

INSTRUCTIONS FOR USE



EN

YOUTHreach Application



Model: YOUTHreach App v4.5.0
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1. Introduction

These Instructions for Use support the safe and efficient use of the YOUTHreach application for the collection of passive and active data to investigate mental health in adolescents and young people. These instructions are intended to support a correct installation and use of the application.

All efforts have been made to ensure the latest and most accurate information to be included in these Instructions for Use. As part of the product's life cycle, these instructions will be updated without further notice by the manufacturer. Please be sure to always work with the latest version of the document.

These instructions are available electronically via a dedicated website (<https://youthreachrepo.ab-acus.com/>). Print versions are available upon request. Simply contact us by writing an e-mail to yreachsupport@ab-acus.eu.

Read the entire information manual for use before any use of the device. Periodically review the operating procedures and safety measures.

The YOUTHreach application has been designed and manufactured only for the intended use described in this manual (chapter 3 - *Intended use*). Any other usage is not allowed.

The most relevant warnings and precautions are also listed individually in Chapter 2 - *Safety Information: Warnings and Precautions*.

1.1 Standards




The YOUTHreach has been developed and tested according to the following regulations and standards:

- Regulation (EU) 2017/745 on medical devices (MDR)
- IEC 62366 -1, Medical devices - Part 1: Application of usability engineering to medical devices.
- IEC/TR 62366-2: Medical devices — Part 2: Guidance on the application of usability engineering to medical devices.
- IEC 62304, Medical device software — Software life cycle processes.
- ISO 13485, Medical devices - Quality management systems - Requirements for regulatory purposes.
- ISO 14971, Medical devices - Application of risk management to medical devices.
- ISO 24971, Medical devices - Guidance on the application of ISO 14971.
- ISO 82304:2, Health and wellness apps

1.2 Symbols

These instructions, as well as the product YOUTHreach, use symbols according to the following standards:

- ISO 15223-1:2021: Medical devices - Symbols to be used with medical device labels, labelling and information to be supplied - Part 1: General requirements
- Regulation (EU) 2017/745 on medical devices (MDR)

Symbol	Meaning
	Consult the instructions for use
	Warning
	Manufacturer

1.3 Terminology definition

1.3.1 Error messages

WARNING: designates a possible imminent risk. If it is not avoided, it could lead to death or serious injuries.

CAUTION: designates a possible imminent risk. If this is not avoided, it could lead to minor injuries.

NOTICE: designates a possibly harmful situation. If this is not avoided, the product could be damaged.

1.4 Incident reporting

An **incident** means any malfunction or deterioration in the characteristics or performance of the system, including use errors due to ergonomic features as well as any inadequacy in the information supplied by the manufacturer and any undesirable side effects.

It is our responsibility to assure safe and efficient products on the market. If the user feels that any malfunction of our system can be classified as an **incident** as described above, they should contact us immediately at yreachsupport@ab-acus.eu.

2. Safety Information: Warnings and Precautions



NOTICE: read all safety instructions before installing and operating the YOUTHreach application.



NOTICE: the application requires remote data transfer. The transfer occurs using a Wi-Fi connection where available, or the mobile data usage associated with the smartphone on which the application is installed and running.



NOTICE: application access credentials are uniquely assigned and must not be shared with anyone.



NOTICE: when the user consents, the application uses the sensors of the smartphone to gather information about the lifestyle. Such data is transferred remotely for analysis.



NOTICE: when the user consents, the application uses the smartphone's microphone for collecting data on voice acoustic characteristics. Microphone activation is signalled to the user, and the data is transferred remotely for analysis.



NOTICE: The application requires no less than 45 MB of memory on your phone to install.

3. Intended use

The YOUTHreach App is a mobile phone application meant to investigate youth (12-24 years) mental wellbeing by collecting digital data from various sources. The collected data are made available to the research centres enrolling them. The app has been developed within the Horizon Europe project YOUTHreach (<https://youth-reach.eu/>), GA 101156514.

The YOUTHreach App contains a mental health questionnaire and two activities to be spontaneously executed: 1) the typing of a short text to answer a general question or reflection which changes every day. From this activity we analyse the typing modalities, which we found from scientific evidence to be related to mental status. 2) the recording of user's voice while answering a simple general question (i.e. What colour are you feeling today?). The recorded data are elaborated by looking at the acoustic and semantic features of the speech.

The app is also capable of passive data collection from the sensors embedded in the smartphone, upon user consent. For certain users, the app also allows them to complete a set number of EMA questionnaires each day. Within the clinical trial of the YOUTHreach project, the app is meant to be used for 12 months by each user.

3.1 Contraindications

The system should not be used:

- For uses other than those indicated in the *Intended use* chapter
- As a medical device

3.2 Operating environment

To use the YOUTHreach application, it is necessary to meet the following prerequisites:

- Own a smartphone with Android operating system version 10.0+, or iOS version 14+.
- Have access to a stable internet connection (Wi-Fi or mobile data) on the device where the YOUTHreach application is installed.
- Have been assigned the credentials (username and password) from your reference research centre.

4. Product description

4.1 System overview

The YOUTHreach application has the main purpose of collecting data about lifestyle and habits from the young participants to the YOUTHreach clinical study in a “passive” way, i.e., acquiring data in the background.

Moreover, it proposes some voluntary activity of audio and text production, together with a clinical questionnaire, that can be “actively” performed by the user. It also allows certain users, as determined by the clinical centres, to complete the EMA questionnaires

4.2 System components

4.2.1 Smartphone Application

See in Figure 1 the overall information architecture of the YOUTHreach mobile application.

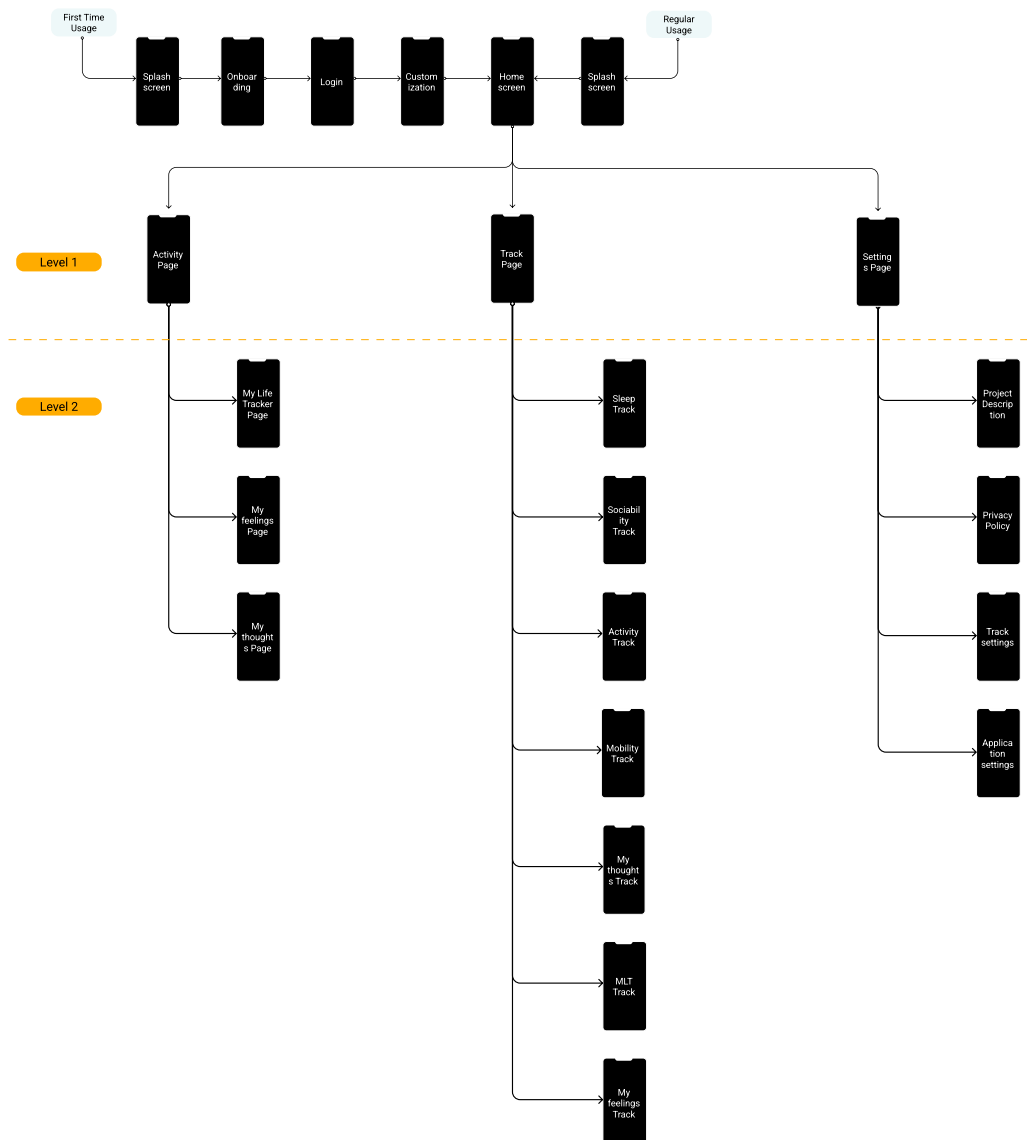


Figure 1: YOUTHreach app information architecture

According to the proposed information architecture, the YOUTHreach mobile app includes different functionalities hierarchically organised.

Starting from the top part of the figure there is an onboarding functionality, aimed at presenting the project and the main parts of the app that is administered just one time at the first access to the app.

Before starting, the user is also explained about the passive data collection features and is requested to provide the related permissions to access sensorial data. Permissions may be modified later at any time through the settings page.

The log in screen is also part of this introductory functionality, being the user requested to read and agree the privacy policy before any further action. Credentials may also be saved to speed up the login in the next visits.

Once entered in the core of the app, the passive background data acquisition is started.

Looking at the user interaction with the app, the functionalities can be divided in three main parts: activities performing, data tracking and settings.

The proposed activities involve the compilation of a mental health questionnaire (My Life Tracker), the recording of an audio file while answering a simple question (i.e., What colour are you feeling today?) and the keyboard typing for answering simple ice-breaking questions. All these actions are performed on a voluntary basis. Only after onboarding – that is, when the app is first installed – this page will also display a tab labelled 'EMA', which will allow users to conduct a demo session of EMA with the clinician. This session will not be saved and the tab will disappear immediately afterwards; for this reason, it is not included in the overall architecture.

Looking at the tracking, the user is allowed to track both the passive and active data. The passive data may be checked on a daily or weekly basis and consist of mobility features (computed from GPS data), physical activity (computed from accelerometer and pedometer data), sleep (computed from accelerometer data) and sociability (described in terms of mobile screen locks and unlocks, calls, and apps usage). Even the active data can be tracked for each single activity performance in each activity category (i.e., questionnaire, audio recording, typing acquisition).

The settings page allows to modify different settings of the tracking and the app. Also, information about the project and the privacy policy are included in this part of the application.

All the functionalities, agreed upon with the clinical partners of the YOUTHreach consortium, have been further discussed to make them usable by means of a suitable user experience.

The textual messages of the YOUTHreach application are made available in six national languages (Spanish, Estonian, German, English, Italian, Dutch).

In the following chapters of this user manual, all these functionalities are described in terms of user experience.

4.2.2 System architecture

Behind the mobile app design, the complete architecture of the YOUTHreach system is depicted in Figure 2. The overall system includes the YOUTHreach app (here described) as sources of live data; a devoted AI model (not part of this user manual) as the engine to provide clinical operators with additional information; the YOUTHreach webapp dedicated to the clinical/researchers operators to check acquired data.

The server to collect data acquired with the YOUTHreach mobile app is part of a virtual architecture set in Frankfurt (Digital Ocean provider).

The server architecture includes a data storage for storing of raw acquired data and a SQL database for storing of users related information including features extracted by the acquired raw data.

The functionalities of the AI model are not part of this user manual and are fully independent from the YOUTHreach mobile app here described.

This user manual deals only with the usage of the YOUTHreach mobile application.

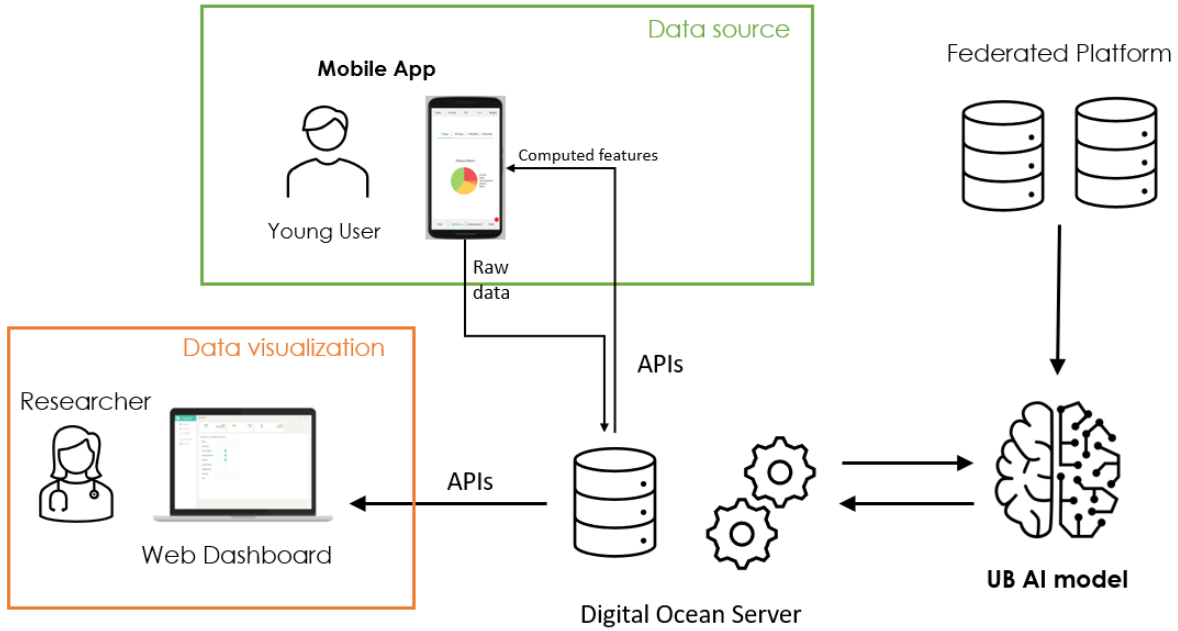


Figure 2: YOUTHreach system architecture

5. App installation and first usage

NOTICE: this section is intended for the young user and describes the actions he/she needs to perform to correctly use the system.

5.1 App download and installation

The YOUTHreach application is available on the Apple App Store under the name YOUTHreach App and on the devoted Ab.Acus repository at <https://youthreachrepo.ab-acus.com>.

To install the app on an Android device, you need to open the youthreachrepo.ab-acus.com website from your smartphone and tap on the button “Get it from Ab.Acus repo”. If requested (see Figure 3) tap on the “Download” button to trigger the download of the app on your phone. Search for and open the installation file. Tap on the “Install” button to start app installation.

NOTE: The phone may suggest you scan the file before installing; tap on “Scan app” button and then on “Install”. Once process it completed, you can tap on “Open” to launch the app.

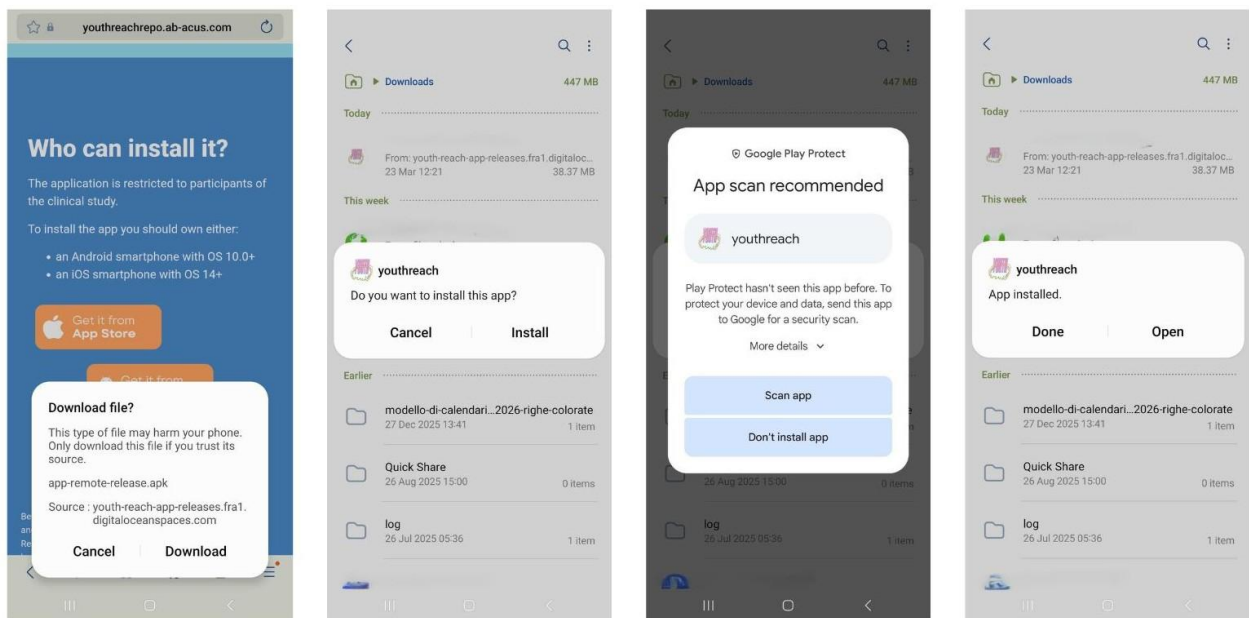


Figure 3: Android system installation process.

5.2 Application launch

If not done already, launch the YOUTHreach application by tapping on the application icon shown in Figure 4 and available on your homepage.



Figure 4: YOUTHreach app icon

5.3 Onboarding

At the first launch of the application, you will go through the onboarding procedure where you are informed about the YOUTHreach project and the main functionalities of the YOUTHreach application. Carefully read each page and tap on the “Next” button to go to the next one. If you want to come back to a previous page, you can tap on the “Back” button. On the last page of the

Onboarding section, the button “Get started” will show up: tap on it to complete the onboarding procedure. Please note that once you have set the language on the last page of this section, it cannot be changed within the app. Pages of the onboarding section are shown in Figure 5.

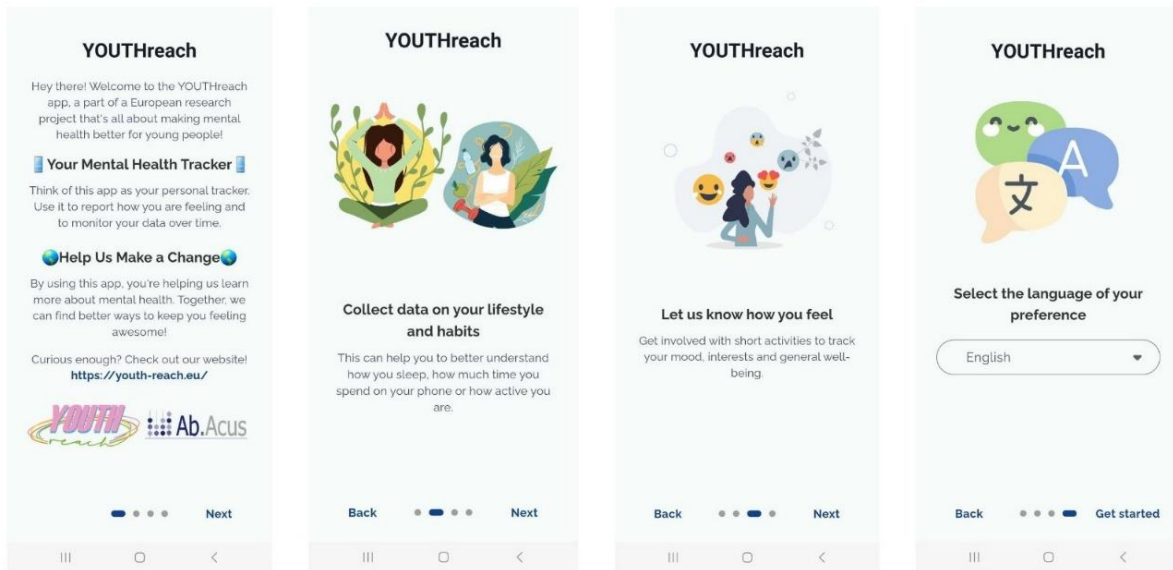



Figure 5: Onboarding pages. From left to right: description of the YOUTHreach project, monitoring lifestyle functionality, spontaneous activities execution.

5.4 Login

The YOUTHreach mobile app login page shows up after the onboarding section during the first launch, while, from the second launch of the application, it is the first page shown right after the launch. Login page is shown in Figure 6.

To correctly log in, fill the fields Username and Password with your credentials assigned by clinical centre. Tap on the  icon to see the inserted password.

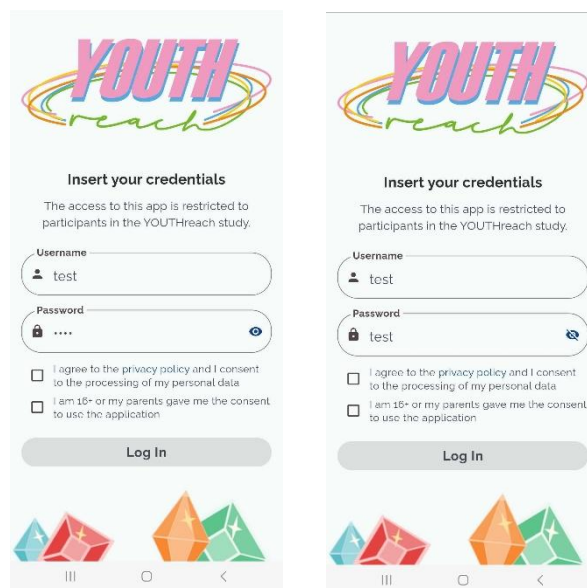


Figure 6: Login page.

By tapping on the text “privacy policy”, you are redirected to a brief summary of the YOUTHreach app privacy policy as shown in Figure 7. Read it carefully. If you are interested, you can tap on the

link icon that appears at the bottom of the page (scroll down until the end) to be directed to a web page containing the extended policy of the app.

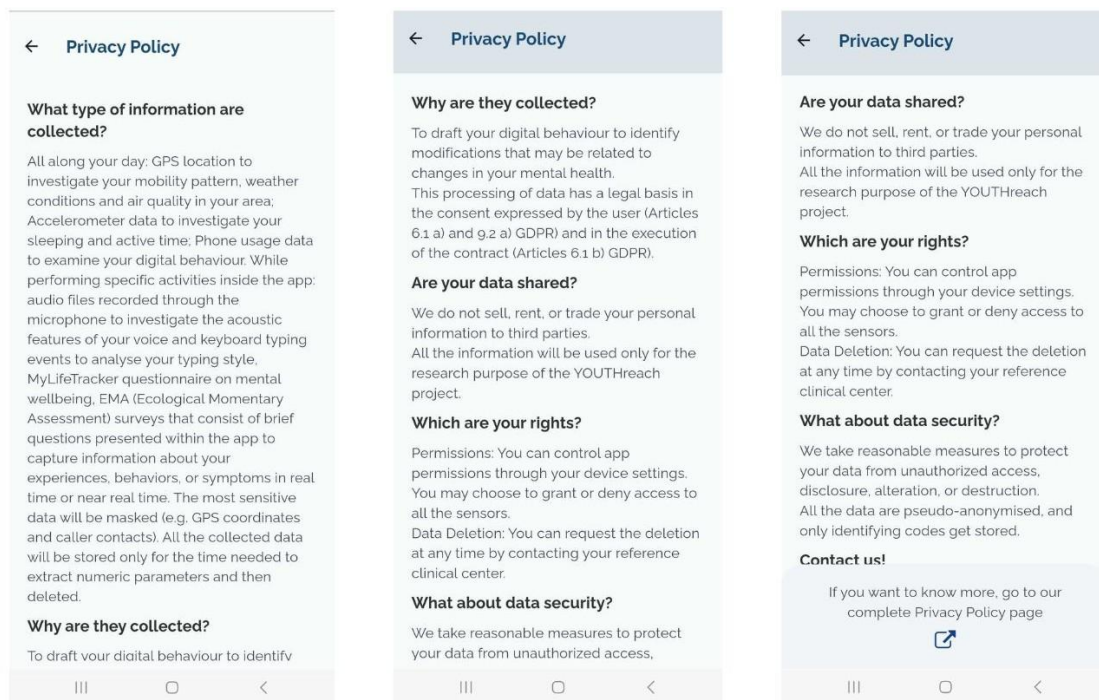


Figure 7: Summary of the YOUTHreach app privacy policy.

To complete the login procedure, you must flag the two boxes in the login page which state “I agree to the privacy policy and I consent to the processing of my personal data” and “I am 16+ or my parents gave me the consent to use the application”.

NOTE: if you are under 16, you need to ask your parents or legal guardian for the consent to use the application. After flagging both the checkboxes, the “Log In” button will be enabled, as shown in Figure 8. Tap on the button. If you inserted the correct credentials, a pop up should appear asking you if you want to save your credentials. Tap on “Yes” to have them memorized the next time you log in the app.

If you did not insert the correct credentials or if you have internet connection issues, a message should appear informing you of the problem. Go to the *Troubleshooting guide* of the manual to proper manage it.

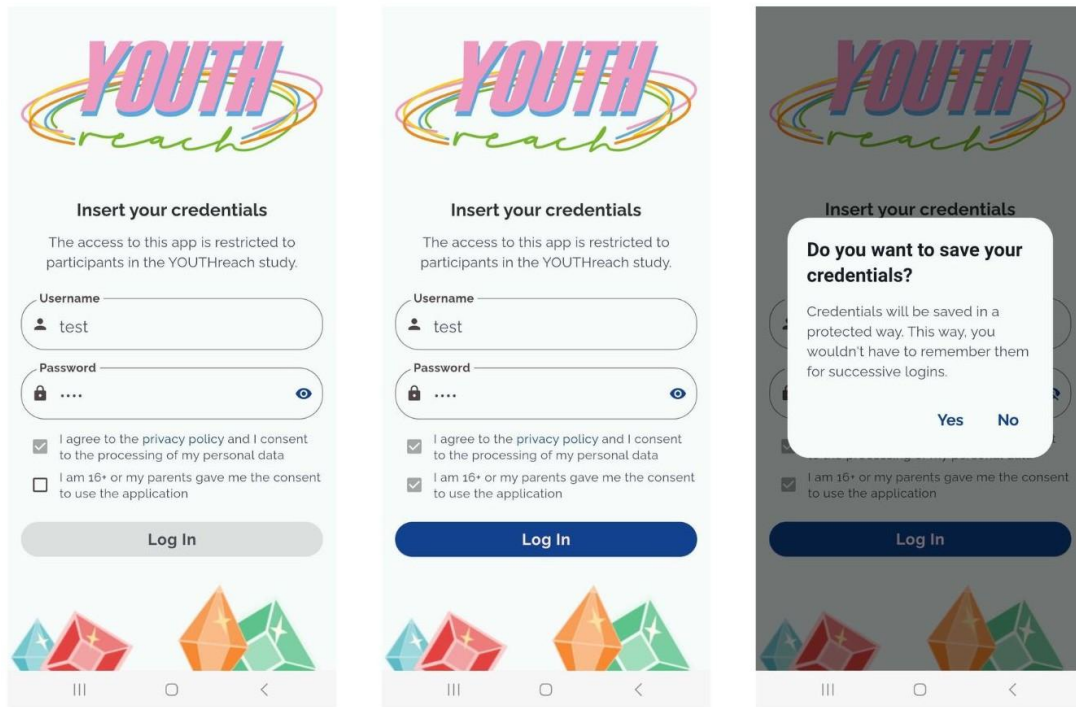
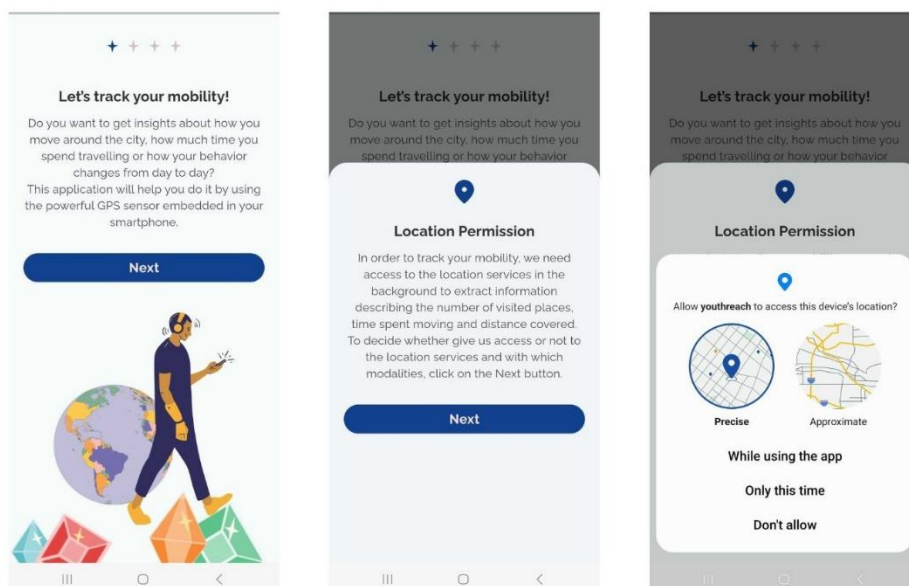


Figure 8: Left - Login page with credentials inserted and Privacy Policy box flagged. Middle – Login page with both boxes flagged and log in button enabled. Right – pop up to save account credentials.

5.5 Personalization – smartphone sensors

The personalization section of the app is shown only after the first log in. In the Personalization section you are asked to decide which data acquisition configuration you want inside the application. Each page of the Personalization section presents a different functionality of the application that involves data collection: you are asked to choose if you want this functionality to collect your data or not. You will be able to change this configuration at any moment inside the application in the settings (see the 7.3 Track Setting page description in this manual). We suggest choosing “Yes” to all the Personalization sections for a complete app usage experience.



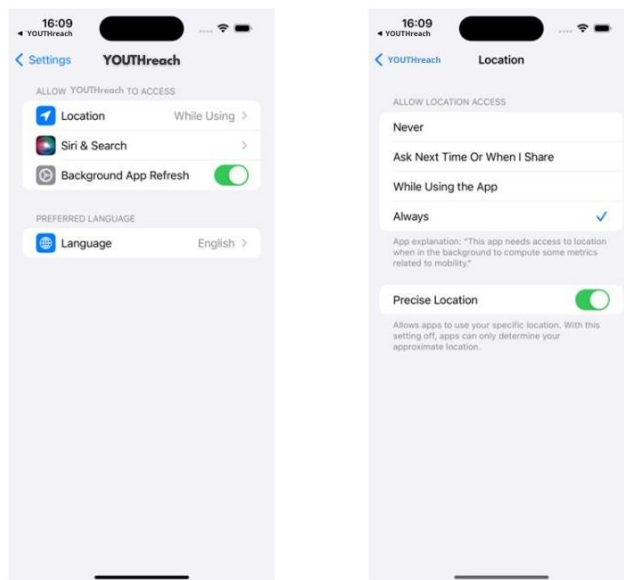
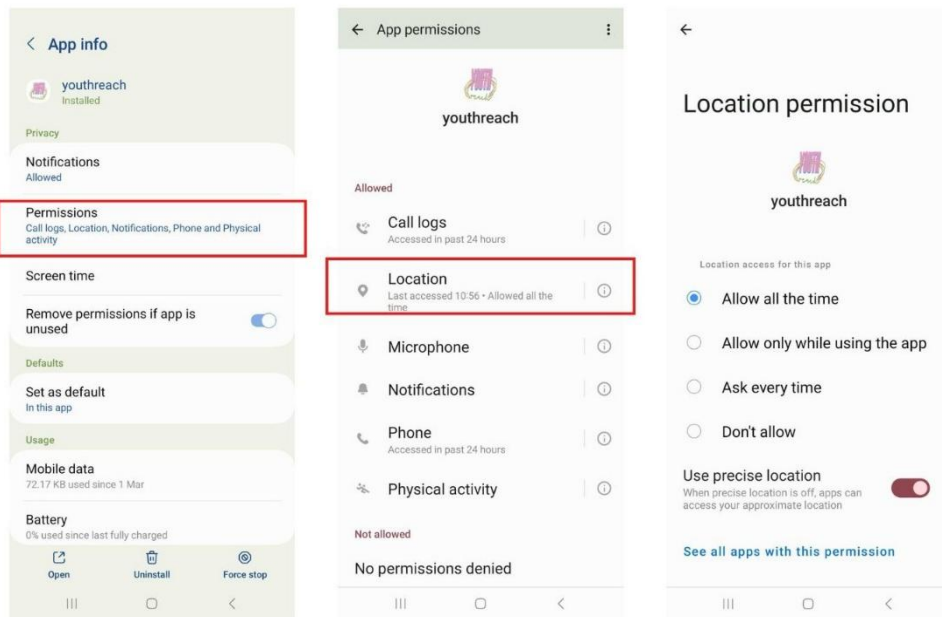


Figure 9: Personalization - mobility page and GPS permission request for Android (up) and iOS (down)

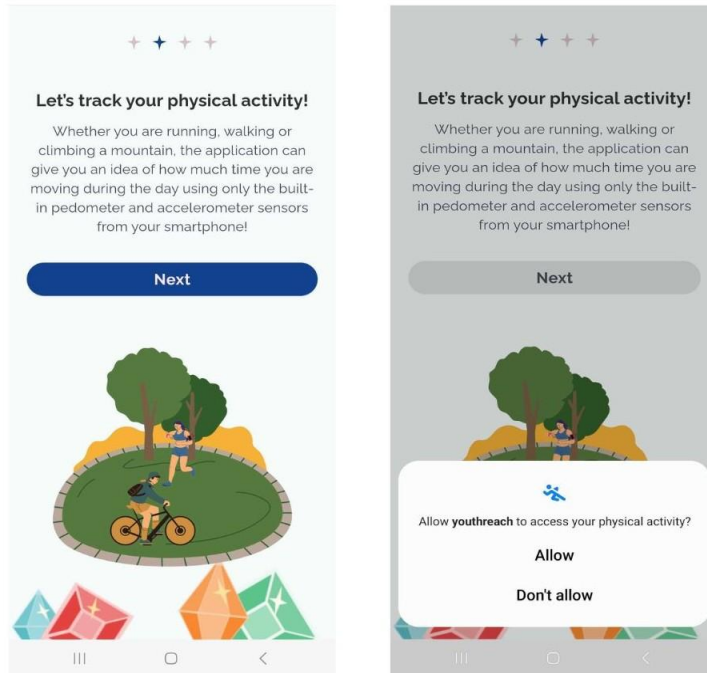


Figure 10: Personalization - physical activity page and physical activity permission request

The first page of the Personalization asks if you are interested in tracking your mobility habits (see Figure 9). Tap on the “Yes” button if you want to activate this feature, otherwise tap on “No”. If you tap on “Yes” you are shown a text explaining that the mobility tracking feature involves the collection of location data from the GPS sensor embedded in your smartphone. By tapping on the “Next” button you are asked to provide specific permission to access the Location data of your smartphone. The location permission page(s) may be different for different smartphone brands and operating systems. We suggest providing the broadest permission (e.g. always rather than when using the app) to have a better app usage experience. To provide the ‘always’ permission on Android devices you need to navigate the phone settings as shown in Figure 9: app info → permissions → app permissions → location → Allow all the time.

To provide the ‘always’ permission on iOS devices you need to go to the app settings and select: Location → Always.

The second page of the Personalization asks if you are interested in tracking your physical activity (see Figure 10). Tap on the “Yes” button if you want to activate this feature, otherwise tap on “No”. If you tap on “Yes” you are asked to provide specific permission to access the physical activity data of your smartphone.

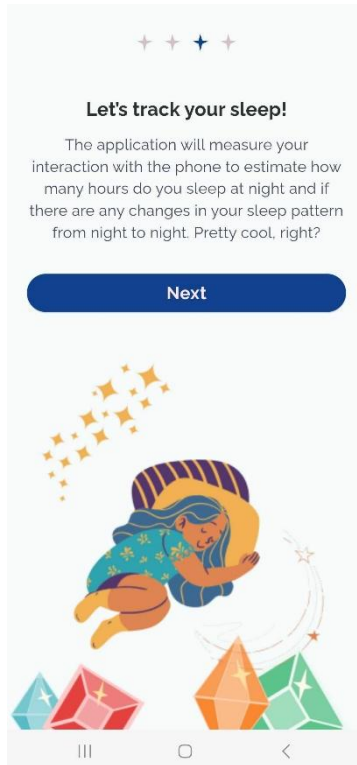
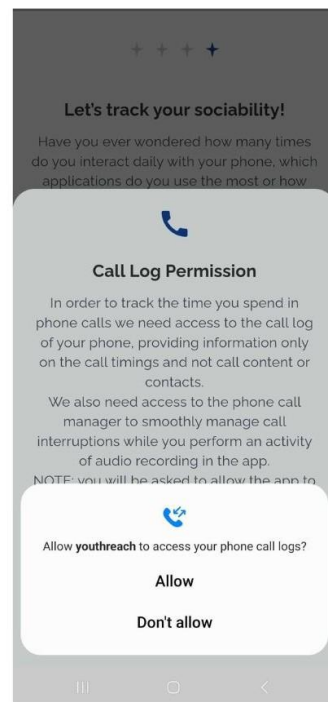
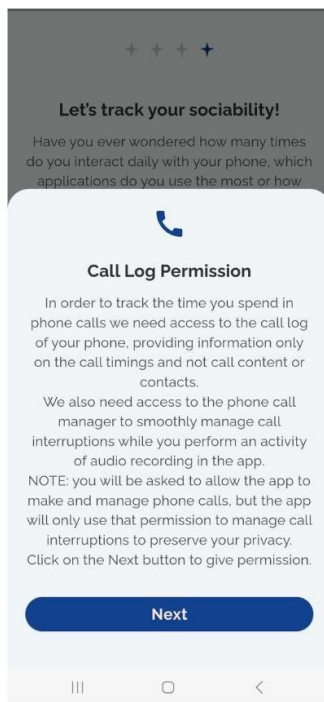
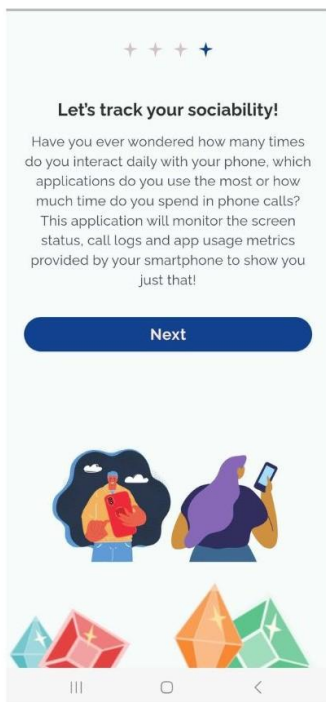


Figure 11: Personalization - sleep habits page



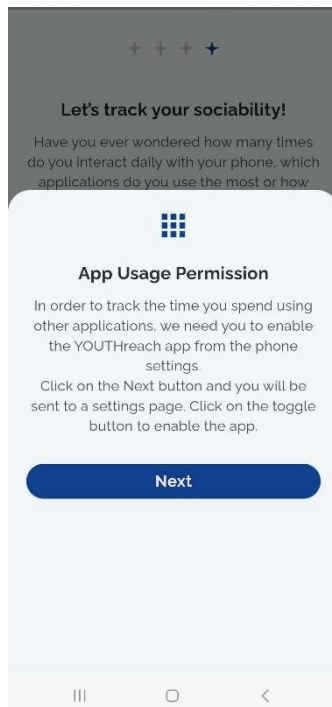


Figure 12: Personalization - sociability page and permissions request

The third page inquires about your permission to track your sleep habits (see Figure 11). Sleep habits are computed by looking at the data coming from different sensors embedded in your phone like the accelerometer recording the motion of the phone or the light sensor evaluating environmental light.

The fourth page of the Personalization is displayed only to Android users and asks if you are interested in tracking your sociability (see Figure 12). Tap on the “Yes” button if you want to activate this feature, otherwise tap on “No”. If you tap on “Yes” you are asked to provide specific permission to access the call log of your smartphone and the app usage information. The procedure to provide app usage permission may be different for different brands and operating systems. In more recent devices, the permission might be disabled at first, but it can be enabled directly during onboarding by tapping the relevant flag in setting page, as shown in Figure 13.

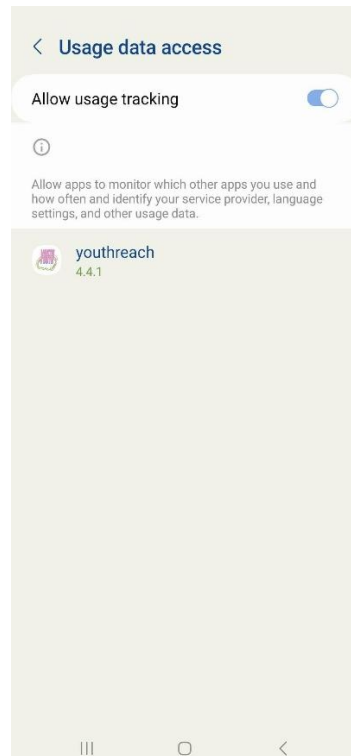


Figure 13: App usage permission enabled in settings.

5.6 Personalization – battery and notifications

The last step of the permissions setup is the request to ignore battery optimization (only for Android) and to enable notifications (see Figure 14).

By accepting to ignore battery optimization, you can allow the app to run a long-lasting data collection and reduce OS interferences. In some device models it is a simple pop-up, while in others it is a settings page where to select Battery → Unrestricted.

Notifications are used within the application as reminders of activities to be performed (see *My life tracker* section), as reminders to re-open the app for restarting data collection and to inform you on the status of the data collection service (see *Background data collection* section).

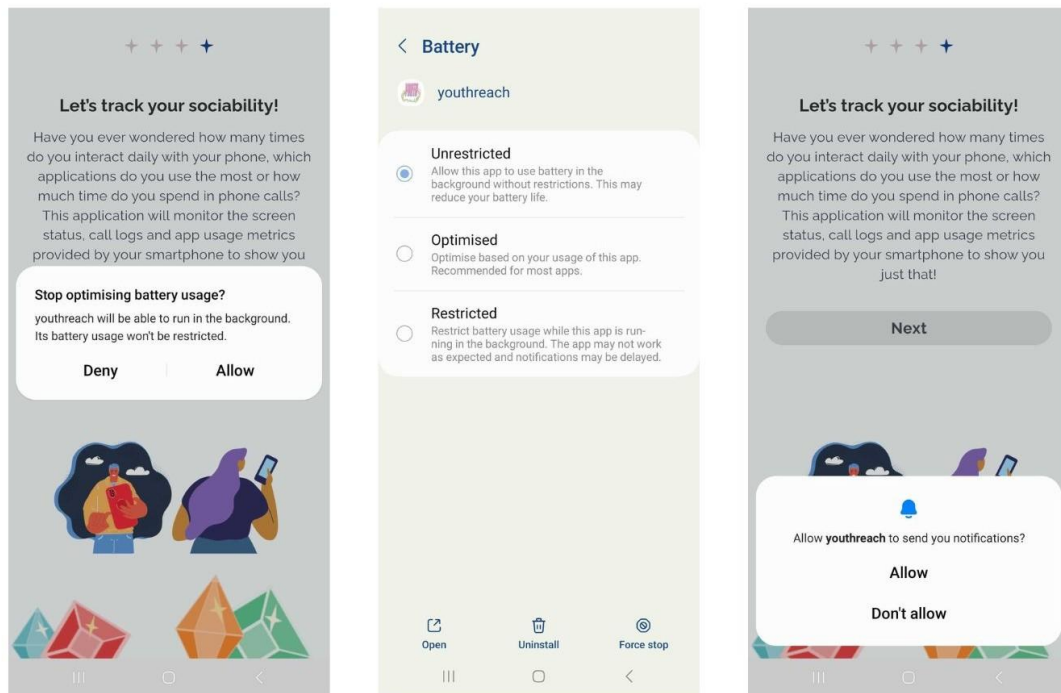


Figure 14: Left –Ignore battery optimization pop up. Middle – Battery unrestricted from settings. Right - Notification permission request

Note on Notification

Depending on which clinical trial you are part of, there are two types of notifications you may receive (if you are unsure which trial you are part of, please ask your treating clinician):

- **SELFIE** → As will be explained in more detail in section 6.1.4 *Ecological Momentary Assessment*, participants in this study receive two types of notifications: one type that alerts them that it is time to complete an EMA questionnaire (8 per day on the days specified in the protocol) and another that is received in the days leading up to the new period of app use (3 notifications in the week preceding the new period), which asks the user to confirm or set the time range during the day in which to receive the first type of notification.
- **YEAH** → Participants in this study receive two notifications during each of the four study periods defined by the protocol. The first notification is sent at 6.00 pm on the day before the start of the period, informing participants that the new period will begin the following day. From that point onwards, participants are encouraged to use the app for the next two weeks. At the end of the two weeks, specifically at 8.00 pm on the final day, a notification is sent with a message congratulating the user on completing the usage period in question.

6. Daily usage

NOTICE: this section is intended for the young user and describes the actions he/she needs to perform to correctly use the system.

6.1 Activities

The Activities page (see Figure 15) is the first one showing up after the personalization process for the first access, and it is the first one showing up after the login for the other accesses. On this page you will find activities that you can execute daily. Pressing the information button, you will get full description of the activities with the exception of the EMA card; the reason for this (along with the card itself) is explained in section 6.1.4 EMA card. When an activity is not available (because you have already performed it on the same day) you get a warning message.

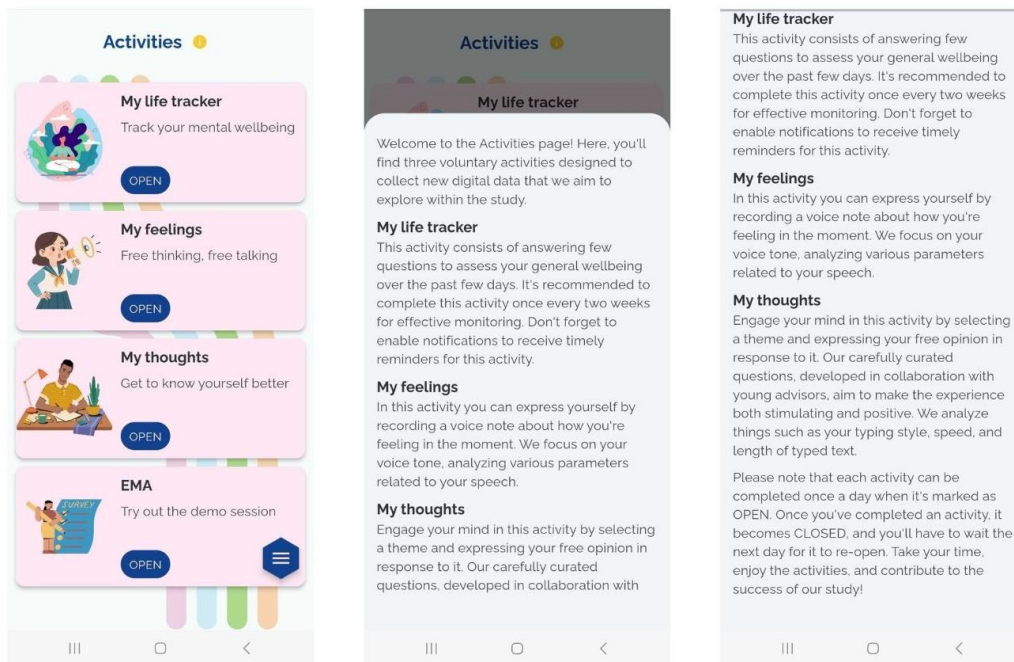


Figure 15: Activities page

6.1.1 My life tracker

“My life tracker” activity allows you to answer some questions about your wellbeing through a scientifically validated questionnaire (see Figure 16).

The questionnaire consists of five general questions about your wellbeing. Once selected the activity, the first question is shown. You must answer on a scale from 0 to 100 by moving the slider. When you have scored the first question, the “Next” button is enabled to allow you to move to the second one and so on. From the second question onward, you may also move back to previous questions by tapping the “Back” button.

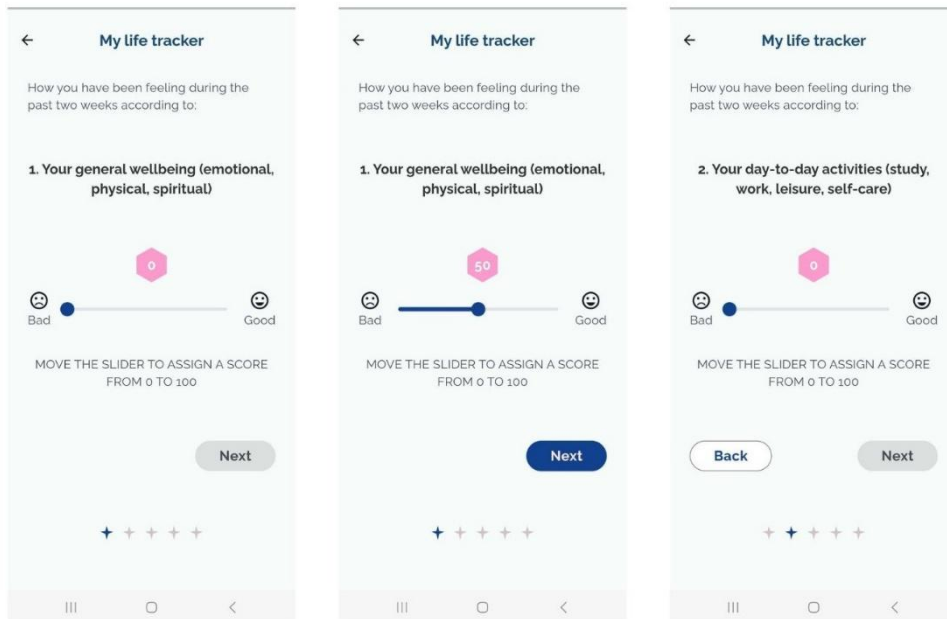


Figure 16: My life tracker questionnaire

Once the questionnaire is completed, all the scores are displayed, and you may decide to send them or go back to questions (Figure 17).

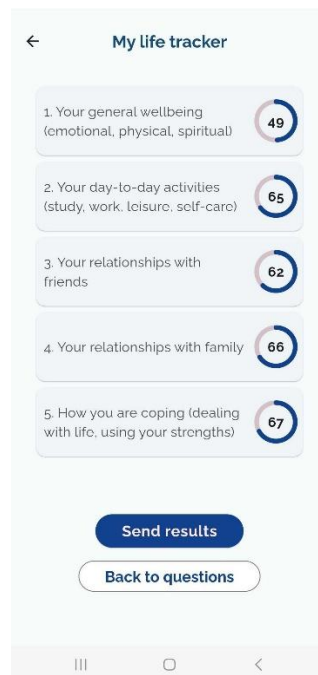


Figure 17: My life tracker final page

6.1.2 My feelings

By selecting “My feelings” activity from the “Activities” page, you are redirected to the page displayed in Figure 19. Here you are requested to record your voice while answering the question “What color are you feeling today? Describe in a few sentences why you chose that color”. To start the recording, tap on the microphone icon.

The first time you will be shown a pop up explaining you need to provide permission to the microphone to record your voice. Android users will also have to give permissions (if not already

done in the personalization section) to the phone call manager to effectively manage call interruptions during the audio recording (see pop ups in Figure 18).

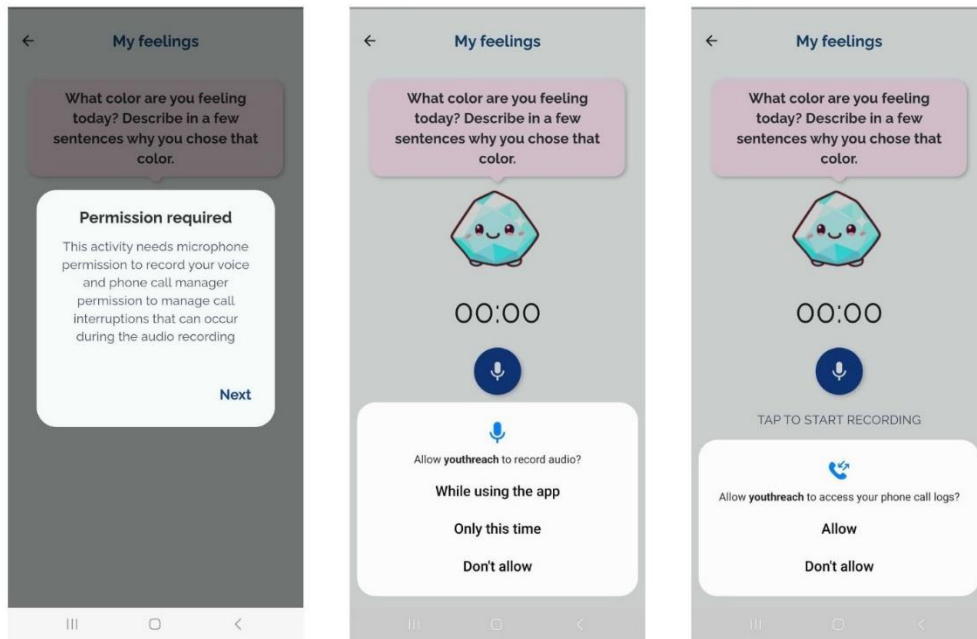


Figure 18: Microphone and call log permission pop ups.

After all permissions have been properly provided, the timer will start, and your voice will be recorded. The microphone icon will be changed to a square icon that you have to tap to stop the recording. Once you finish, you may listen to your recording before sending and if you are not happy with it, you may delete it. Otherwise, you may send it. Tap on the “Send” button to complete the activity. This activity is a daily activity, so if you do it, it will become available again only the day after.

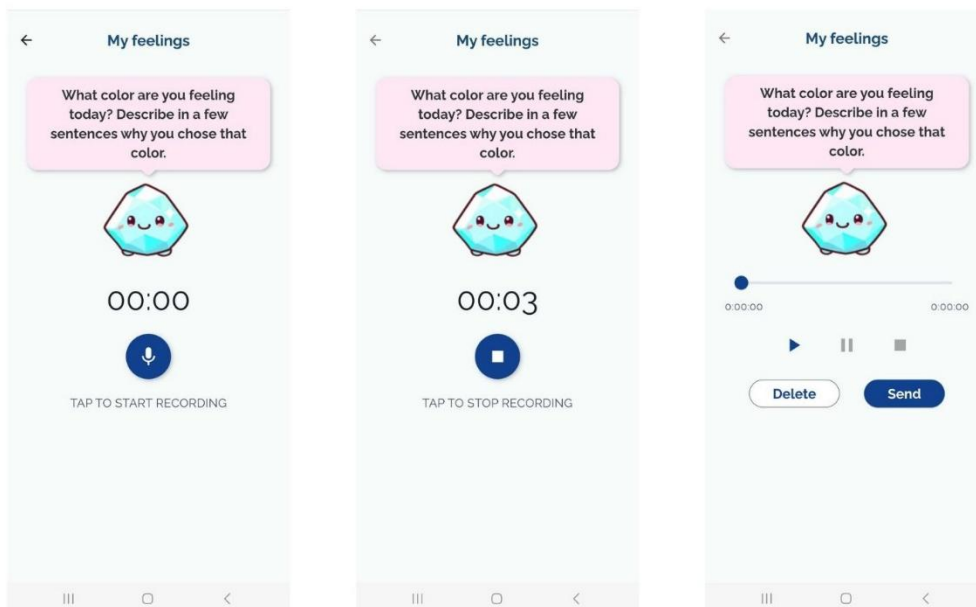


Figure 19: My feelings activity. Left – start recording. Middle – stop recording. Right – play the recorded audio.

6.1.3 My Thoughts

By selecting the “My thoughts” activity from the “Activities” page, you are redirected to the page displayed in Figure 20. Here, you are asked to select a question to answer among three choices. To

select the question, you have just to tap on it. Then, you may input your answer in a devoted text box. Emojis and other graphical stuff are not allowed, only text with a maximum of 1000 characters. Once you have completed your text, you may tap the button “Send” to submit it.

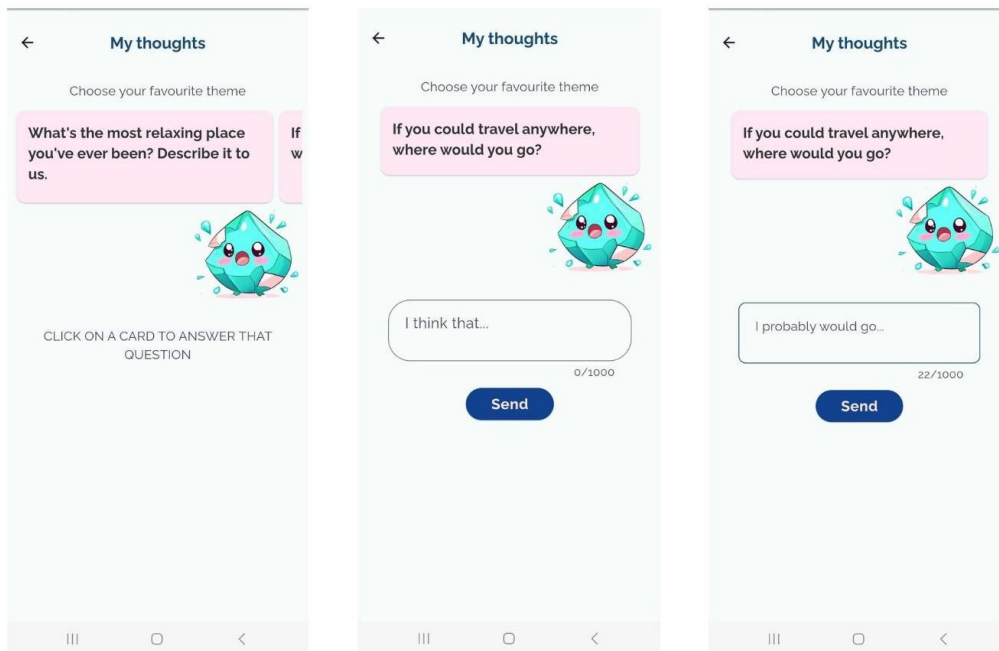


Figure 20: My thoughts activity

6.1.4 Ecological Momentary Assessment

If you are part of the SELFIE study, you also have the option to complete the Ecological Momentary Assessment (EMA) within the app (if you are not, you can skip this 6.1.4 section). In this case once the onboarding phase is complete, the activity page will also display a card labelled ‘EMA’ as shown in Figure 15, which should be used as a demo session. Tap on the EMA card to start the demo session and to configure everything required for the EMAs to function correctly during the study, (which will now be explained). Please note that the data related to this demo session will not be stored and the card will disappear immediately afterwards. The EMAs (as shown in the info button that always appears next to the questions, Figure 21-a) consist of a series of questions that must be answered by moving a slider and thus assigning a score from 0 to 100 depending on the question, or by selecting the answer deemed most appropriate (Figure 21-b and c). When you have scored the first question, the “Next” button is enabled to allow you to move to the second one and so on. From the second question onward, you may also move back to previous questions by tapping the “Back” button.

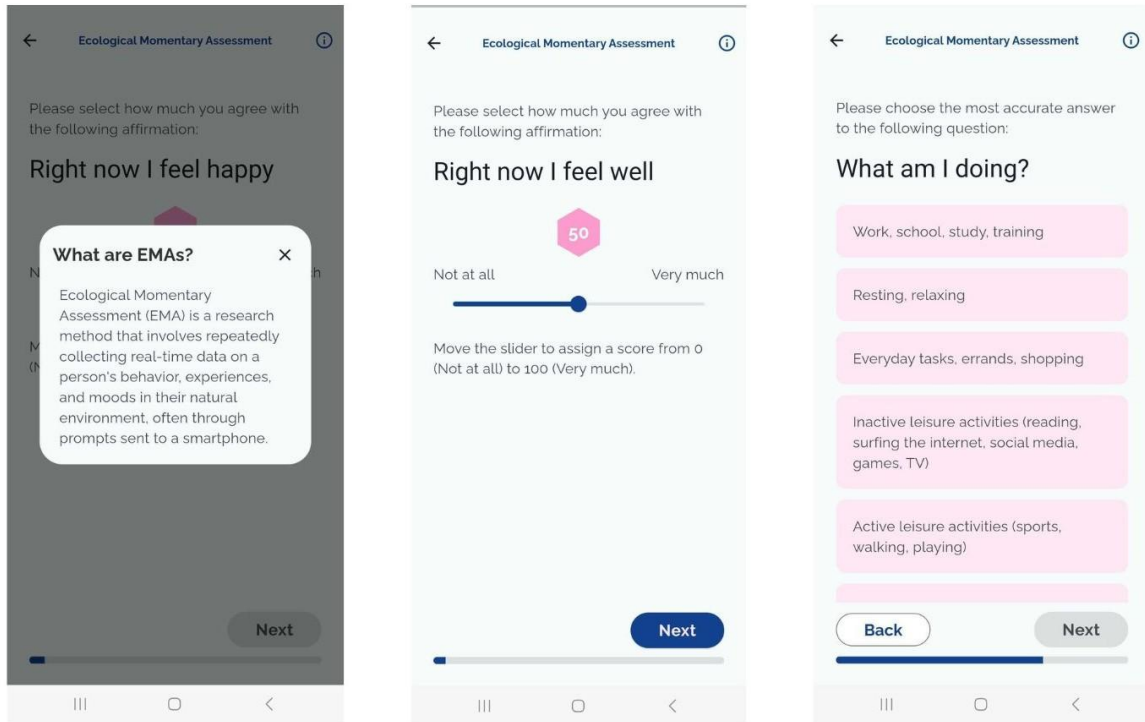


Figure 21: Ecological Momentary Assessment questions

At the end of the question demo sequence, at the bottom of the summary, users are given the option to set the time range during which, on the days the EMA is administered, they will receive the 8 daily notifications (Figure 22).

This time range must be at least 12 hours long; otherwise, it will not be considered valid and the selection will fail with a red error message. It is very important to note that the selected time range cannot be changed once the EMA has started (i.e. during baseline, t1, t2, t3), but only between one period and the next.

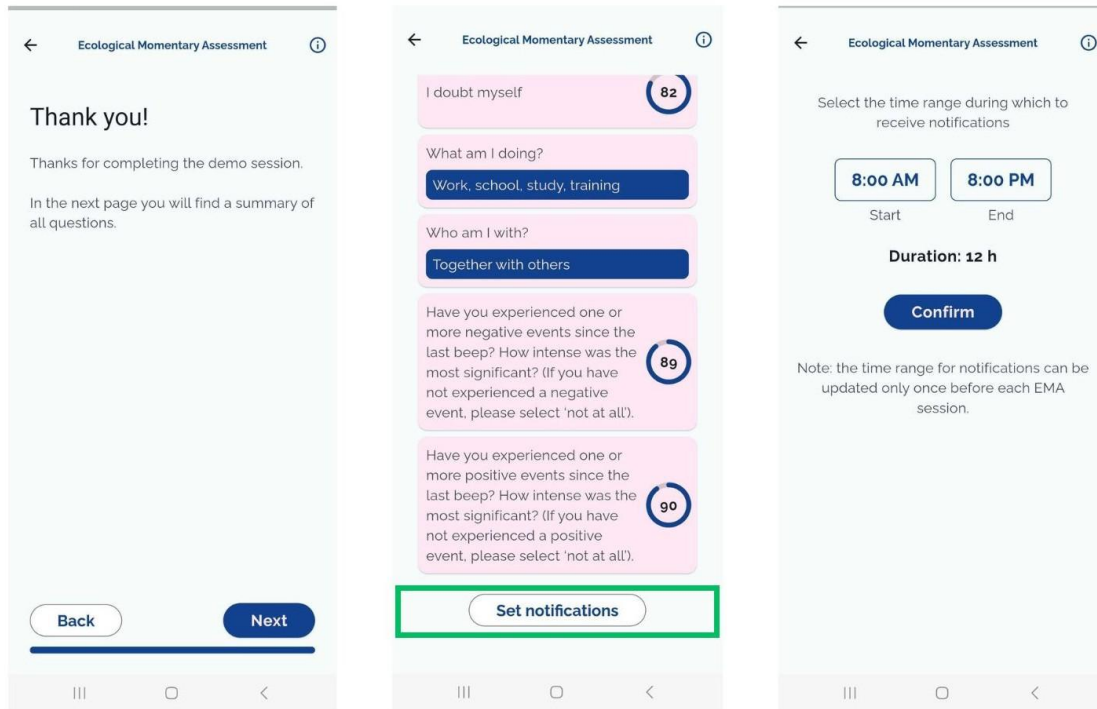


Figure 22: Set notification time after demo session

NOTE: It is absolutely essential to complete the 'demo' session and set the time range at the end to activate all EMA functionality! All notifications will only start once this has been completed. The EMA administration periods will follow those set out in the clinical protocol, namely 8 assessments per day for 6 days, repeated 4 times (0+1 days (baseline), 3 months + 1 day (t1), 6 months + 1 day (t2), 12 months + 1 day (t3)). The first period begins the day after the completion of the demo session.

During the periods when the EMA is being administered, you will receive 8 notifications each day at random times within the time slot you have selected. These notifications, which ask if you have a moment to complete the EMA (as shown in Figure 23), allow you to perform one of the following actions when tapped: say yes, in which case you are redirected directly to the questionnaire to be filled (the same of the demo session, but this time data will be stored and there is no setting functionality at the end of the summary); say no (the notification disappears); postpone the

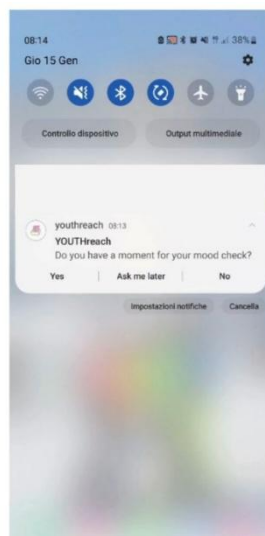


Figure 23: EMA notification

notification (ask me later option). In the latter case, the notification will reappear after 15 minutes and, this time, can only be accepted or declined.

If no action is taken on the notification within 15 minutes, tapping the notification will take the user to the app's home page, where a pop-up will inform the user that too much time has elapsed and that it is no longer possible to complete the EMA associated with that notification (the questionnaire will be considered 'missed'). The user will have to wait for the next notification.

In the week preceding the EMA period (in the case of t1, t2 and t3), you will receive 3 notifications on 3 different days at 8 am, asking to confirm or reset the time range during which receive the 8 EMA notifications throughout the day in the immediately following EMA period. You must tap this notification so that can be redirected to the app's settings section, where the time range can be changed/confirmed (Figure 24). This specific section is disabled outside these periods.

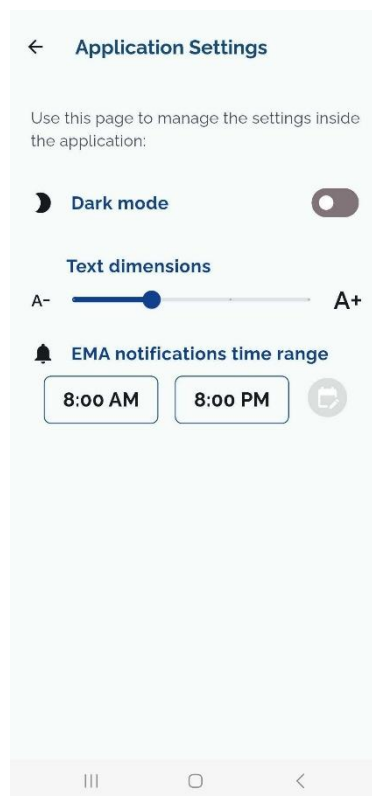


Figure 24: setting section to set time range for EMA

It is important to note that at least one of these 3 notifications must not be ignored, because if the time range is not set/confirmed, the notifications for the EMA period will not be triggered. Note that, regardless of the day on which this action is performed on the time range, the EMA period will begin the following week (corresponding to the clinical protocol period).

IMPORTANT: Never uninstall the app from phone. Even when the app is not in use, simply pause sensor data collection via the settings. This way, the app will not interfere with normal phone use or affect the user, but information regarding EMA scheduling will not be lost.

6.2 Navigation

To navigate from the “Activities” page to other pages, you must tap the routing button in the bottom right part of the screen (Figure 25). Once the button is tapped, a complete menu is displayed. The menu allows to access the “Activities” page (that we already described), the “Tracking” page to track your lifestyle from the sensorial data and the “Settings” page to change general settings of the applications.

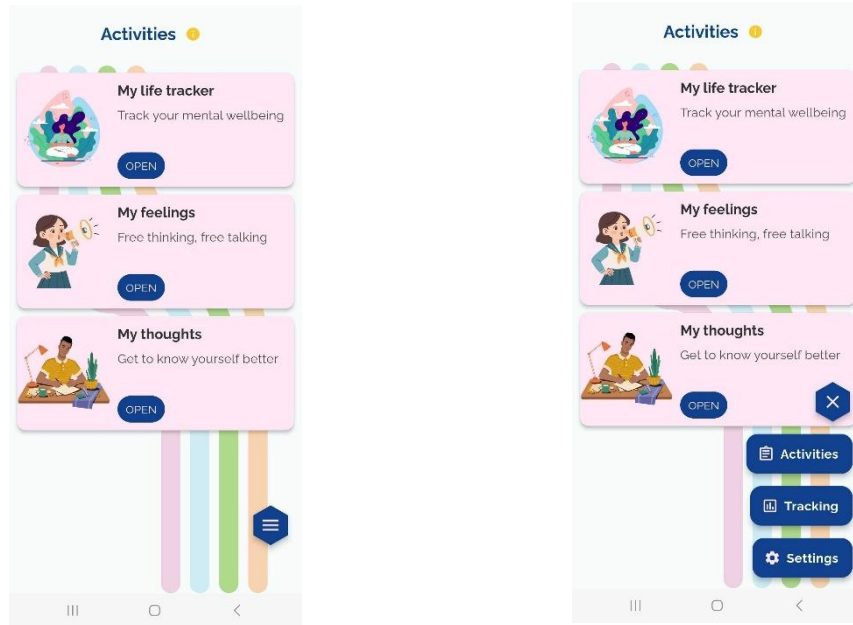


Figure 25: Navigation through sessions

6.3 Tracking

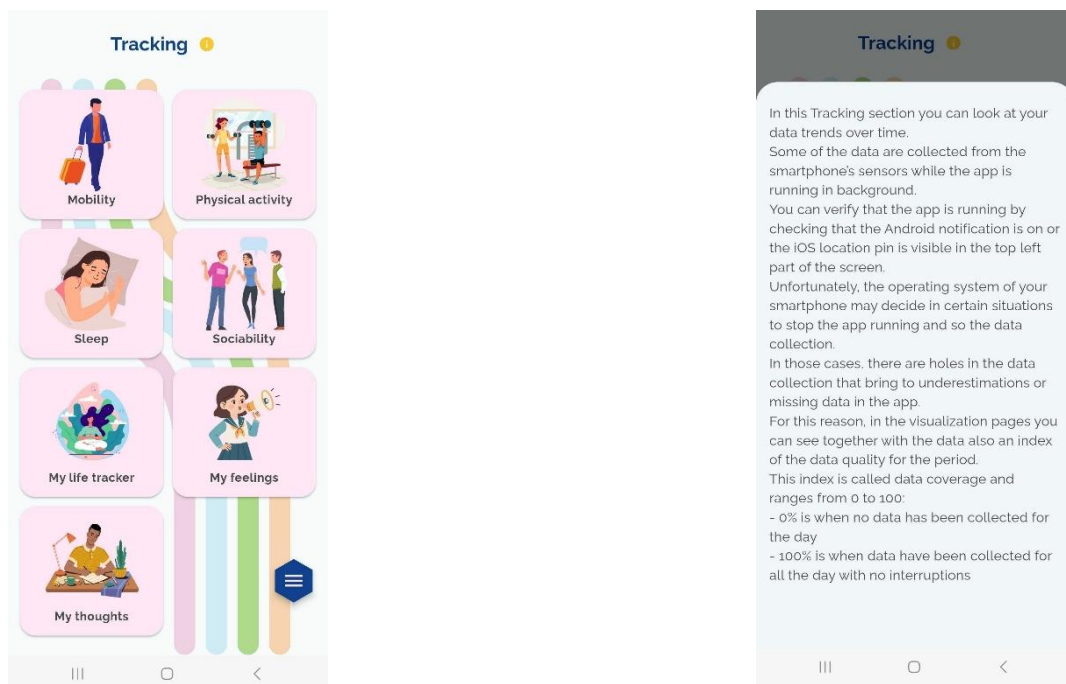


Figure 26: Tracking page

The Tracking page (Figure 26) allows you to access all the data that are acquired by means of the YOUTHreach app for their visualization. The cards you may access in this page are labelled “Mobility”, “Physical Activity”, “Sleep”, “Sociability”, “My life tracker”, “My feelings”, “My thoughts”. NOTE: The “Sociability” card is only available to Android users.

These items include both all the data collected in background and the data coming from the voluntary activities of the “Activities” page. Tapping the information button, you will get full description of how to check data are properly collected and how to interpret data missing.

If you expressed your interest in collecting a certain type of data but did not provide all the permissions required for a proper acquisition, another pop-up message will be shown giving you the possibility to enable the required sensors (Figure 27 – b). Moreover, if you provided all the permissions required to collect a certain type of data but, after that, you stopped the actual collection from the “Track Settings” page (see dedicated section), a different type of pop up will be presented giving you the possibility to re-activate the data collection (Figure 27 – c).

Finally, for what concerns data related to the activities that can be performed within the app, if no activity was performed ever, a message will be displayed informing there are no data to show (Figure 27– d).

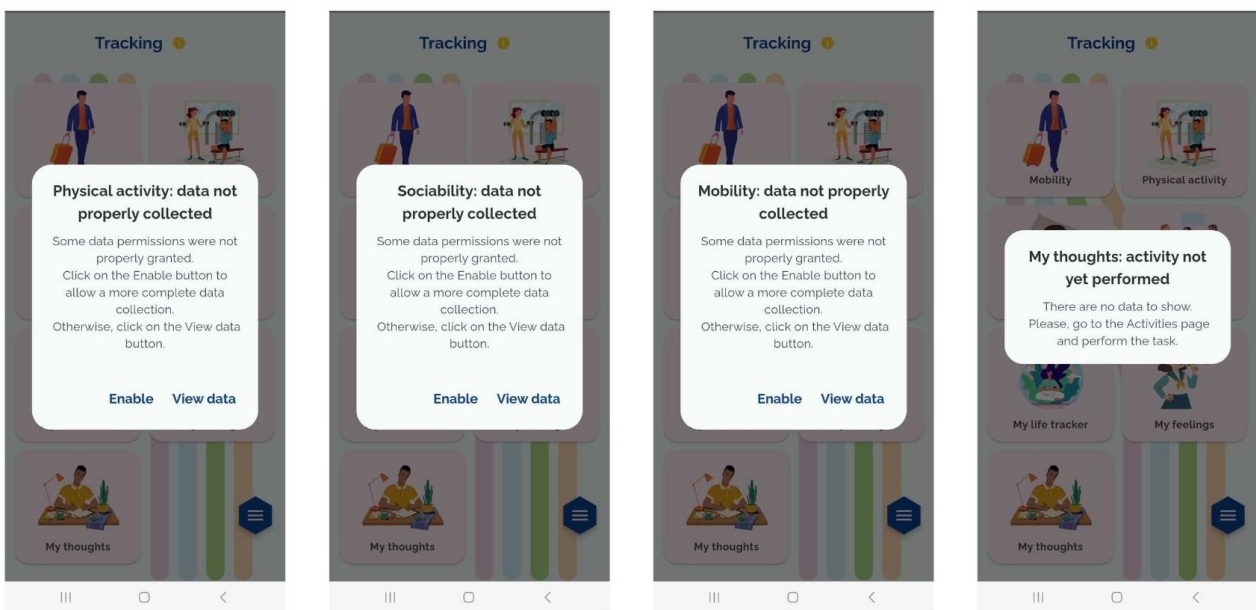


Figure 27: a – data not available pop up; b – data not properly collected pop up; c – data collection is not running pop up; d – activity not yet performed pop up.

6.3.1 Mobility

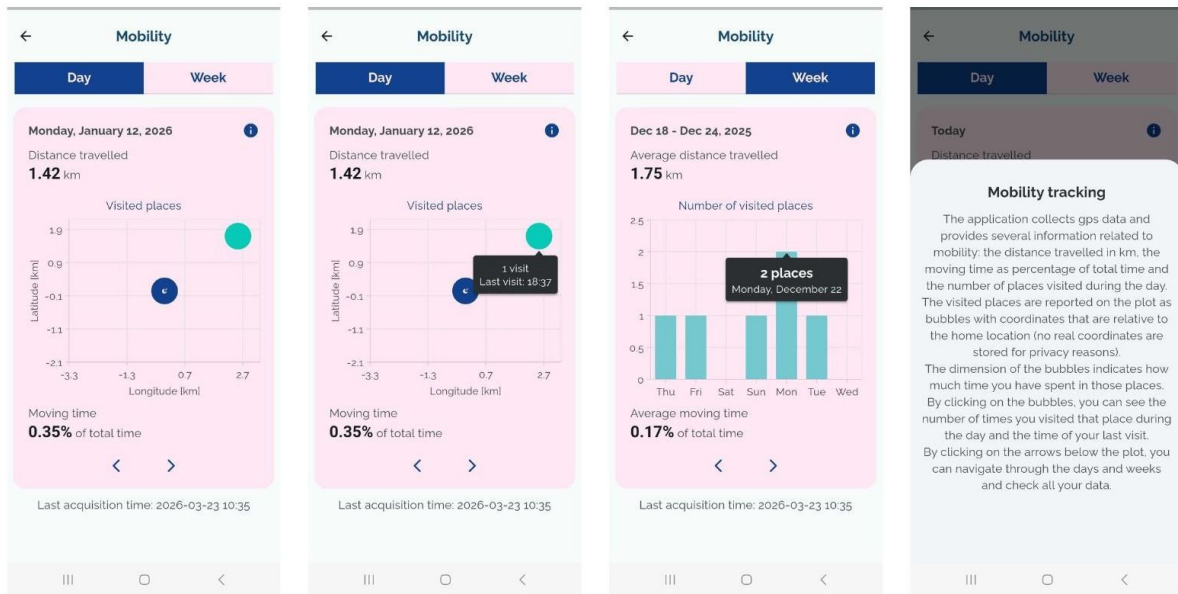


Figure 28: Mobility page

Within the “Mobility” page, the GPS data are displayed (Figure 28). Data are displayed day by day in terms of bubbles showing the most visited places. For each place, the number of visits and the time overall spent there are displayed. Moreover, daily distance travelled, and percentage of moving time are also shown.

Data are displayed also on a weekly base where, for each date, the number of visited places is reported. A general information on average distance travelled and moving time over the week are reported. Tapping the information icon, a brief description of the data is reported. In the upper part of the page, you can select if you want a day/week visualization. Below the graph you can navigate back and forth in time using the left and right arrows.

6.3.2 Physical activity

Within the “Physical Activity” page, the accelerometer data (describing the movement of the phone) plus steps are displayed (Figure 29). Data are displayed day by day in terms of columns showing the activity in percentage on the total time hour by hour, that means that 100% indicates that the phone has been moving for the entire hour rather than subperiod (e.g. 10%, 50%, ...). Moreover, an indication on the total steps performed is provided above the plot.

Only for Android users, under the plot an indication is provided on data coverage, which is the percentage of time data was properly collected over the 24 hours.

Data are displayed also on a weekly base where, for each date, the daily activity, always as a percentage of the overall time, is reported, together with the average number of steps. Tapping the information icon, a short description of the data is shown. In the upper part of the page, you can select if you want a day/week visualization. Below the graph you can navigate back and forth in time using the left and right arrows.

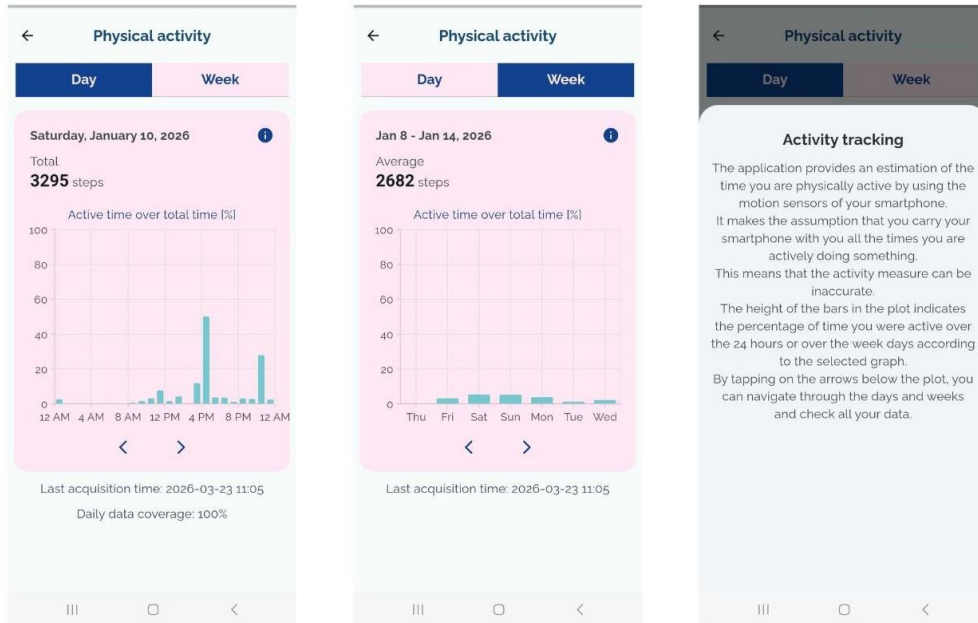


Figure 29: Physical activity page

6.3.3 Sleep

Within the “Sleep” page, the sleep time computed by looking at the behavior of several sensors like the phone movement, the environmental light (when available), and the phone usage is displayed (Figure 30). Data are displayed on a weekly basis in terms of columns showing the sleep interval (sleep onset, awake time, and sleep duration). If some awake periods are identified during the night, a double information on time in bed and time asleep is provided. Moreover, only for Android users, the tooltip on the chart also provides an estimation of the data coverage during night, that can be used to evaluate the goodness of the sleep computation (Figure 30 - middle). Tapping the information icon, a brief description of the data is shown. Below the graph you can navigate back and forth in time using the left and right arrows.

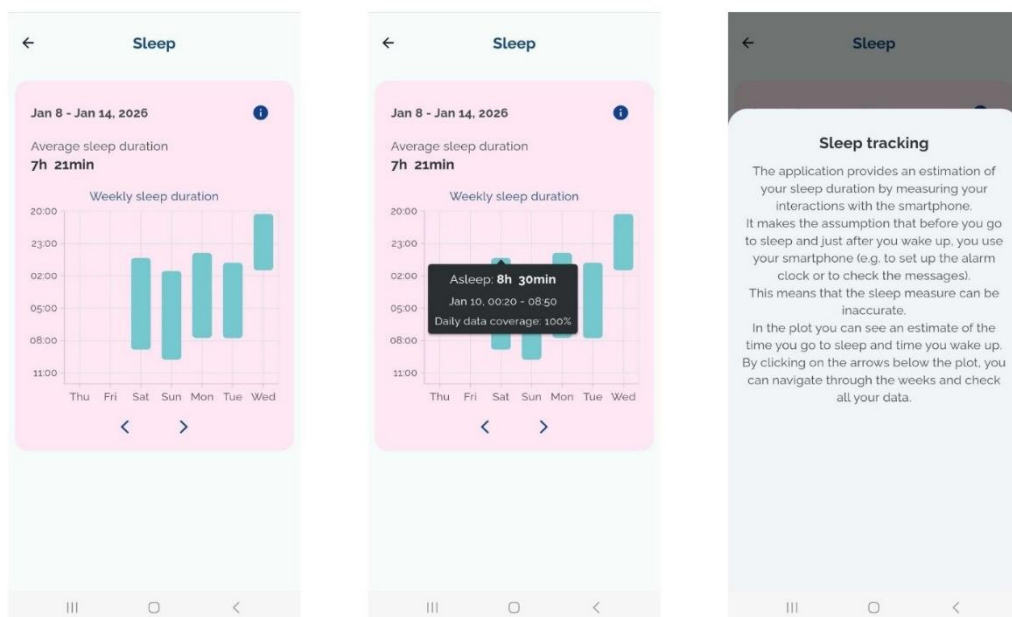


Figure 30: Sleep page

6.3.4 Sociability

Within the “Sociability” page (available only for Android users), the data describing the phone usage, both in terms of performed calls and apps usage are displayed (Figure 31). Data are displayed on a daily and weekly base. Within the day visualization, the total time of phone usage and the number of screen unlocks are also reported. Moreover, for both the call events and app usage information, an indication of data coverage over the 24 hours is reported. Referring to the usage of apps, no information is saved and displayed on the single application, but the total amount of time for category (i.e. communication, browsing, games, entertainment, ...) which applications belong to is displayed. Tapping the information icon, a brief description of the data is shown both for the calls and the apps. In the upper part of the page, you can choose between a day or week visualization, and you can navigate back and forth in time by tapping on the left and right icons next to the date indication.

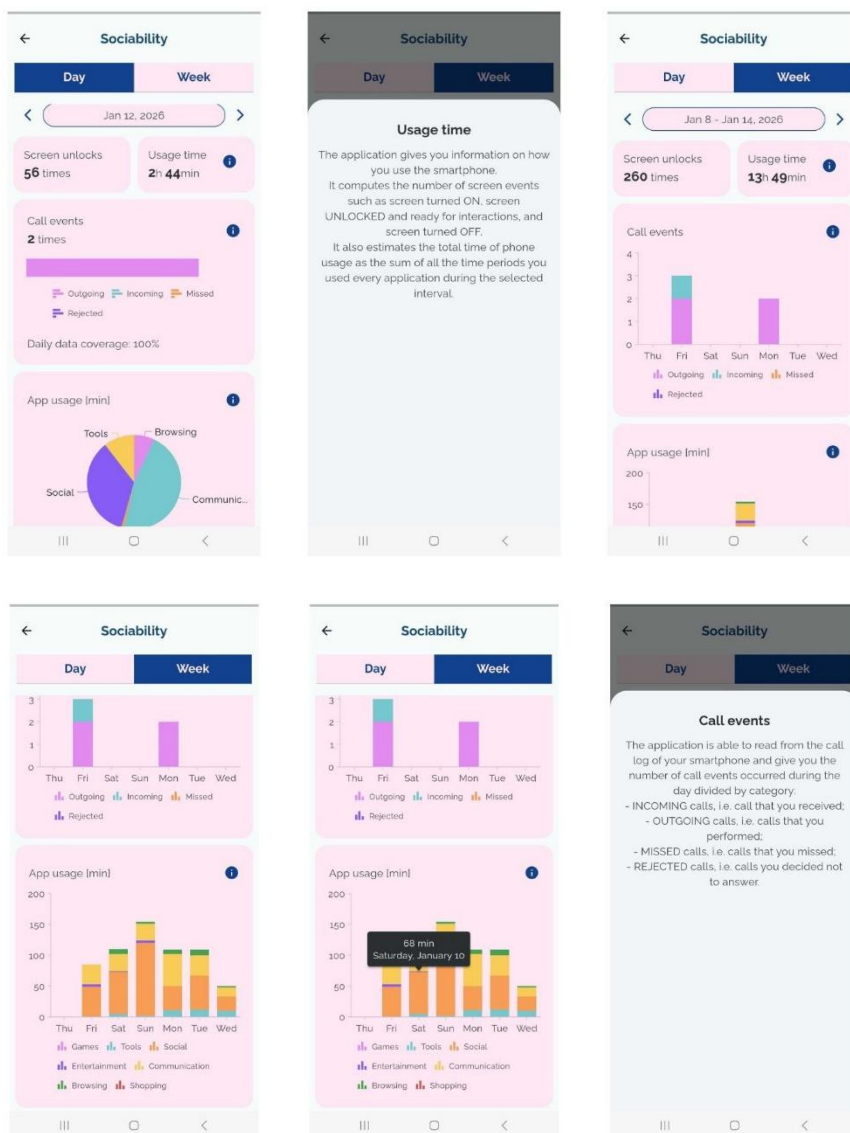


Figure 31: Sociability page

6.3.5 My life tracker

Within the “My life tracker” page, the scores provided to the questionnaire are displayed on a daily base (Figure 32). On top of the page there is a chart showing the trends of MLT scores over time. The plot is interactive and shows a total score of quality of life (trend line) computed as the average of the five scores related to specific aspects of life (general wellbeing, day to day activities...) plus the singular scores identified as colored points on plot. Both the total and single scores can be enabled or disabled on plot to increase the readability of the same. The plot shows three items at the time with an indication of the time just below the plot. It can be navigated back and forth using the left and right arrows.

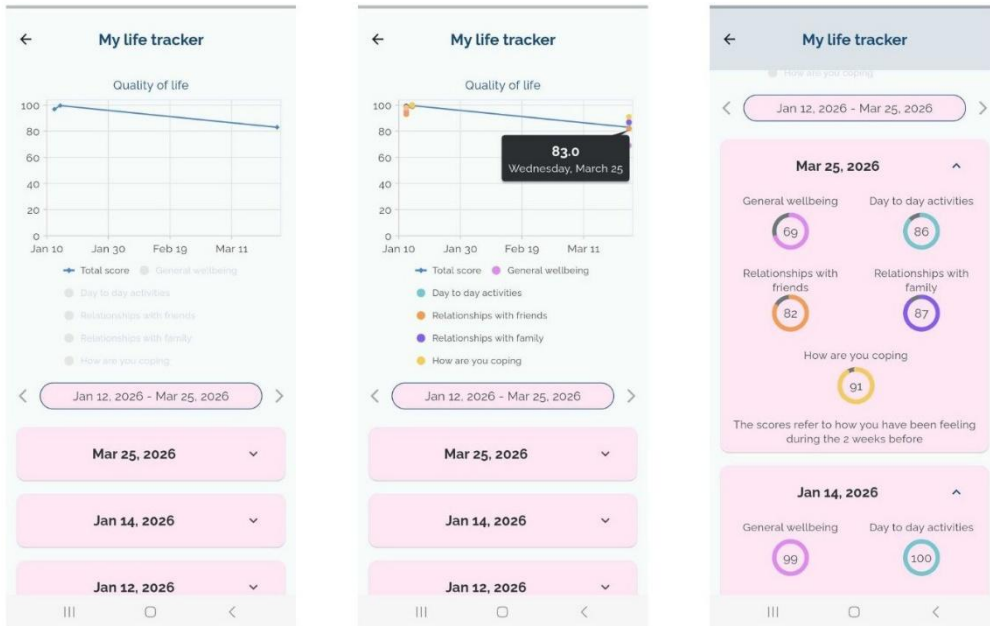


Figure 32: My life tracker visualization page

Below the plot, there are cards for each date on which you performed the questionnaire. These cards can be expanded by tapping on them and display five circles showing the value assigned to each of the five questions are displayed.

New data can be loaded by both going back in time with the left arrow or scrolling down the list of cards.

6.3.6 My feelings

Within the “My feelings” page, the data describing the audio recording of the My feelings activity are presented (Figure 33). In the upper part of the screen, it is possible to play the main frequency of the speech acquired in each date, which is like your voice tone. The dates are linked to produce your own audio. Also, for each date, tapping on the date card, it is possible to display the main acoustic parameters of the selected speech, such as recording duration in seconds, percentage of time spent taking and harmonic to noise ratio in decibels.

To load more data, you can simply scroll down the page and previous cards will appear.

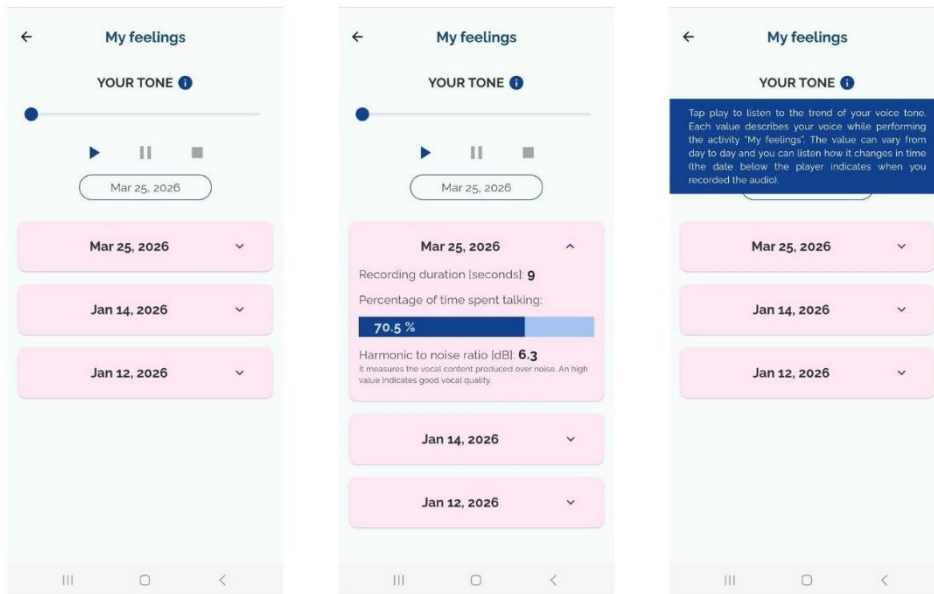


Figure 33: My feelings visualization page

6.3.7 My thoughts

Within the “My thoughts” page, the data describing the text typed in each date when the My thoughts activity has been performed are graphically displayed in the upper part of the screen (Figure 34). The displayed data are the time between key pressions in seconds, the number of stops, the session duration, and the number of words. By tapping on the left and right arrows below the graph, you may navigate the different days. By tapping on the up/down arrow you can switch the data presentation from an expanded to a more condensed view, and vice versa. Below there is a card for each date of activity performed, which can be scrolled and tapped to expand and display the chosen question and typed answer.

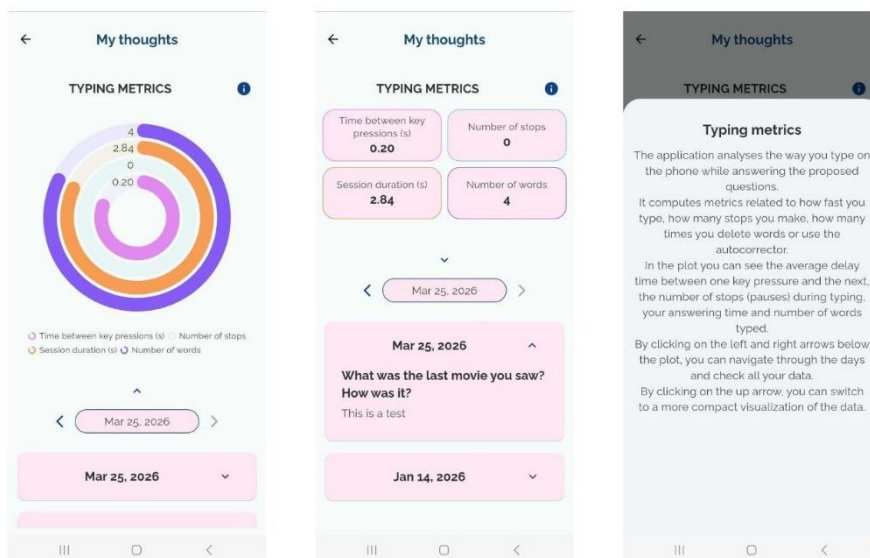


Figure 34: My thoughts visualization page. Left – expanded view. Middle – condensed view. Right – explanation popup.

7. Support functions

NOTICE: this section is intended for the young user and describes additional functions implemented in the application to support the application usage.

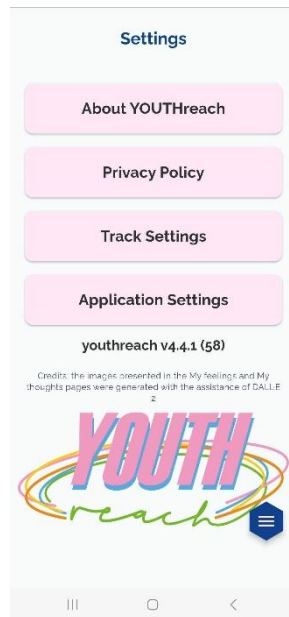


Figure 35: Settings page

The Settings page (Figure 35) allows you to manage all the miscellaneous functions of the applications (check the project description and privacy policy pages, manage the sensors and application settings). It provides information on the application version.

7.1 About YOUTHreach

This page provides a general description of the YOUTHreach project and the aims of the YOUTHreach application (Figure 36).

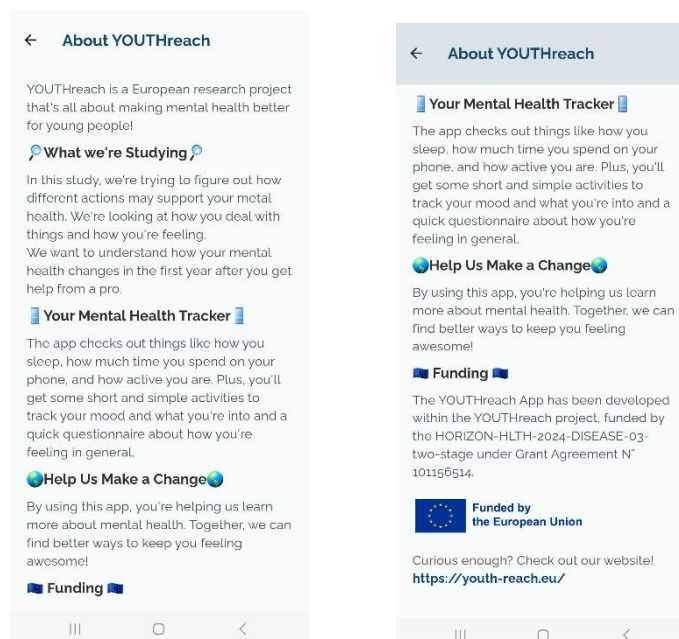


Figure 36: YOUTHreach project description page

7.2 Privacy policy

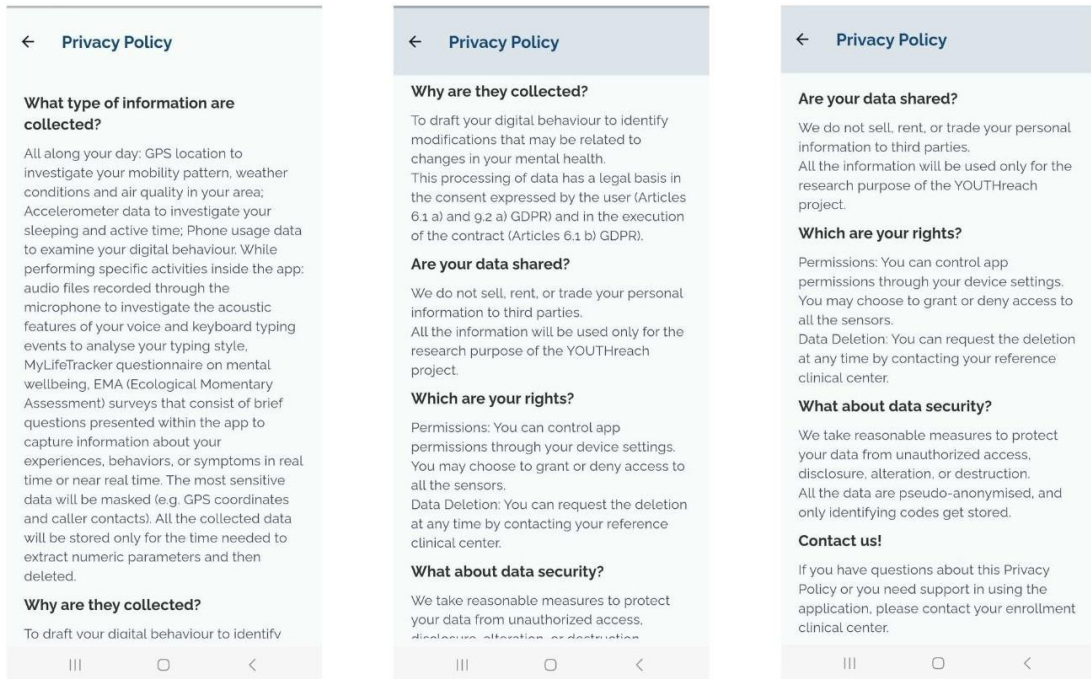


Figure 37: Privacy policy page

This page enables you to always check the privacy policy of the application to which you have agreed on during the first access.

7.3 Track Settings

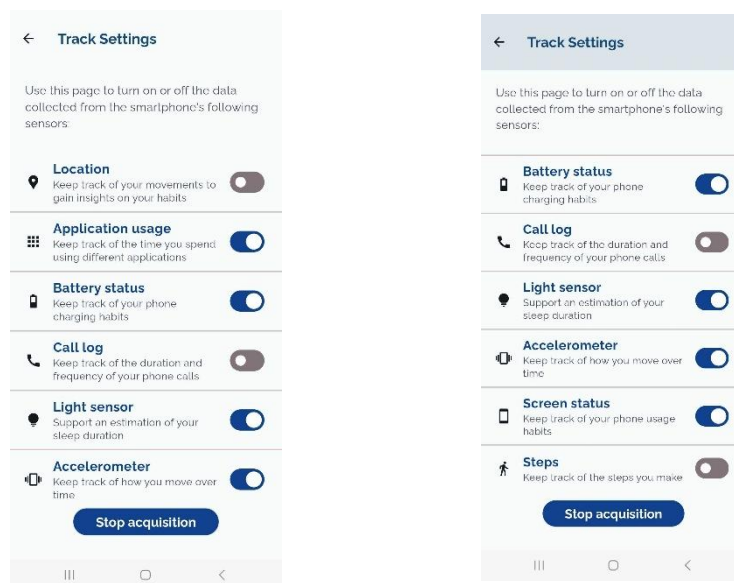


Figure 38: Track Settings page

On this page you can manage data collection inside the application by turning on and off each specific sensor (Figure 38).

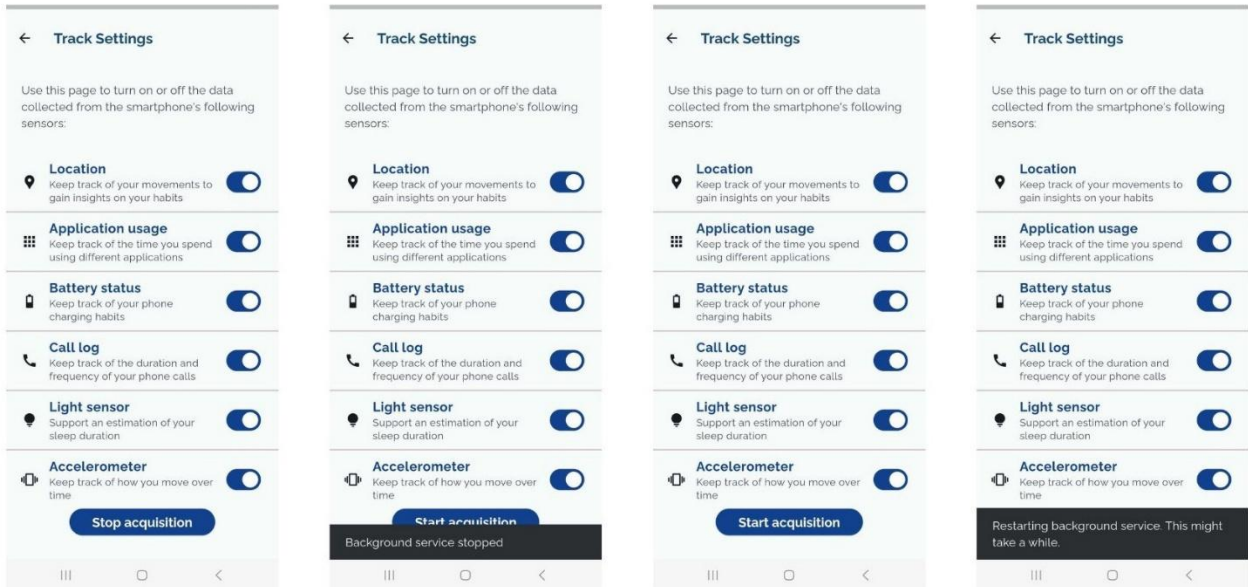


Figure 39: Track Settings page with button to start/stop acquisition and messages informing about the background service status.

Alternatively, you can decide to stop all data collection by tapping on the button “Stop acquisition” (Figure 39). A message will appear informing you that the service has been stopped. You can continue navigating the app afterwards and you can decide at any time to restart the data collection by tapping on the same button that is now “Start acquisition”. Another message will inform you that the service is restarting, and it might take a while.

7.4 Application Settings

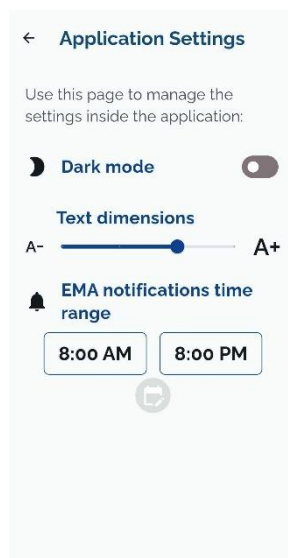


Figure 40: settings page of the app

On this page you can manage specific settings of the application. Here you can enable the dark mode and decrease/increase the font dimension. Between EMA periods and when the relevant notification alerts you that the next period is about to begin (the week before the new period), this is also when you can confirm or reset the time range for which you will receive EMA notifications. The rule still applies that the range must be at least 12 hours; otherwise, a banner will appear warning you that the selected time range is invalid (Figure 40).

8. Background data collection

8.1 Data collection on the YOUTHreach mobile app

The YOUTHreach application is designed to acquire continuously data from the embedded sensors of the smartphone (e.g. accelerometer, GPS, ...) as well as from the phone usage registers (e.g. performed calls, used applications). The acquisition of these data can run when the application is in the foreground (i.e. the application user interface is on, and you can interact with it) as well as when it is in the background (i.e. the application is not active).

For all Android users and iOS users that have the latest OS versions installed (17+) and have provided location permission “Always” in the settings, the data collection can continue to run even when the YOUTHreach application is swiped (i.e. no longer visible).

On Android smartphones, you can check if the data collection is running by searching for the YOUTHreach icon in the left part of the phone status bar. If you open the notification center, you can see a permanent notification with the text “App is running a foreground service to collect data from sensors” (see Figure 41). To have a data collection which is suitable for the study purposes, you should periodically check that the data collection is running and, if not, restart the application. On iOS smartphones, instead, you can monitor if data collection is running by searching for the location pin in the left part of the phone status bar.

NOTE: Data collection can work properly only if location permission has been granted.

If permission has been granted with the “When in use” permission level, the data collection will be running only if the application is either in the foreground or background states (see above).

If permission has been granted with the “Always” permission level (and OS version is 17+), the data collection will be running even with the application closed every time the user moves the phone (it detects phone motion and resume the data collection).

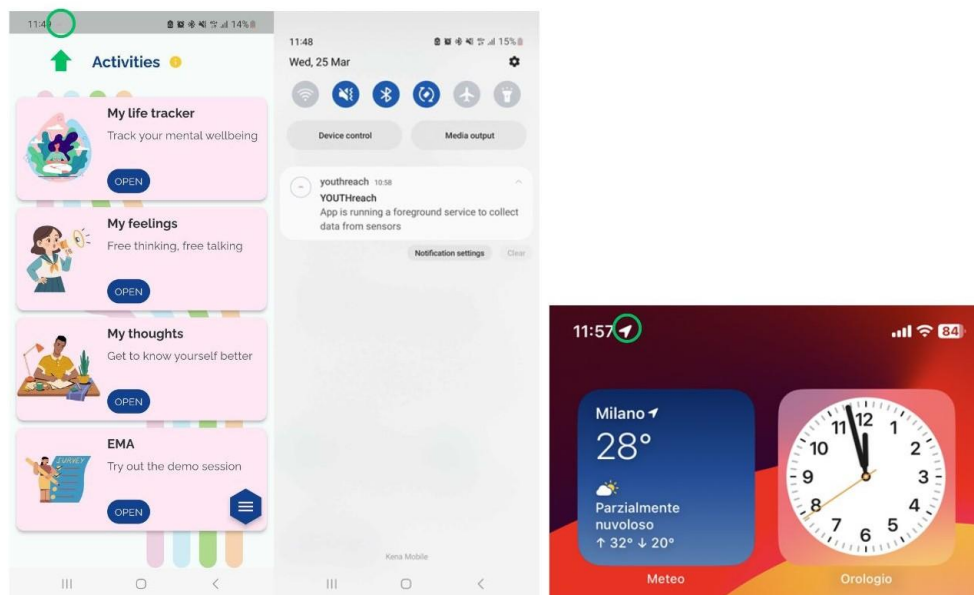


Figure 41: Background service monitoring. Left – Android project icon. Middle – Android permanent notification. Right – iOS location pin.

9. Application termination

To terminate the application, you can either swipe it or (Android only) use the Android back button. In the first case, the application will be terminated but the background data collection will continue to run in the cases described above (see *Background data collection*).

In the second case, because of the importance of the background running of the data acquisition, you are warned to confirm the two subsequent actions: to quit the screen and, if the answer to this first question is “yes”, to stop the background data collection (see Figure 42). If you answer “yes” both to the first and second question, the data collection gets terminated along with the application. For the iOS cases in which data collection gets stopped on application closed, a notification is sent to ask to re-open the app and keep it in the background.

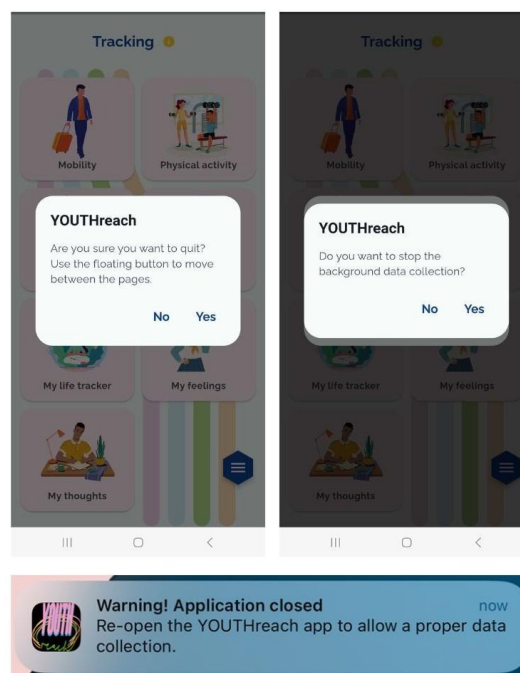


Figure 42: Upon – Android pop ups to terminate the application and the background service. Bottom – iOS notification received on app termination.

10. Application update

Whenever a new version of the app gets released, at app start a message appears informing about the new version available and asking to update. It's highly recommended to keep the app updated since new releases include bug fixing and feature enhancements. Tap on the "Update Now" button to trigger app update. In case of iOS device, you will be routed to the App Store page to update app. In case of Android device, an automatic download is started (as in Figure 43).

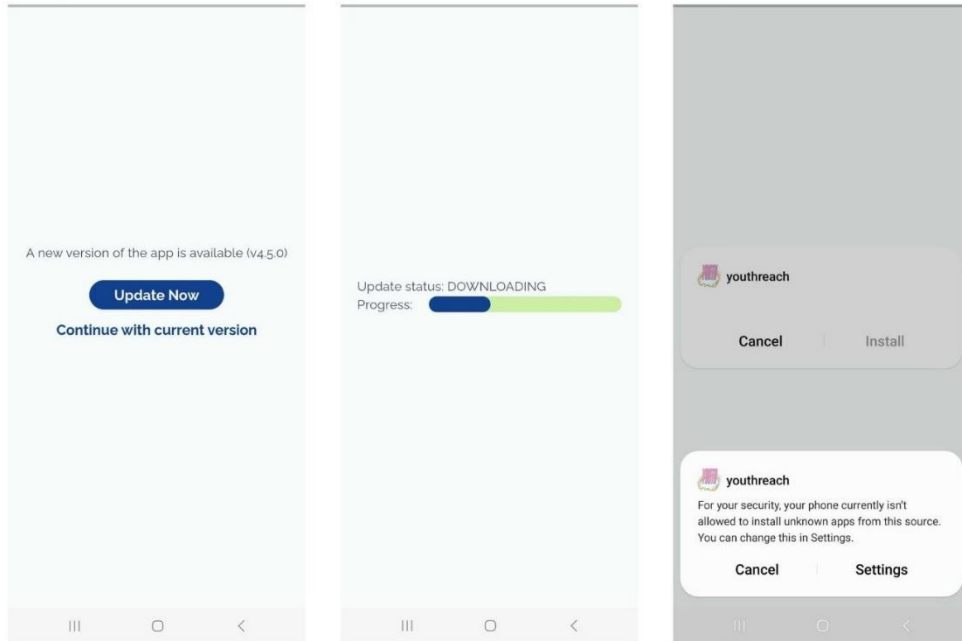


Figure 43: Update app screens.

In case the smartphone doesn't have permission to install unknown apps, a pop up appears asking to go to phone Settings to provide permission. Toggle "Allow from this source" in the Settings screen (Figure 44). Another pop up will appear asking confirmation to update the app. Tap on "update". If the process completes correctly, a final pop up with "app installed" is shown. If the process has issues, you can tap on "Try again" to re-run it.

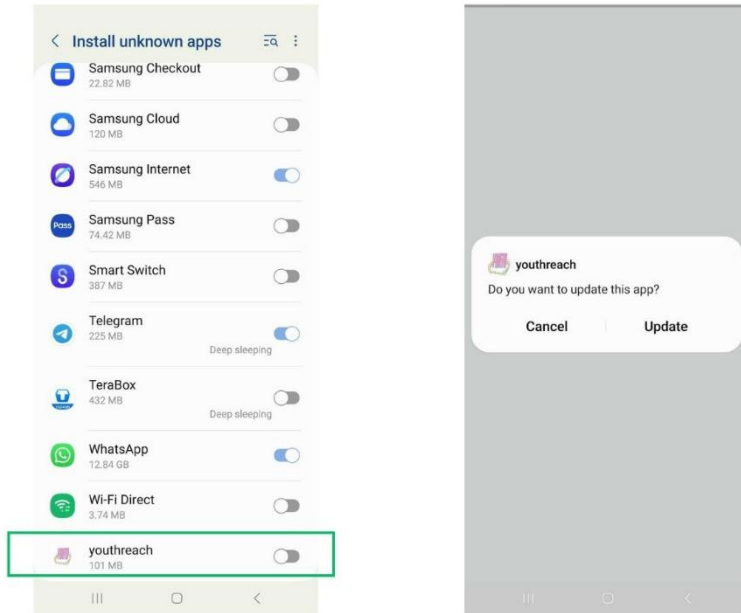


Figure 44: Settings process for app update.

11. Troubleshooting guide

This section addresses the major errors that can limit the usage of the YOUTHreach system. It includes troubleshooting for software functions.

11.1 Troubleshooting for software functions

This section addresses the main errors that can limit the use of the YOUTHreach application. It aims to troubleshoot the software functions of the app. For some functions, pop-up windows and warnings will appear when the error occurs, informing the user on what to do. Below is a list of errors identified with the possible causes and probable remedies.

In case none of the indicated actions resolves the problem that you have encountered, please contact your reference research center.

	Description of errors	Possible causes	Probable remedies
1	The application is not launching.	Problem in the app installation.	Restart the device. Update the app to the latest version. Clear app cache and data. If none of this works, uninstall and install the app from scratch.
2	The user cannot access the application.	Problem with the internet connection.	If the phone is connected to a Wi-Fi network, check that the Wi-Fi symbol is present at the top edge of the screen, with at least two bars. If your phone uses a SIM card, there should be a "4G" signal indication. If there is no indicator or other symbol, go to smartphone Settings. If your phone uses Wi-Fi, select "Wi-Fi" in the smartphone settings and check that it is active and connected to the network you want to use. If there is no network indication, check that the router is working. If the network is present in the list of available networks but not selected, select it and, if necessary, enter the relevant password. If, however, your phone uses the SIM card, select "Cellular" in the settings, and check that Cellular data is

			active, the Cellular data option is roaming, and the network provider is the correct one.
3	The user cannot access the application.	The credentials were not entered or are incorrect.	Check your credentials. Reinsert them and log in. Ask your reference research center for the correct credentials.
4	The user cannot access the application.	The credentials have expired.	Credentials correctly expire after 2 years of usage of the system. If that time has not passed, report the issue to your reference research center.
5	The user is unable to perform the My feelings activity.	User did not grant access to the microphone and (Android only) to the call manager.	Provide all required permissions from the dedicated pop ups. (Android only) Go to the phone Settings and search for the YOUTHreach app. Under Permissions search if microphone and call logs permissions are allowed. If not, tap on them and allow them.
6	The user is unable to send the results of one activity.	Problem with the internet connection.	Check solution described at row 2 of the table.
7	A card is greyed in the Tracking section.	User decided not to track that data.	Tap on the card and enable data collection by providing permissions from the dedicated popups.
8	There are no data shown in tracking section for a specific data type.	Data have not been properly collected.	If you just enabled a data collection, you need to wait a couple of hours before data are shown. Check if related data collection is turned on in Track settings. Check if background service is properly running (Android permanent notification or iOS location pin).
9	The user is unable to provide app usage permission (it is disabled in settings).	The permission is "restricted" by the Operating System.	Follow the procedure described in section Errore. L'origine riferimento non è stata trovata.