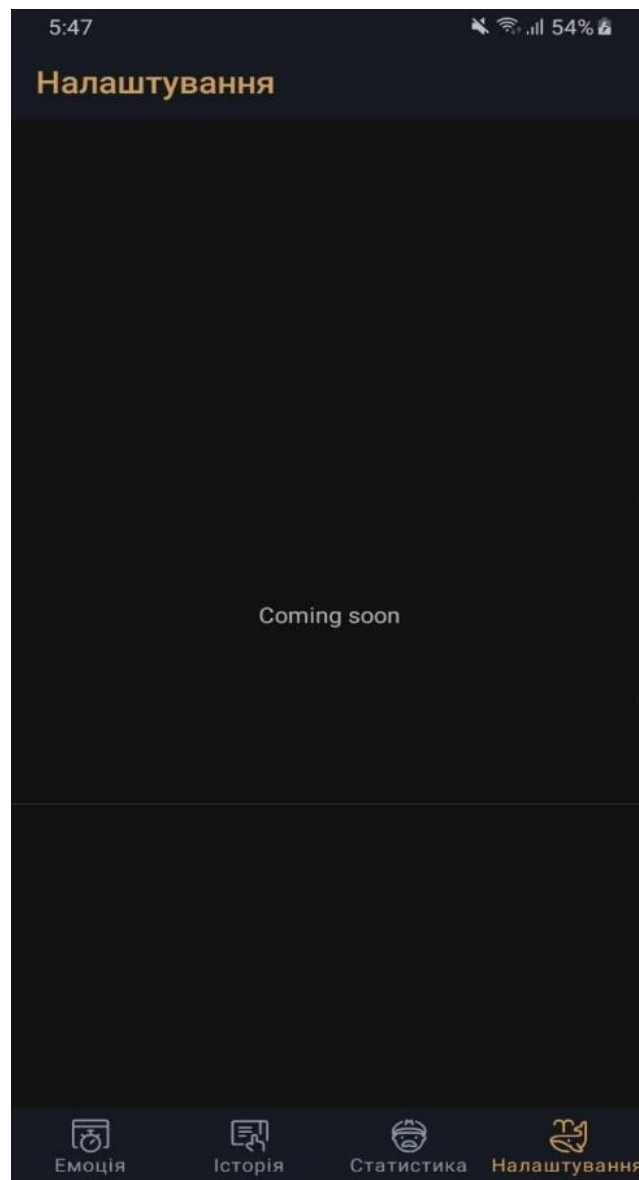


Figure 3.7 – Mobile application page design (dark theme)

The design in the dark theme is more concise and all the basic elements are easy to see and understand. Also a big plus is saving battery power. Due to the fact that the screen emits less light, the power consumption of your smartphone is reduced. Google has conducted research that has shown that, for example, the dark mode in the YouTube application saves from 15 to 63% of the time of offline use of the device. Agree, sometimes 10% of the charge is very important. Also, a dark topic increases the perception of information.

4 DESCRIPTION OF SOFTWARE SOLUTIONS

The main page should contain the main information, ie 4 tabs with the following information / functionality:

- emotion;
- history;
- statistics;
- settings.

Each of the tabs contains information and its own functionality. The Android platform and the Kotlin programming language are used for writing.

The first tab is called «Emotion» and reflects the 8 main emotions that people can feel. This model / wheel of emotions (see Fig. 4.1.) Was introduced by Robert Plutchik.

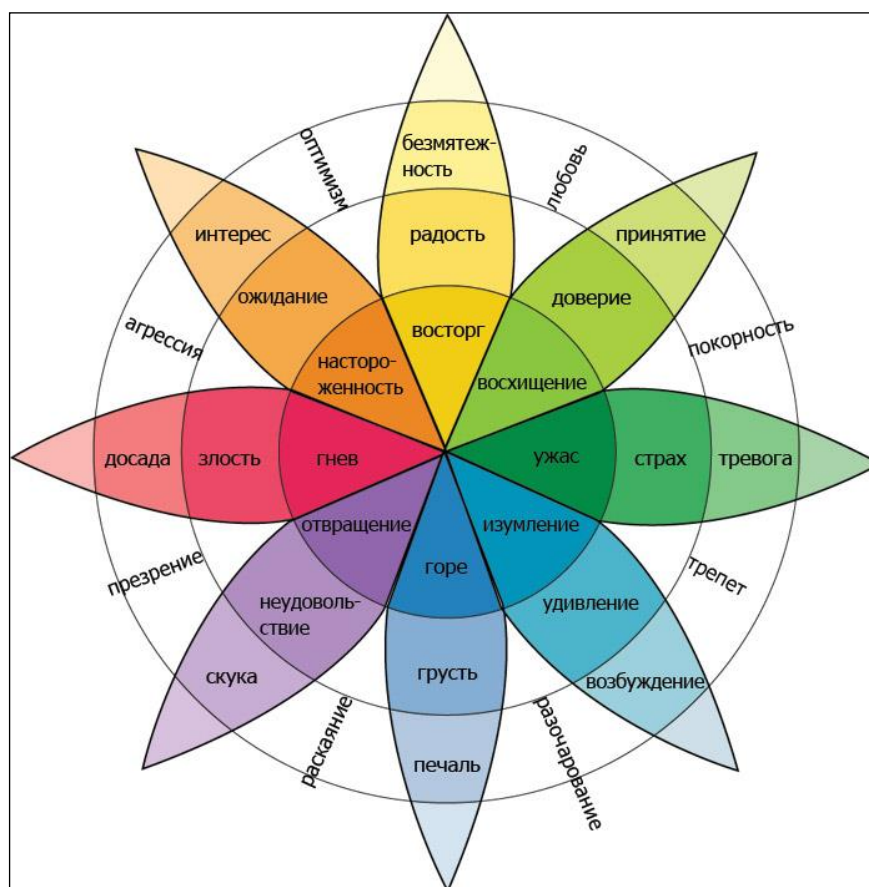


Figure 4.1 – Robert Plutchik's wheel of emotions

The main functionality on this tab looks like this (see Fig. 4.2.).

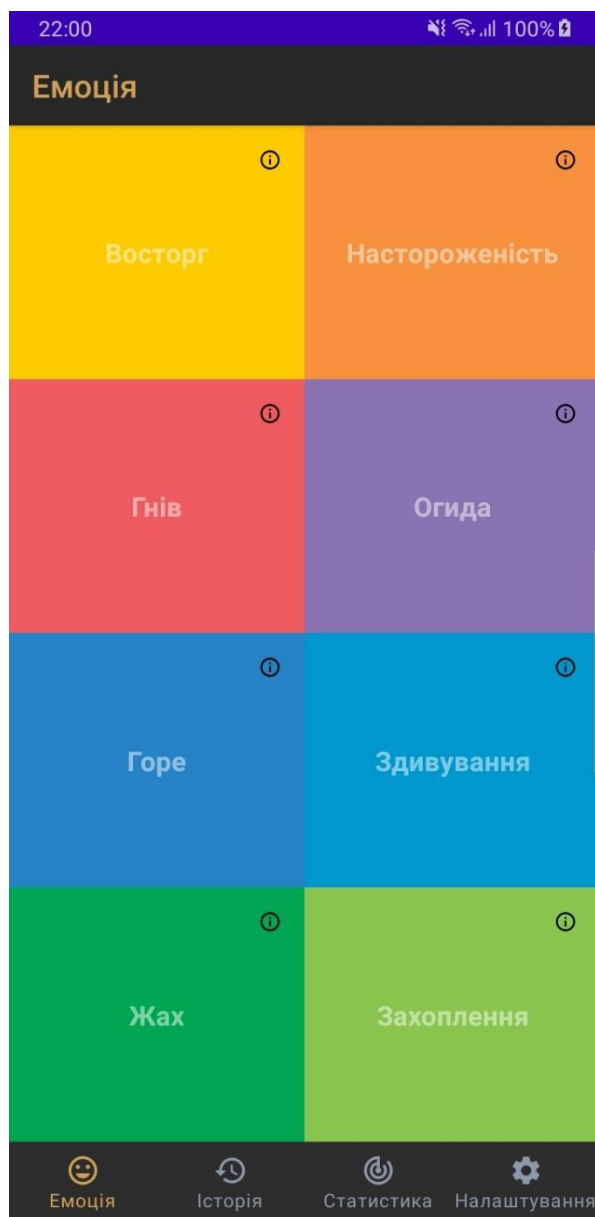


Figure 4.2 – Emotion tab

When you click on any of the emotions, the screen with the details of the recording opens (see Fig. 4.3.). Where the following information is displayed: the emotion itself, date, time, extra. info. All of these fields are editable, except for emotion, as the user selects it on the previous screen. There is also a «Save» button for storage.

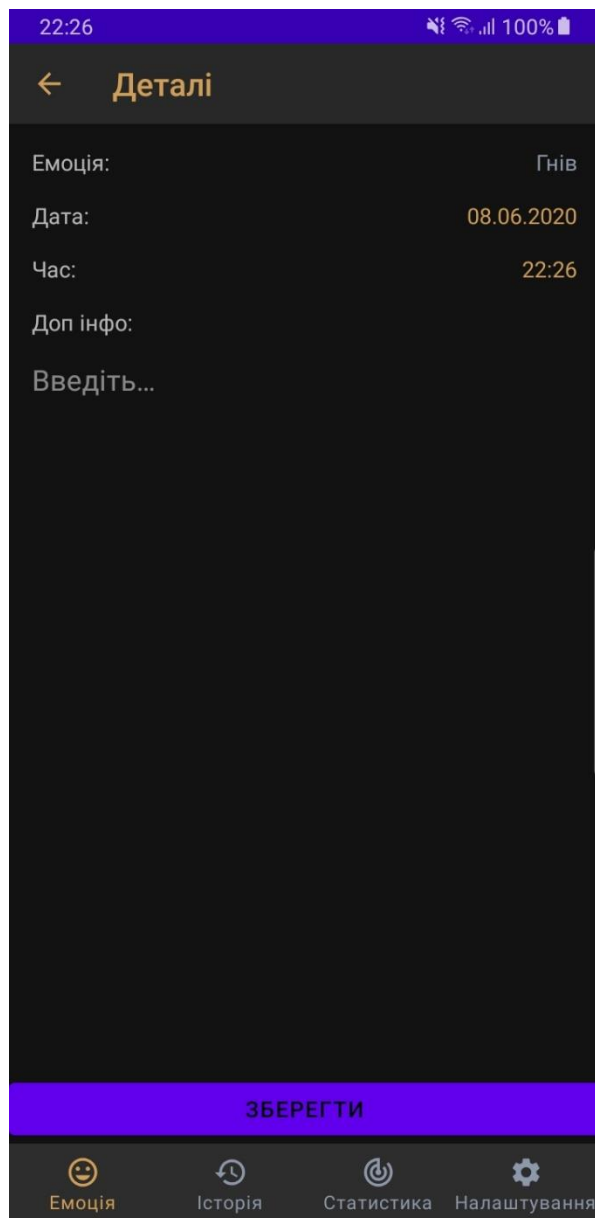


Figure 4.3 – Details screen

The second tab is called «History» and has two states: with the display of information (see Fig. 4.4.) Or an empty list (see Fig. 4.5.). On this screen, you can tap an item or delete an entry by swiping left or right. Each of the elements displays the following information: the emotion of the record and the date with which the record was added. When pressed, the user goes to the «Details» screen and can edit the information on the record.

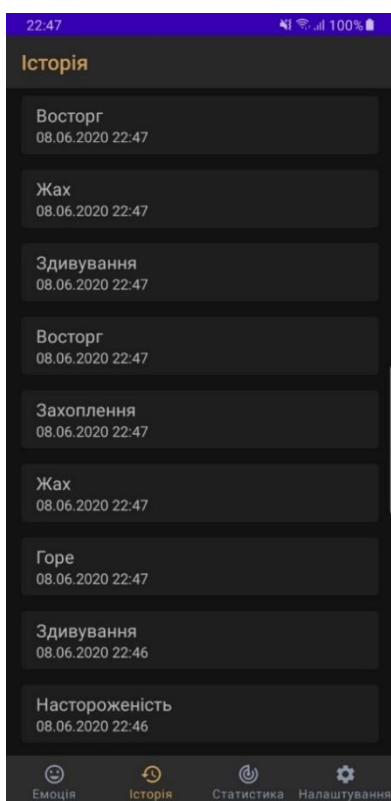


Figure 4.4 – «History» tab with information

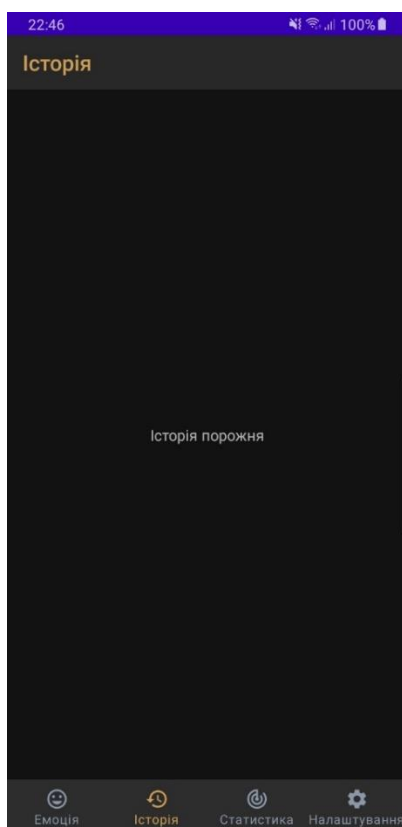


Figure 4.5 – «History» tab without information

To display the list, it was necessary to create an adapter that would prescribe what data and how to display and prescribe the logic of clicking on the element (see Fig. 4.6.). Also settings with a swipe to delete (see Fig. 4.7.).

```

class HistoryAdapter(
    private val items: ArrayList<EmotionItem>,
    private val onClickListener: OnEmotionItemListItemViewClickListener
) : RecyclerView.Adapter<ViewHolderHistory>() {

    override fun getItemCount(): Int = items.size

    override fun onCreateViewHolder(parent: ViewGroup, viewType: Int): ViewHolderHistory =
        ViewHolderHistory(
            DataBindingUtil.inflate(
                LayoutInflater.from(parent.context),
                R.layout.history_item,
                parent,
                attachToParent: false
            )
        )

    override fun onBindViewHolder(holder: ViewHolderHistory, position: Int) =
        holder.bind(items[position], onClickListener)
}

class ViewHolderHistory(val binding: HistoryItemBinding) : RecyclerView.ViewHolder(binding.root) {

    fun bind(item: EmotionItem, onClickListener: OnEmotionItemListItemViewClickListener) {
        binding.item = item
        binding.llHistoryItem.setOnClickListener { it: View!
            onClickListener.onClick(item)
        }
        binding.executePendingBindings()
    }
}

interface OnEmotionItemListItemViewClickListener {

    fun onClick(item: EmotionItem)
}

```

Figure 4.6 – Example of adapter creation code

```

override fun onViewCreated(view: View, savedInstanceState: Bundle?) {
    super.onViewCreated(view, savedInstanceState)
    binding.recyclerView.adapter = HistoryAdapter(viewModel.historyList, onClickListener: this)
    val itemTouchHelperCallback =
        object :
            ItemTouchHelper.SimpleCallback( dragDirs: 0, swipeDirs: ItemTouchHelper.LEFT or ItemTouchHelper.RIGHT) {
                override fun onMove(
                    recyclerView: RecyclerView,
                    viewHolder: RecyclerView.ViewHolder,
                    target: RecyclerView.ViewHolder
                ): Boolean {
                    return false
                }

                override fun onSwiped(viewHolder: RecyclerView.ViewHolder, direction: Int) {
                    val item = viewModel.historyList.removeAt(viewHolder.adapterPosition)
                    viewModel.delete(item)
                    binding.recyclerView.adapter?.notifyDataSetChanged()
                }
            }
    val helper = ItemTouchHelper(itemTouchHelperCallback)
    helper.attachToRecyclerView(binding.recyclerView)

    viewModel.getList()
}

```

Figure 4.7 – Example of swipe configuration code for items

The third tab is called «Statistics» and also has two states: with information / graph display or blank screen (see Fig. 4.8.). In this erkan, if the user has added enough entries, a diagram is displayed that informs the user which of the emotions predominate in his life, and which are few (see Fig. 4.9.).

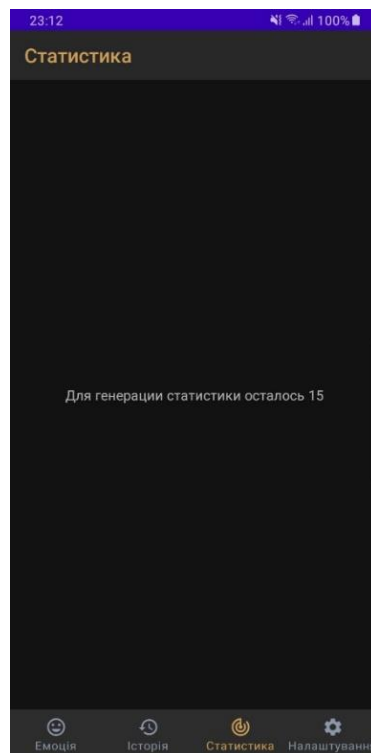


Figure 4.8 – «Statistics» tab without information

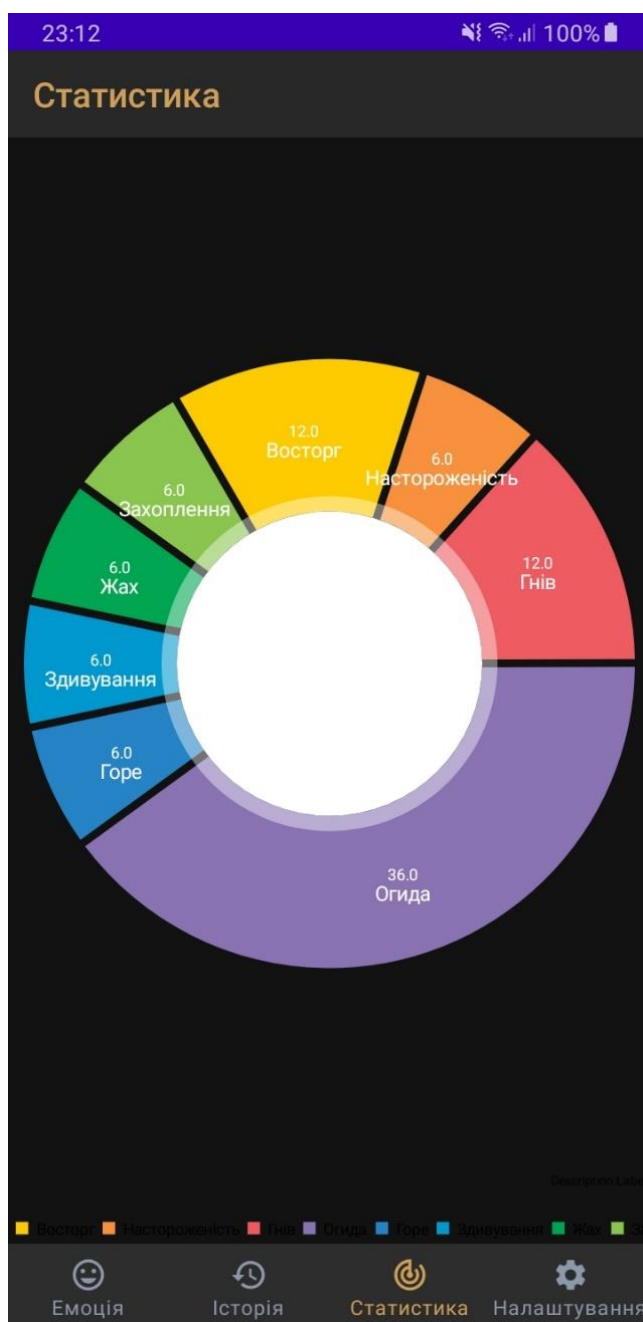


Figure 4.9 – Chart on the «Statistics» tab

The MPAndroidChart library is used to generate this chart, which is a library that allows you to generate various charts. This library is often used to generate charts, progressions or charts for cryptocurrency exchanges and other applications that need it. To use it, you need to specify the number of emotions you need, their color scheme, and concise data in accordance with the total number of records (see Fig. 4.10).

```

override fun onCreateView(view: View, savedInstanceState: Bundle?) {
    super.onCreateView(view, savedInstanceState)
    val list = getEntries()
    val pieDataSet = PieDataSet(list, label: "")
    val pieData = PieData(pieDataSet)
    binding.pieChart.data = pieData
    pieDataSet.colors = context?.let { it: Context
        listOf(
            ContextCompat.getColor(it, R.color.ecstasy),
            ContextCompat.getColor(it, R.color.vigilance),
            ContextCompat.getColor(it, R.color.rage),
            ContextCompat.getColor(it, R.color.loathing),
            ContextCompat.getColor(it, R.color.grief),
            ContextCompat.getColor(it, R.color.amazement),
            ContextCompat.getColor(it, R.color.terror),
            ContextCompat.getColor(it, R.color.admiration)
        )
    }

    pieDataSet.sliceSpace = 2f
    pieDataSet.valueTextColor = Color.WHITE
    pieDataSet.valueTextSize = 10f
    pieDataSet.sliceSpace = 5f
}

```

Figure 4.10 – Example of chart generation code

The fourth tab is called «Settings» (see Fig. 4.11) and includes some options for configuring the application: dark theme, language, reminders and the time of its operation and cleaning of user information. The dark theme is customized thanks to such an abstract class AppCompatActivity. The language is configured thanks to the Configuration class. A notification channel is created as a reminder. The time is selected thanks to TimePickerDialog. Also, all these states are saved in SharedPreferences and can be cleared by clicking the «Clear» button and confirming in the dialog box (see Figure 4.12). This dialog is generated by calling the alert method from the Anko library. Stripping involves deleting all records, ie

the user will not have access to history, statistics or previously set settings until he fills in the relevant information.

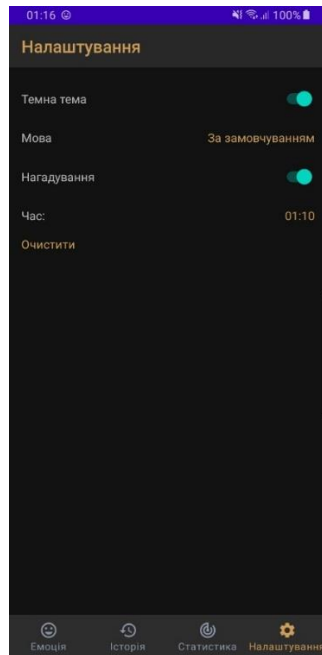


Figure 4.11 – Settings tab

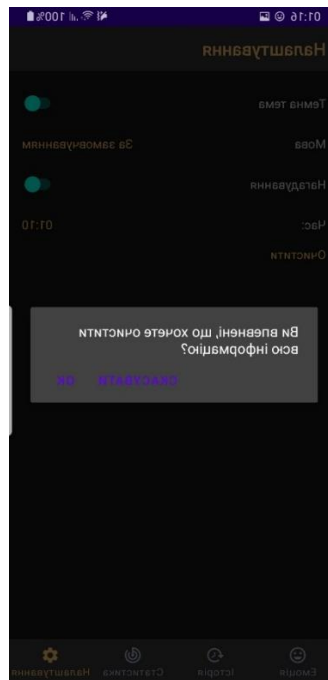


Figure 4.12 – Dialog box

5 TESTING OF THE DEVELOPED SOFTWARE

Software testing is the verification of the correspondence between the actual and expected behavior of a program performed on a final set of tests selected in a certain way. In a broader sense, testing is one of the techniques of quality control, which includes activities for work planning (Test Management), test design (Test Design), testing (Test Execution) and analysis of results (Test Analysis).

Test objectives. Increase the likelihood that an application designed for testing will work properly under any circumstances. Increase the likelihood that the application intended for testing will meet all the described requirements. Providing up-to-date information on the current state of the product. Therefore, software testing was carried out constantly as the functionality was created and the relevant information was displayed.

Basic testing methods. Testing is carried out by simulating different situations, based on special methods: black box, white box and gray box.

Black box – «Black box». We do not know the internal structure of the code and do not have access to the database. The process of researching software for bugs is carried out by generating test cases based on the analysis of the functional specification (a document that describes the desired characteristics of the system and the final result) or certain elements of the system.

White box – «White box». This is testing that takes into account the internal mechanisms of the system or component. Availability of detailed information about the internal component of the system – the structure of the code. Traditionally, white box testing is performed at the module level, but it is used for system integration testing and system testing, in-device testing, and pathways between devices. This test method cannot detect unfulfilled parts of the specification, no requirements, or the creation of the wrong application.

Gray box – «Gray box». Only some elements of software implementation are known. Thus, gray box testing is most in demand when QA engineers can gain

full access to project documentation and have enough time to prepare test cases with test scenarios. The maximum benefit from the use of this type of testing is observed when testing web applications, web services, graphical user interface, and when performing various functional tests of software focused on system and client security. Therefore, testing was performed in this way to thoroughly test the performance of the mobile application.

Types of testing:

- regression testing. Checking the functionality of the software after making changes;
- functional testing. Checking the product's compliance with functional requirements and specifications;
- load testing. Ensuring the reliability of the software under specified conditions. Performance measurement, system configuration determination;
- modular software testing. Full cycle of testing of individual components for the possibility of integration and use in larger systems. Testing of source code modules for compliance with design requirements;
- optimization testing. Eliminate bottlenecks by improving algorithms, as well as the use of reliable technologies;
- interface testing. Testing the user interface of the product to check the functional characteristics, ease of use, clarity and compliance with a particular style;
- analysis of source code. Analysis of the code in accordance with the requirements of the project;
- analysis of documentation. Analysis of specifications for completeness and reliability, verification of user instructions and software documentation;
- general (final) testing. Black box testing based on verification of the functionality that the tested product must have in accordance with the specification and documentation;

– in order to better test the software, the following types were selected: regression testing, functional, modular, optimization, source code analysis and general testing.

Test case Change the information on the record.

Steps:

- include the application «Emotion Controller»;
- switch to the «History» tab;
- click on any item/entry;
- edit date, time and extra info;
- click the «Save» button.

The result of the test is that the record was edited (see Fig. 5.1).

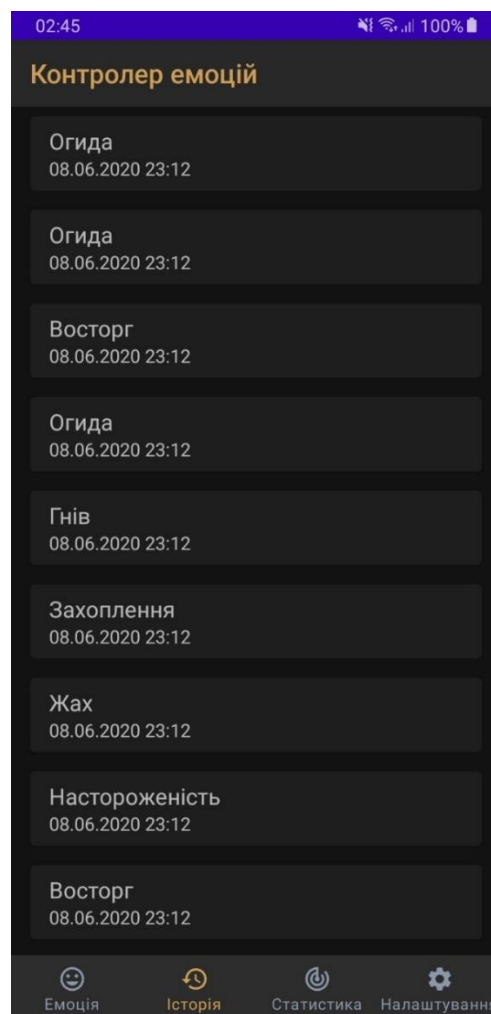


Figure 5.1 – Test result «Change of record information»

Test case Changing the theme.

Steps:

- include the application «Emotion Controller»;
- switch to the «Settings» tab;
- click on the switch in front of the inscription «Dark theme».

The result of the test is that the topic has changed (see Figure 5.2).

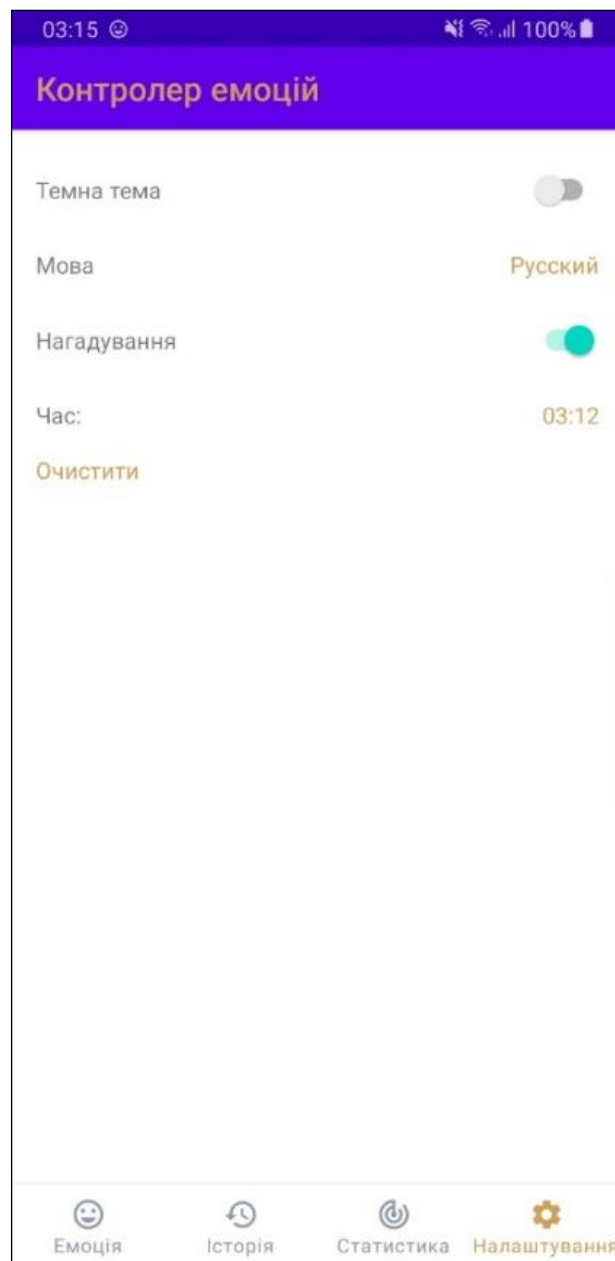


Figure 5.2 – The result of the test «Change theme»

Test case Generation diagram.

Steps:

- include the application «Emotion Controller»;
- add 15 records of different emotions;
- switch to the «Statistics» tab.

The result of the test is that the chart on the «Statistics» tab is generated (see Fig. 5.3).



Figure 5.3 – The result of the test «Chart generation»

CONCLUSIONS

In the process of performing the qualification work, the subject area, which in the context of this work is emotions, was performed / researched. The topic of emotional intelligence was analyzed, why it should be developed and why this work should live. A mobile application was developed to help the user to understand their emotions, keeping statistics with processed data / records.

Analogues of mobile applications with a similar direction were dismantled, the main shortcomings were identified and taken into account for the correct task of the vector of software system development for the development of emotional intelligence.

Also, in order to understand the system requirements that need to be monitored so that the system is understandable for expansion and easy testing, it was decided to make a specification for the project.

After analyzing all of the above, the project architecture design phase began. The choice of components and technologies with which this system will be implemented. Choose the main color palette. Design the first screens based on design, colors and light theme, and dark theme.

For a detailed description and clear design of the system, it was chosen to selectively design UML-diagrams that detail the essence of the functionality of parts of the system using graphical elements.

The developed mobile application provides the functionality and ability to keep daily records of their emotions through notifications over a period of time, view records, edit, reset data and adapt the visual part for comfortable use.

Result. Given all the above, we can say that at this stage the project is ready for use / release or extension of functionality.

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