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Drones 4GREEN

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Deliverable of Activity

A3.1 Mobile apps supporting drone flights

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Acronyms

Acronym	Explanation
WP	Work Package
RS	Requirements Specification
MoSCoW	Must Have, Should Have, Could Have, Won't Have
F	Functional
NF	Non-Functional
MAUI	Multi-platform App UI
PWA	Progressive Web App
API	Application Programming Interface
EU	European Union
EASA	European Aviation Safety Agency
CAA	Civil Aviation Administration
DG CAA	Directorate General Civil Aviation Administration
HCAA	Hellenic Civil Aviation Authority

Executive Summary

Deliverable A3.1 is the key component of Work Package 3 (WP3), focusing on creating a mobile app that supports drone flights. The application integrates real-time weather forecasts, official regulatory information, and authorized map data to guide users in identifying suitable flying areas and complying with flight rules across different regions.

The Deliverable is based on five key tasks. The first one is Task T3.1.1, which focuses on the requirements specifications, architecture design and implementation of Drones4GREEN mobile application. Then, Task T3.1.2 determines and implements the ideal UI/UX graphics libraries for both android/iPhone mobile applications, while Task T3.1.3 includes content adaption regarding legal issues, security issues, weather reports, available flight deployment locations etc. As for Task T3.1.4, this one is responsible for performing beta-testing tasks to ensure quality of the final product. Finally, T3.1.5 focuses on gathering all requirements related with multilingual content support.

The findings of this Deliverable highlight how a user-friendly, multilingual and adaptable digital tool can meet both educational and professional needs. Addressing current challenges in drone awareness, regulatory compliance and accessibility to reliable information, the application offers value to students, researchers and academic institutions, while providing practical support to industry stakeholders using drones in real-world operations.

By developing a multi-dimensional application, this Deliverable achieves practical support for users who wish to fly drones, while ensuring knowledge exchange and safer operational practices.

1. Introduction

1.1 Purpose of the Deliverable

The goal of this deliverable is to present the activities performed for the development of the Drones4GREEN mobile application that can support drone flights in the context of A3.1. Specifically, it focuses on the creation of a user-friendly and configurable mobile application that supports both android and iPhone smartphones. For the completion of A3.1 the following tasks were performed:

- **T3.1.1:** Requirements specifications, architecture design and implementation of Drones4GREEN mobile application
- **T3.1.2**: Determining/implementing the ideal UI/UX graphics libraries for both android/iPhone mobile applications
- **T3.1.3:** Content adaption regarding a. legal issues, b. security issues, c. weather reports, d. available flight deployment locations etc.
- **T3.1.4:** Performed beta-testing tasks to ensure quality of the final product
- **T3.1.5**: Requirements related with multilingual content support

The mobile application is designed to be useful in both academic and industry sectors, addressing the needs of a broad range of stakeholders, including students, researchers, entrepreneurs, start-ups, and established companies. Through its multilingual support, it enables access for users from different countries and encourages cross-border exchange of knowledge and practices. The app provides reliable information on drone regulations and operational considerations, making it suitable for learning, teaching, and research purposes in higher education. At the same time, its practical features, such as weather-based flight assessment and official map guidance, make it a valuable tool for industries and businesses that rely on effective and compliant drone use.

1.2 Relation with other Deliverables

This deliverable is part of WP3 (Mobile Apps Supporting Drone Flights) and more specifically of A3.1. The expected result of this activity is that through the mobile application described in this document, the drone users will be able to determine the most suitable locations in order to deploy drone flights observing the corresponding regulations at the same time. This deliverable is based on the description of the mobile application, which was developed in terms of A3.1 and includes practical challenges and technical requirements for educational and professional applications, which were highlighted in A2.1.

1.3 Structure of the Document

The deliverable is structured as follows:

- **Section 1**: Section 1 introduces the deliverable including its purpose, the relation with other deliverables and the structure of the deliverable.
- **Section 2**: Section 2 presents the identified functional and non-functional requirements and the high-level architecture of the Drones4GREEN mobile application.
- **Section 3**: Section 3 outlines implementation process of the Drones4GREEN mobile application.

- **Section 4**: Section 4 focuses on the content that has been included in the Drones4GREEN mobile application.
- **Section 5:** Section 5 presents the process and results of the testing of the Drones4GREEN mobile application.
- **Section 6:** Section 6 concludes this deliverable.

2. Requirements Specifications and Architecture

The Requirements Specification (RS) will provide a clear description of all the functional and non-functional requirements of the system, describing what the application must do and the conditions under which it must operate. It will also define a set of use cases that illustrate the different ways in which users are expected to interact with the application's functions.

It will include details of the content that the application will contain, its environment, the necessary settings that it must include and all the legal details with which it must be compliant. It will include also details for the compatibility of the application with various devices as well as scalability and update issues.

This ensures that both the capabilities of the system and the user experience are well understood before development proceeds, forming a structured basis for design, implementation and evaluation.

2.1 Requirements Specifications

The first step of the development of the Drones4GREEN mobile application is the definition of requirements both functional and non-functional.

Functional requirements describe what the app must do, focusing on specific behaviors or features it must support to meet user needs while non-functional requirements define how the app should perform these functions, emphasizing quality attributes like performance, security, usability, reliability, and scalability.

In order to define the mobile application's requirements, the followed steps were followed:

1. **Gather Requirements**: Collect all requirements, without immediately classifying them as functional or non-functional.
2. **Identify Functional Requirements**: Determine the features, tasks, and specific actions the mobile app must support to achieve its objectives.
3. **Identify Non-Functional Requirements**: Identify requirements that address the app's performance, security, usability, and other quality-related aspects, ensuring they capture the app’s operational constraints.
4. **Develop Technical Requirements**: Translate both functional and non-functional requirements into clear, detailed technical requirements for implementation, covering necessary integrations, architecture, and system design.

The MoSCoW prioritization method has been aligned with high/medium/low priority rankings, as it naturally categorizes requirements by their importance. Specifically, the mapping that has been utilized is presented in Table 1.

Table 1: MoSCoW prioritisation – Priority mappings

MoSCoW	Priority ranking	Description
Must Have (Critical)	High	These are the critical requirements that are absolutely essential for the mobile application to function.

Should Have (Important)	Medium	These requirements are important but not crucial for the mobile application's core functionality. The mobile application can still function without them, but their inclusion would greatly improve the overall application.
Could Have (Desirable)	Low	These are desirable features but not essential to the mobile application's core operation.
Won't Have (Not in Scope for Now)	No Priority or Future Consideration	These requirements are out of scope or not prioritized for the current release or project phase.

Table 2 presents the list of functional (F) and non-functional (NF) requirements that were identified.

Table 2: List of functional and non-functional requirements

ID	Requirement	Type	Priority
R01	The app should enable users to find appropriate places with good weather conditions for taking off.	F	High
R02	The app should include weather forecasts for the chosen flying area.	F	High
R03	The app should inform users about 'no-fly' zones and about suitable locations.	F	High
R04	The app should provide information about regulations.	F	High
R05	The app should provide a user-friendly layout.	NF	High
R06	The app should enable users to customize the UI.	NF	High
R07	The app should be available for the basic versions of both Android and iPhone smartphones.	NF	High
R08	The app should provide information that can be regularly updated (over application and content updates).	NF	High
R09	The app should be easy to expand through additional modules.	NF	High
R10	The app should support multilingual content.	F	High

Following the identification of the aforementioned functional requirements, these were translated into technical requirements and are shown in Table 3.

Table 3: List of technical requirements

ID	Requirement	Req. ID	Priority
TR01	Integrate weather data APIs to retrieve real-time weather conditions for specific geographic coordinates.	R01	High

TR02	Integrate weather data APIs to retrieve weather forecasts for selected locations.	R02	High
TR03	Integrate a geospatial data service (such as an aviation authority database or a drone no-fly zone API) to display restricted airspace and legal fly zones on a map.	R03	High
TR04	Display region-specific drone flying rules and restrictions based on the user's location (country) or selected area.	R04	High
TR05	Follow UI/UX guidelines (e.g., Material Design for Android and Apple's Human Interface Guidelines for iOS) to ensure a consistent and intuitive UI/UX experience.	R05	High
TR06	Implement responsive design to cater to different screen sizes.	R05	High
TR07	Implement a settings module where users can customize themes, layouts and toggle specific display options such as map layers.	R06	High
TR08	Ensure compatibility with Android versions and iOS versions using a cross-platform framework or a content management system (CMS) to maintain a single codebase while supporting both platforms.	R07	High
TR09	Implement a server-side update mechanism that periodically fetches the latest regulatory and weather data.	R08	High
TR10	Ensure automatic app content updates without requiring the user to manually download new versions.	R08	High
TR11	Develop the app using an architecture that allows for the easy addition of new features.	R09	High
TR12	Implement a system for the management of translations for all app content.	R10	High

The app enables the identification of emerging technology trends and existing skills gaps. This is achieved through the Information page, which provides users with constantly updated information and educational materials on current developments in the sector, along with the Regulations page, where official and up-to-date legal frameworks are readily accessible. The mobile app offers both general knowledge and regulatory awareness in a regularly updated way and also helps users understand where the industry is heading and which skills are becoming increasingly important.

In addition, the app supports the collection, organization and effective use of learning resources. This way, it helps to address skills shortages in the drone and aviation sector. The design emphasizes user-friendly navigation, in order to ensure that all kind of users, despite their different experience levels can easily use it. This user-friendly interface encourages learning and continuous self-improvement and makes educational content accessible to both beginners and professionals.

Finally, the application contributes to strengthening cooperation between Universities and Industry, acting as a common platform for knowledge exchange and practical use. Users can both learn about the drone industry, the legal background, the places available for drone flights and also actually perform a drone flight. As a result, the application becomes a link between Universities and Industry in the drone and aviation ecosystem.

2.2 High-level Architecture and Technology Stack

Before starting the implementation of the Drones4GREEN mobile application the ideal UI/UX graphics libraries should be determined first. Based on the identified requirements, these libraries should be suitable for both Android and iPhone mobile applications. To this end, extensive research on UI/UX graphics libraries was conducted and the different options were compared. The easiest and most efficient option was finally adopted.

Among others, Kotlin, ionic, Flutter, Xamarin, Swift and React Native were investigated. React Native is a JavaScript framework for building native mobile apps using React. On the other hand, Flutter is Google's UI toolkit for building natively compiled applications for mobile, web, and desktop from a single codebase. Furthermore, Ionic is a popular open-source framework for building cross-platform mobile apps using web technologies like Angular, HTML, and CSS. Finally, .NET Multi-platform App UI (MAUI) is a framework from Microsoft for building cross-platform apps using .NET and C#.

However, the Progressive Web App (PWA) option was selected as the best practice and therefore, was adopted in the context of the Drones4GREEN project. Using PWA, the user can install easily the application on both Android and iPhone. To this end, the WordPress[1] tool was also selected to support the PWA development. This tool is totally free to use and open-source, while also there is a large user community with similar implementation experience. Furthermore, this platform allows developers to fully customize the mobile application and enables user-friendly layouts. Moreover, this tool ensures single-code base for both Android and iPhone, allowing this way faster development. Finally, it is easier to apply updates on the app on a regular basis and add new modules to the system.

The WordPress consists of core PHP files, database, themes and plugins as shown in Figure 1 below. The database, which is usually MySQL, stores all the content of the mobile application and is created automatically during installation. Themes control the appearance of the mobile application, including the layout, colors, and fonts. They can be installed and activated from the WordPress admin area, and many allow customization of colors and layouts. On the other hand, plugins extend functionality and control the functions of the mobile application. Some plugins operate by offering basic features for free and advanced features for a fee.

[1] https://wordpress.org/

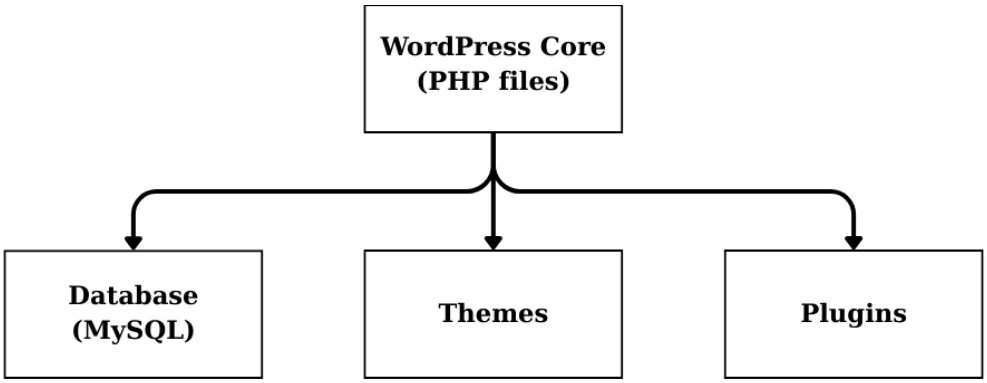

Figure 1: High-level Architecture

3. Implementation Details

After defining the appropriate technology stack, the next step was the implementation of the mobile application. Following the high-level architecture, the application was developed by combining WordPress with Progressive Web App (PWA) technology to ensure accessibility, responsiveness, and ease of maintenance. A local WordPress installation was first set up to allow safe testing and development. Once the environment was ready, a mobile-friendly and user-oriented theme was selected and customized to align with the project's visual identity, including adjustments to colors, logos, and overall layout.

To enhance functionality, dedicated plugins were integrated. Through these tools, the main logo was placed in the upper left corner of the interface, ensuring consistent branding across all screens. On the opposite side, a menu bar was positioned in the upper right corner. This menu provides structured access to all pages and subpages of the mobile application. Each page was created and configured separately within the WordPress environment, allowing for an organized and modular development process.

After shaping the structure, the application's content was added and formatted appropriately. The final design incorporated both a header and a footer. The footer includes a centrally aligned copyright message to protect the distributed content. Additionally, a custom back button was developed and placed in the lower left corner of the footer. This element was implemented using HTML code, enabling users to return to the exact previous page and thereby improving the overall navigation experience.

After the development phase was completed, the final step involved migrating the local WordPress installation to a public server. This process was carried out using a dedicated migration plugin, which ensured a smooth and accurate transfer of all files, themes, plugins and database entries. Once the migration was successful, an additional plugin was configured to enable full PWA functionality, allowing the application to operate seamlessly across mobile devices. Following these configurations, the application underwent testing to verify its performance, responsiveness, and overall stability. After confirming that all components operated as expected, the mobile application was considered complete and ready for deployment. A detailed analysis of all pages and subpages of the mobile application follows below.

3.1 Drones4GREEN Mobile Application – Home Page

The Home page is the first page users see when installing the app. This page includes instructions on how to use the mobile application and explains to users all necessary steps on how to prepare for a drone flight. The main frame includes five steps and after their completion a new message is displayed on screen. All this layout was developed through custom html code.

By clicking to the upper right menu button users can navigate to the other pages of the app, while the bottom left button is used for a navigation to the previous accessed pages. The Figure 2 below displays the Home page of the application both from an Android and an iPhone mobile phone.

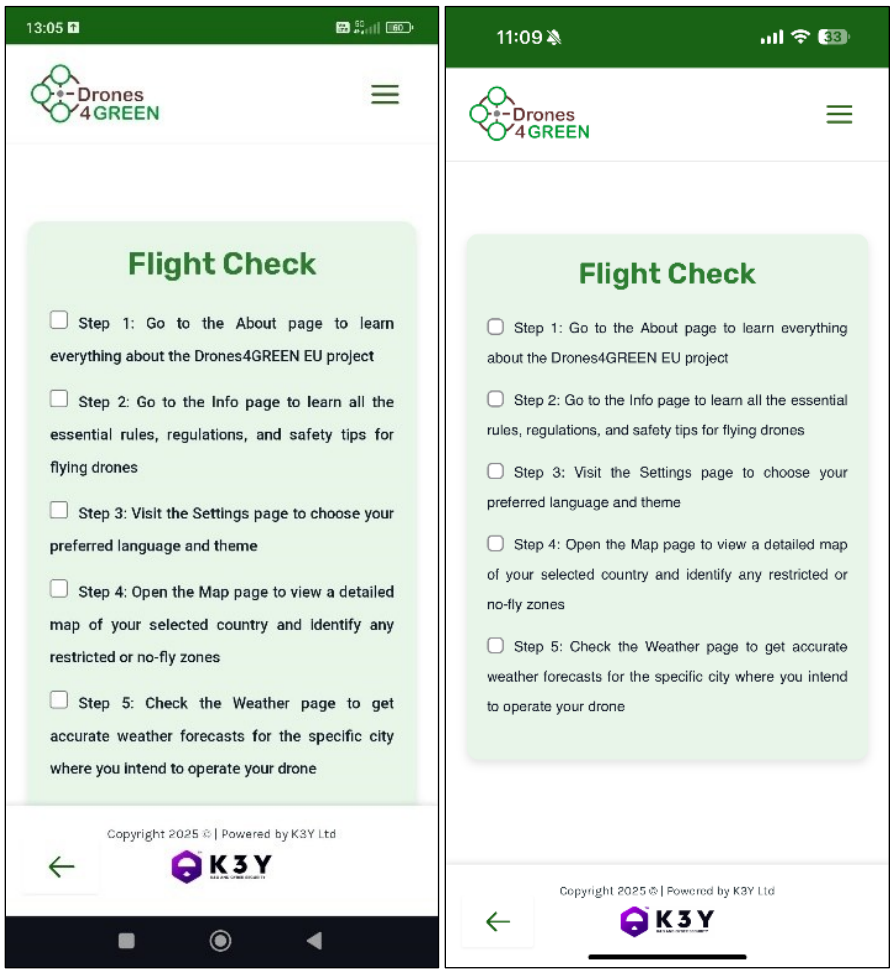

Figure 2: The Home Page of the mobile app

3.2 Drones4GREEN Mobile Application – Map Page

The Map page is developed through custom html code. The main frame includes three buttons. Each one of them redirects the user to the national websites that provide the official no-fly zone maps of each country of the Consortium. Through this button click the user is redirected to these websites to learn where is the suitable location to fly its drone.

The main purpose of this page is to inform users of the locations they are allowed to fly a drone and the zones that these activities are strictly forbidden. This way, it is ensured that everyone has a clear understanding of the drone flight process and all accidents are avoided.

The primary purpose of this page is to clearly inform users about the areas where drone flights are permitted, as well as the locations where such activities are strictly forbidden. By providing this guidance, the page ensures that users have a solid understanding of the operational boundaries and legal requirements associated with drone flying. This way, the mobile application helps promote responsible

use and ultimately contributes to the prevention of accidents or unsafe situations. In Figure 3 that follows there is an example of the Map page from both an Android and an iPhone mobile phone.

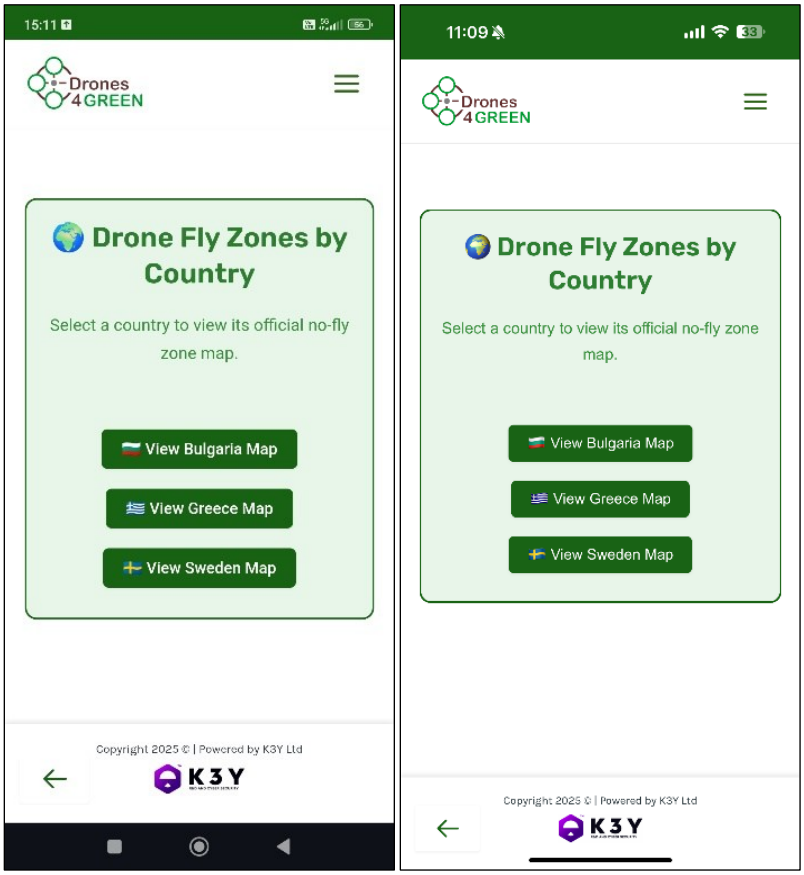

Figure 3: The Map page from both Android and iPhone mobile phones

3.3 Drones4GREEN Mobile Application – Weather Page

The Weather page is developed through custom html code. It includes a search bar that supports multilingual content and a Get Weather button that when clicked provides a detailed weather forecast for the requested area. To display actual and time-related weather data the code integrates an Application Programming Interface (API) from OpenWeatherMap official Website. The data provided includes Temperature, Wind Speed, Wind Direction, Cloud Cover, Visibility and Precipitation Probability, since these parameters are the most critical for accurate weather forecasting and safe drone flight, based on the authors in [1]. To this end, based on the values of these parameters, the page checks if they meet the required thresholds and display a message indicating whether it is safe to fly a drone.

This page includes also two more pages, the Threshold page and the Units page both are developed through html code. The Threshold page includes the weather condition threshold values interfaces and a save button. The user has the opportunity to change the threshold values to the desired ones and then to click the save button. Once the button is clicked, a pop-up window is displayed including a message

verifying that the values have changed successfully. Then, these values are stored and the new weather forecasts compare the current values returned from the API to these new threshold values in order to examine whether the conditions are good to fly or not.

Similarly, the Units page includes the unit interfaces and a save button. Again, the user has the opportunity to change the units to the desired ones and click the save button. Once the user clicks the button the page is refreshed and the new units are stored. So, next time the user tries to get a weather forecast all values are displayed with the new units after converted to the appropriate unit system. Similarly, the threshold values are also converted to the new unit system in order to get compared with the current values returned from the API.

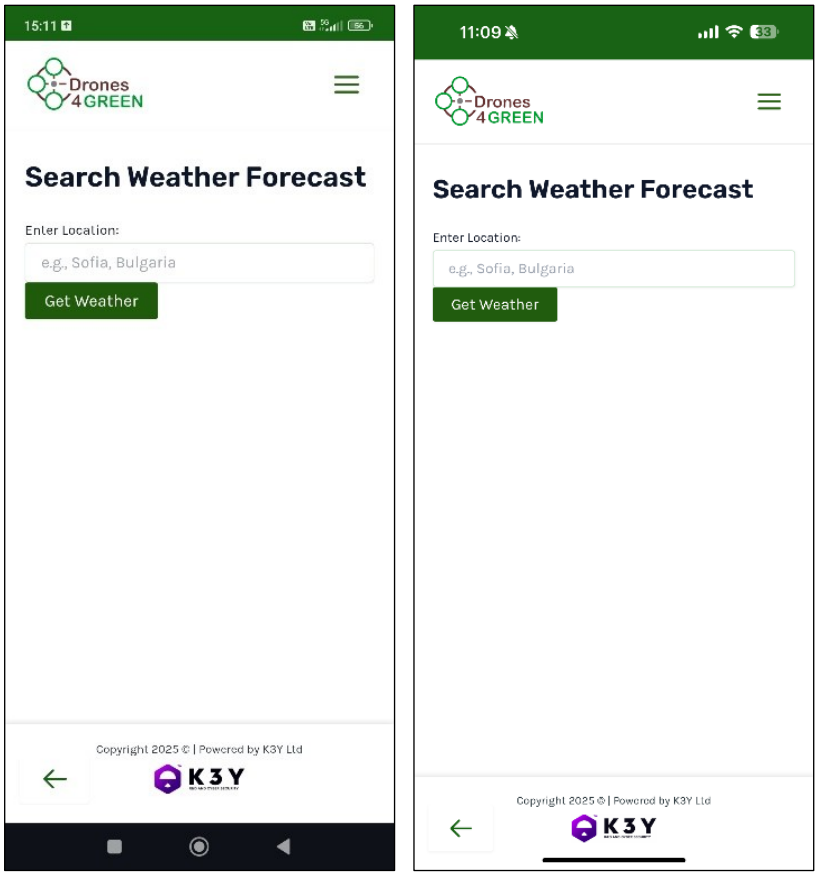

Figure 4: The Weather Forecast page from both Android and iPhone mobile phones

This page enables users to check the weather conditions of a specific location before initiating a drone flight. By providing up-to-date meteorological information, it helps ensure that flights are conducted safely and without unnecessary risks. It is also one of the most user-friendly sections of the mobile application, as it allows users to adjust the thresholds according to their needs and to select the units of measurement that best match their preferences. In this way, the page supports both informed decision-making and a more personalised user experience.

An example of the Weather Forecast page is shown above in Figure 4 and Figure 5 and Figure 6 that follow display the Thresholds and Units pages from both Android and iPhone mobile phones.

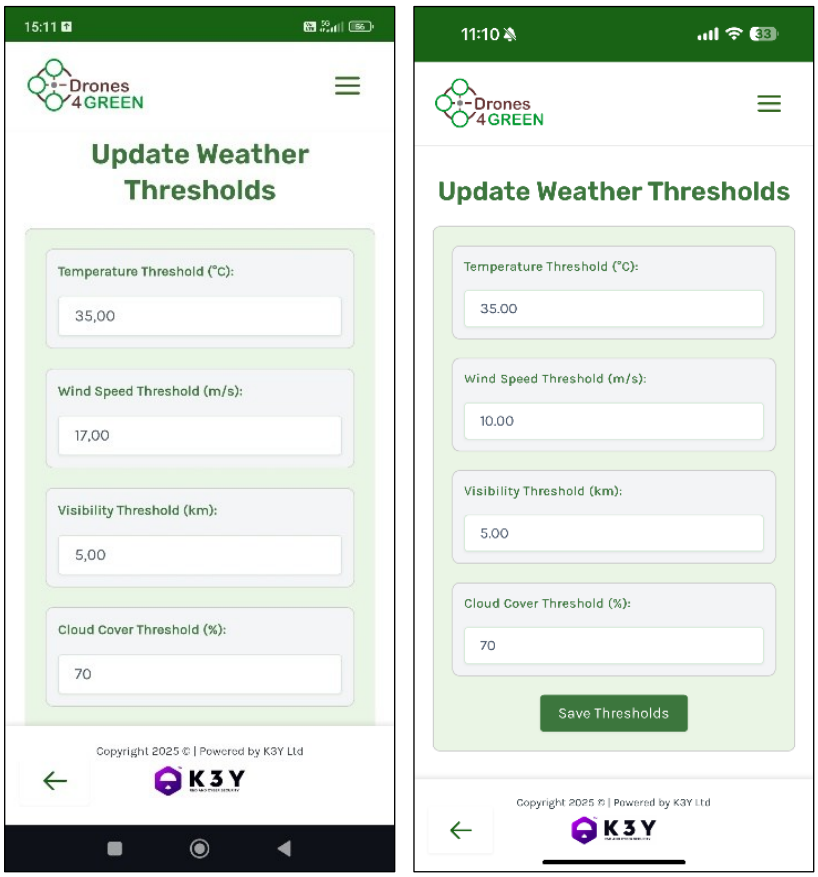

Figure 5:The Threshold page from both Android and iPhone mobile phones

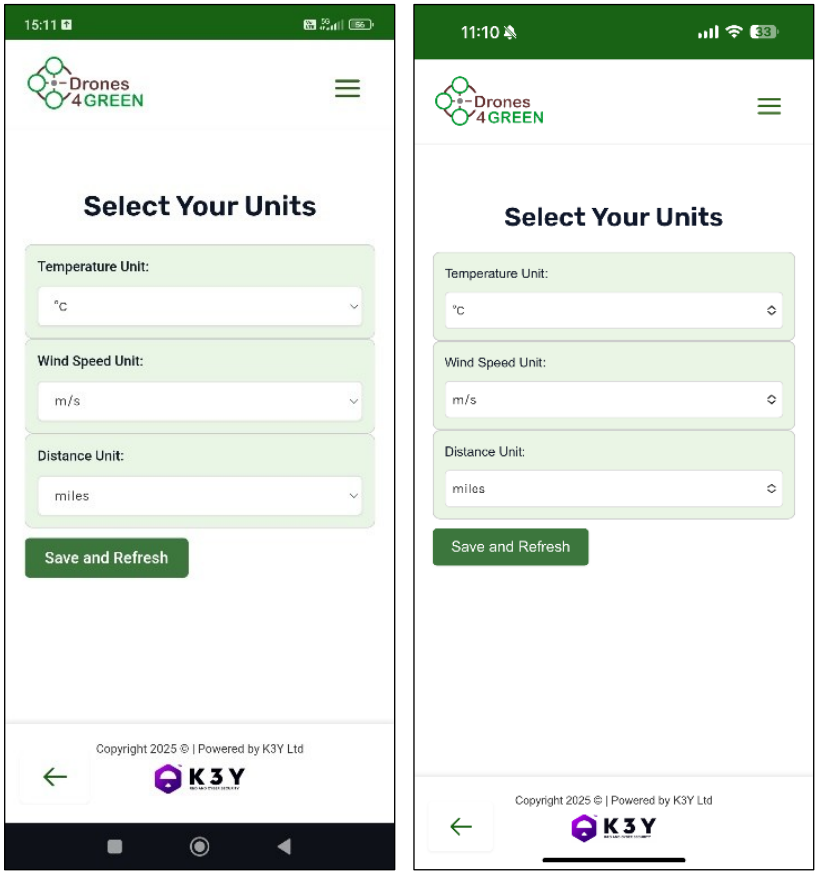

Figure 6: The Unit page from both Android and iPhone mobile phones

3.4 Drones4GREEN Mobile Application – Info Page

The Info page consists of several drop-down menus that each one of them includes details, source links and figures, as shown in Figure 7 below. All these drop-down menus have been created through a well-structured plugin, which allows to customize the whole content and enables easy integration in the main page. The same technique was also adopted during the development of the Regulations subpage.

The primary purpose of this page is to provide users with all the legal and security information required to conduct a drone flight in a secure and compliant manner. By accessing the Info page, users can clarify any uncertainties they may have regarding regulatory obligations and best practices within the drone flight domain. This ensures that every user is well-informed and fully prepared to operate responsibly.

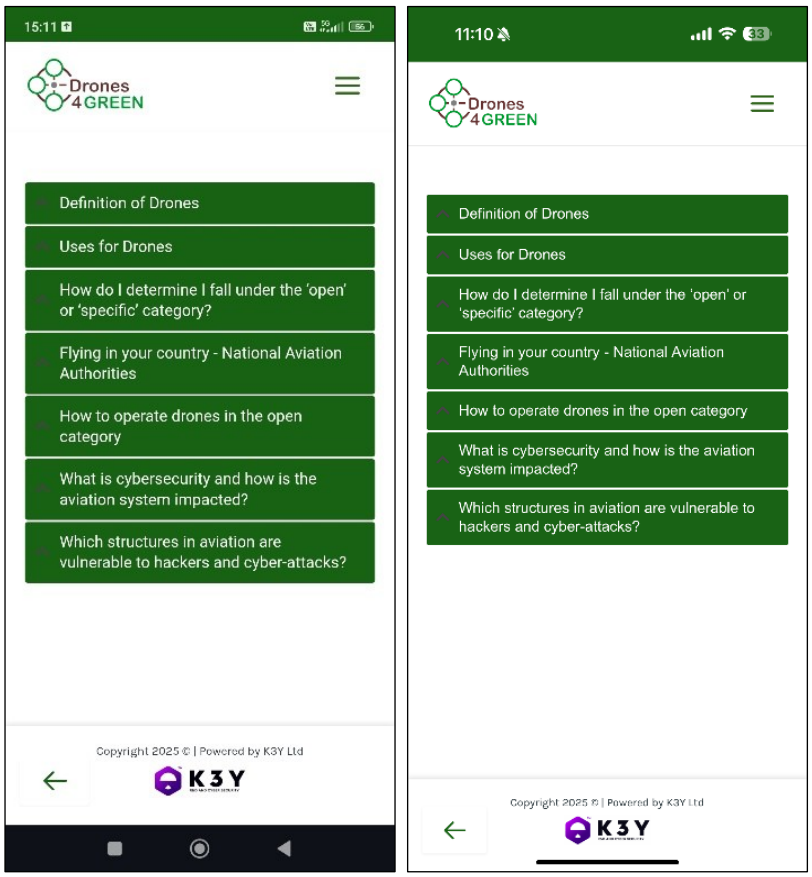

Figure 7: The Info page from both Android and iPhone mobile phones

3.5 Drones4GREEN Mobile Application – Settings Page

The Settings page includes two main settings presented in a drop-down menu. Through this page, the user can configure both the language and the visual theme of the mobile app. The Language drop-down menu allows users to select the app's language from four options: English, Bulgarian, Greek, and Swedish, covering this way all Consortium languages. As a result, the mobile app offers full multilingual support with translated content available in these languages. To this end, a plugin called Polylang, is used to enable multiple languages at the same time. This plugin allows the creation of the exact same menu in the desired languages, as shown in Figure 8 below. Therefore, the admin can easily create copies of all pages and apply the appropriate translations. Furthermore, the user after selecting a specific language, can easily redirect to this language's home page and navigate to the translated menu. All pages were translated in detail using an excel file to include the content. Then partners were requested to give feedback on these translations and minor changes were applied. This file served as a central reference for organizing and managing translations across different languages. Once the initial translations were completed, the file was shared with consortium partners for input. Each partner provided feedback based on linguistic accuracy, clarity, and cultural relevance in their respective languages. Following this collaborative review process, minor adjustments were made to refine the translations and ensure consistency throughout the

app. This approach helped guarantee high-quality and user-friendly multilingual support. An example of the Settings page from both Android and iPhone mobile phones is displayed in Figure 9 that follows.

Full name	Locale	Code	Order	Flag	Posts
English	en_GB	en ★	0		10
Svenska	sv_SE	sv	0		9
Ελληνικά	el	el	0		9
български	bg_BG	bg	0		9
Full name	Locale	Code	Order	Flag	Posts

Figure 8: Main Dashboard of Polylang plugin

As for the visual theme drop-down menu, this is also based on custom html code and enables users to select between two values, light and dark. Once, the user selects the dark theme, as shown in Figure 10 below, the whole app changes to its dark theme layout and when the user selects the light mode the app returns to the default layout. This feature gives users the flexibility to customize the app's visual style according to their preference.

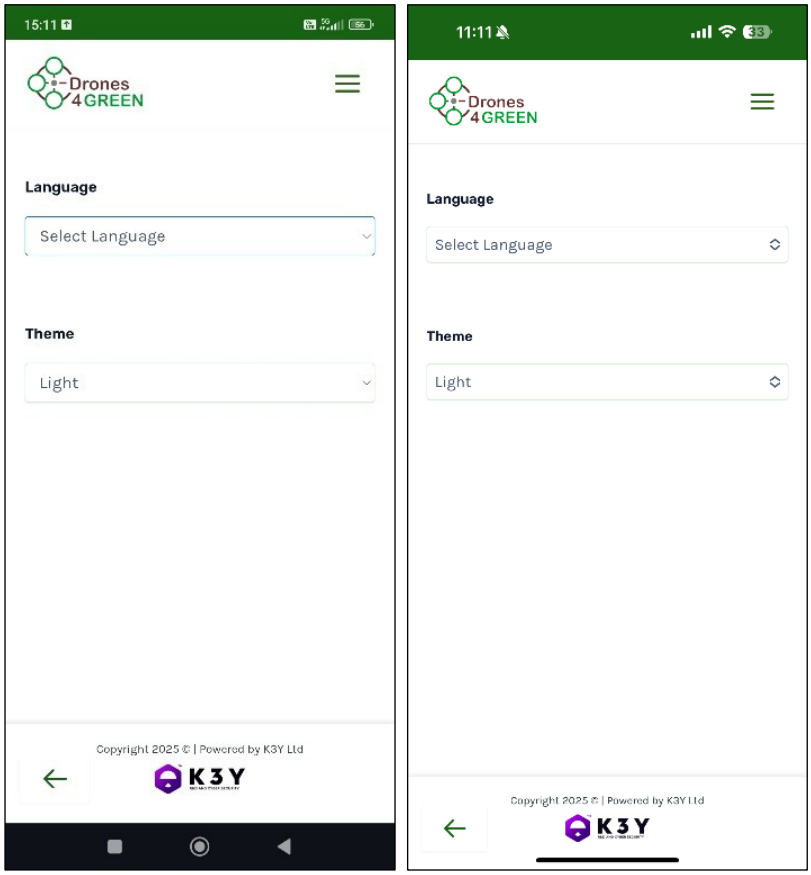

Figure 9: The Settings page in Light mode from both Android and iPhone mobile phones

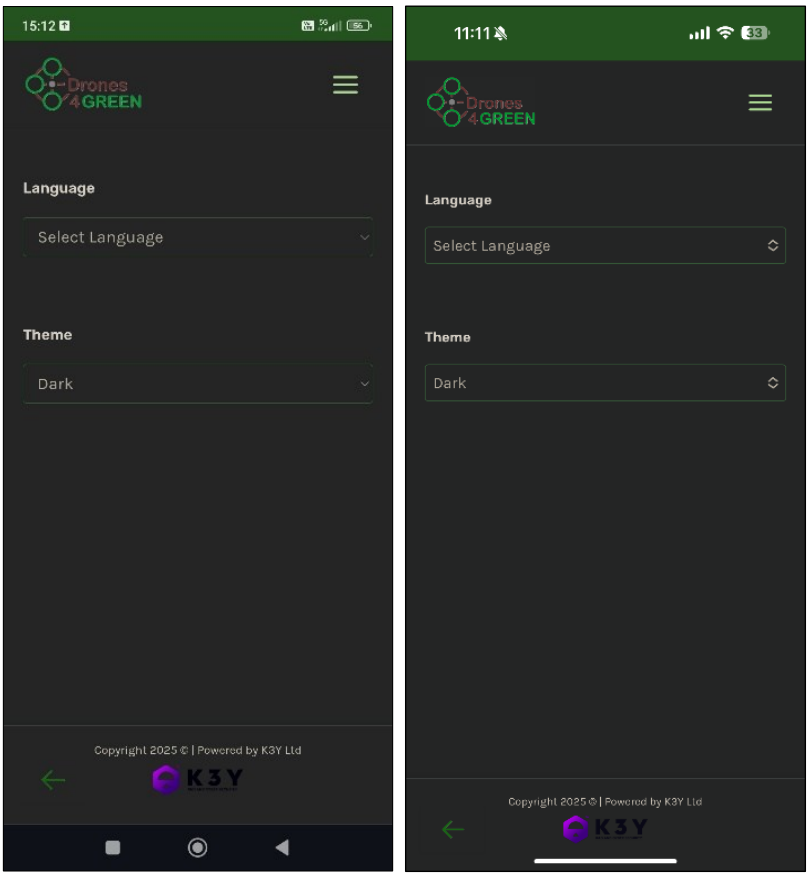

Figure 10: The Settings page in Dark mode from both Android and iPhone mobile phones

3.6 Drones4GREEN Mobile Application – About Page

The About page is developed using custom html code and serves as an informative section within the mobile app. It provides users with an overview of the Drones4GREEN project, outlining its core objectives, implementation strategy, and key results. The content is structured to give a clear understanding of the project's purpose and the value it brings in promoting green and sustainable practices through the use of drone technology. Furthermore, at the bottom there is a Drones4GREEN Website button. Once users click it, they get redirected to the project's official website to learn more about this action, ensuring this way the good dissemination of the project. An example of the About page from both Android and iPhone mobile phones is displayed on Figure 11.

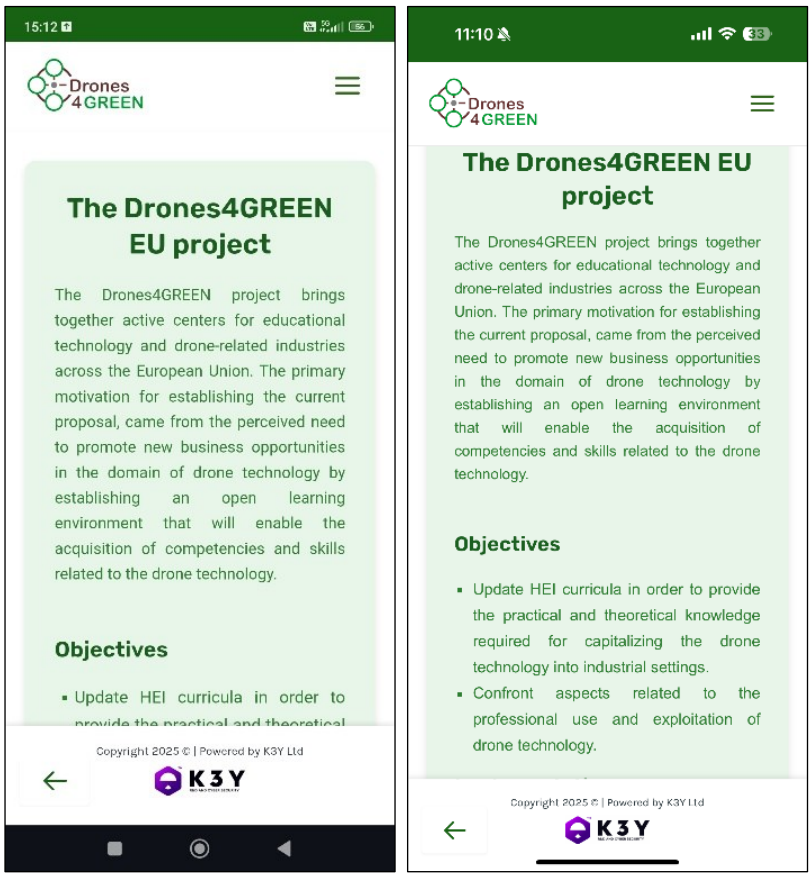

Figure 11: The About Page from both Android and iPhone mobile phones

3.7 Requirements Compliance

Based on the descriptions of the pages and subpages of the application, it is clear how all functional and non-functional requirements are covered. For example, it is clear that the Weather page, providing real-time weather reports for the selected flight area, allows users to get weather forecasts and find suitable locations for take-off, while the Map page includes all the necessary information about 'no-fly' zones. In addition, the Information page and the Regulations subpage allow users to learn about all the legal and safety information they need.

At the same time, the Settings page ensures a user-friendly layout, a customisable UI as well as multilingual support, as it allows changes to the theme and language of the application. Additionally, it is based on WordPress technology which makes it very easy to expand and includes also an API functionality that ensures it remains regularly updated. Finally, the PWA technology that was also selected for the implementation of the Drones4GREEN mobile application makes it available on both Android and iPhone mobile phones. In Table 4 that follows there is a mapping of each requirement to the application page or functionality that covers it.

Table 4: Requirements Compliance

ID	Requirement	Type	Priority	Compliance
R01	The app should enable users to find appropriate places with good weather conditions for taking off.	F	High	Weather Page
R02	The app should include weather forecasts for the chosen flying area.	F	High	Weather Page
R03	The app should inform users about 'no-fly' zones and about suitable locations.	F	High	Map Page
R04	The app should provide information about regulations.	F	High	Regulations Subpage
R05	The app should provide a user-friendly layout.	NF	High	Settings Page
R06	The app should enable users to customize the UI.	NF	High	Settings Page
R07	The app should be available for the basic versions of both Android and iPhone smartphones.	NF	High	PWA Functionality
R08	The app should provide information that can be regularly updated (over application and content updates).	NF	High	API Functionality
R09	The app should be easy to expand through additional modules.	NF	High	WordPress Based
R10	The app should support multilingual content.	F	High	Settings Page

4. Content Adaptation

The app ensures that the content provided to users remains up-to-date. The main reason for this is the use of a live weather API, which retrieves real-time meteorological data directly from its source. This means that the information displayed in the app, such as temperature, wind speed, precipitation probability and weather forecasts in general, is automatically updated and does not rely on manual updates or built-in static data. The app is reliable because it constantly reflects the changes taking place in the environment.

In addition to dynamic weather data, the app integrates direct links to official and authoritative websites for informative content and regulatory guidance. Rather than reproducing or summarizing legal material, the Drones4Green mobile app directs users to the original, maintained sources. This includes links to official European institutions and recognized national authorities, ensuring that users always have access to the most up-to-date and validated legal information. This approach not only guarantees accuracy, but also supports transparency and compliance with regulatory frameworks.

Furthermore, when map-based features are included, for example in the Map page, the mobile app relies on official, country-specific mapping services. This ensures that geographic data, boundaries, infrastructure details and location references remain in line with national standards and updates. By connecting users directly to authoritative map providers, the app avoids inaccuracies and ensures that navigation data or map information remains up-to-date.

Through the combination of real-time API integration, direct connection to official legal and information resources and the use of certified mapping services, the app maintains a high level of reliability. Therefore, users benefit from information that is not only accurate at the time of access, but is also validated and continuously updated at its source.

4.1 Legal and Security

This mobile app also covers all legal and security aspects related to drone flights. To this end, it includes a page dedicated to inform users about the legal obligations and the official regulations related to drone flights. This way it is ensured that all users get informed and preserved from any adverse situations. In particular the mobile app includes the Info page which contains the Regulations subpage. The Info page provides a definition of drones and their basic uses along with their two main categories. Furthermore, the national aviation authorities have been identified and all official links have been added in the description. Moreover, in this page security aspects are included focusing on cybersecurity and cyber-attacks on aviation systems.

The aviation authorities both in Europe and in the countries of the project's partners are presented in Table 5.

Table 5: List of Aviation Authorities

Country	Authority	Location

Europe-wide	European Aviation Safety Agency (EASA) [2]	Cologne, Germany
Bulgaria	Civil Aviation Administration (CAA) or Directorate General Civil Aviation Administration (DG CAA) [3]	Sofia, Bulgaria
Greece	Hellenic Civil Aviation Authority (HCAA) [4]	Athens, Greece
Sweden	Transportstyrelsen (Swedish Transport Agency) [5]	Borlänge, Sweden

A complete list of national aviation authorities is available in the website of EASA[6].

Regarding the legal content that has been included in the Drones4GREEN mobile application, both EU regulations and country-specific regulations were explored. These are shown in Table 6.

Table 6: List of EU-wide and country-specific regulations

Country	Regulations
Europe-wide	Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft
	Regulation (EU) 2019/945 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems
	Regulation (EU) 2020/639 on a standard scenario for the operation of unmanned aircraft
Bulgaria	Civil Aviation Act (with specific provisions for unmanned aircraft
Greece	Government Gazette B/3152/30.9.2016
Sweden	Aviation Act (Luftfartslag, 2010:500)
	Transport Agency Regulations (TSFS 2017:110) on unmanned aircraft

The Regulations subpage, that is shown in Figure 12 below, contains all legal details regarding a drone flight. More specifically, details on registration processes, such as drone registration, drone operator registration and registration recognition are included. Furthermore, insurance details, minimum age restrictions, altitude restrictions and location restrictions are provided. This page also contains critical definitions, such as definitions of drone operator, uninvolved person and assembly of people, for a better understanding of the official regulations. All regulation sources are included in the descriptions.

Regarding security issues, the Info page of the app highlights the growing importance of cybersecurity within the aviation sector. It emphasizes how digital transformation also exposes aviation systems to new forms of cyber-attacks, including unauthorized surveillance, data breaches, and system manipulation. The

[2] https://www.easa.europa.eu/en
[3] https://www.caa.bg/en
[4] https://hcaa.gov.gr/en
[5] https://www.transportstyrelsen.se/en/aviation
[6] https://www.easa.europa.eu/en/domains/civil-drones/naa

page also includes details about the aviation structures that are more vulnerable to cyber-attacks and hackers. Its main purpose is to inform users of the app about the cybersecurity landscape in the aviation sector and make them familiar with the new risks that arise.

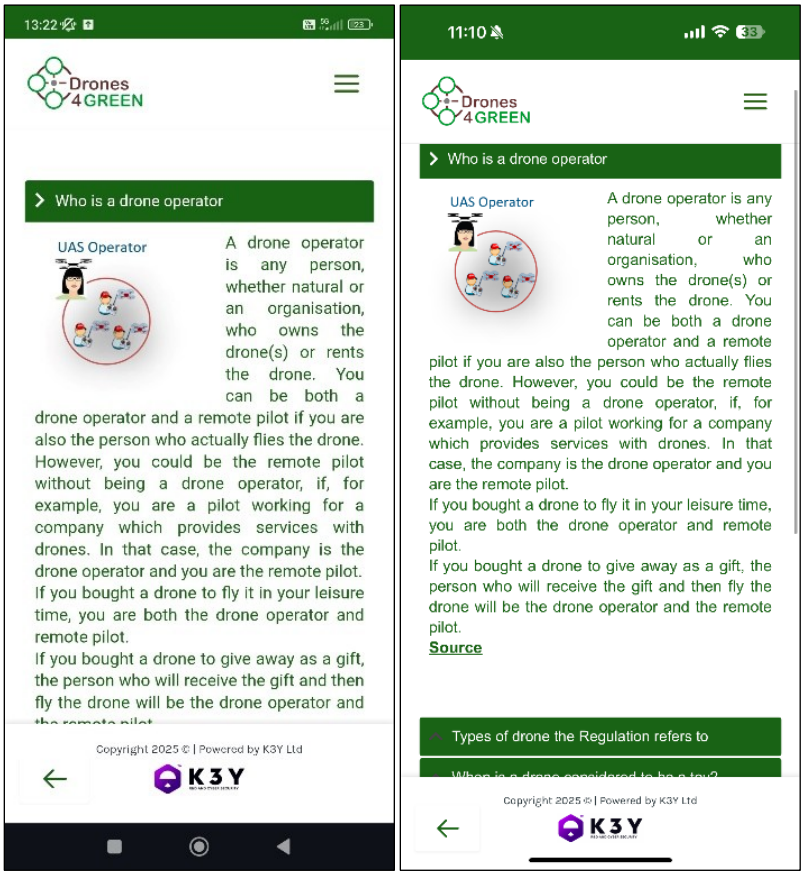

Figure 12: The Regulations Page from both Android and iPhone mobile phones

4.2 Weather

The Drones4GREEN mobile application allows users to view the weather conditions for a specific location. After selecting a location, users can view several weather conditions including temperature, wind speed, wind direction, cloud cover, visibility, precipitation probability. The application also informs user if the current weather conditions are suitable to proceed with a drone flight based on pre-defined thresholds, since the success of a drone flight depends on the appropriate weather conditions of the selected location. These thresholds can be changed by the user through the available menu. Lastly, users are able to choose the units for the weather conditions.

4.3 Flight deployment

The Drones4GREEN mobile application allows users to identify the appropriate flight deployment locations. Users can learn about the areas where drone flights are permitted and the places where they are strictly prohibited. More specifically, users can navigate to the map page and interact with the

available buttons to select their preferred country. After choosing the desired country, they get redirected to the official web application corresponding to that country, as shown in Table 7. There, they can view the areas where flying a drone is either prohibited or restricted, along with specific limitations regarding location and altitude, as displayed in Figure 13. Within the web application, users can access a variety of interactive features. These include the ability to zoom in and out, use a time slider, toggle tools, search for specific locations, and even select airports. In addition, users can initiate a flight authorization request directly through the interface. The application also offers real-time updates, important notices, and access to a flight manager tool, helping guests stay informed and compliant with national airspace regulations.

Table 7: List of official web applications of the consortium countries

Country	Webpage
Bulgaria	https://www.caa.bg/bg/category/633/7062
Greece	https://dagr.hasp.gov.gr/#map_page
Sweden	https://daim.lfv.se/echarts/dronechart/index_original.html?x=1781111.85269&y=7967317.53502&z=6&r=0&l=1001111111

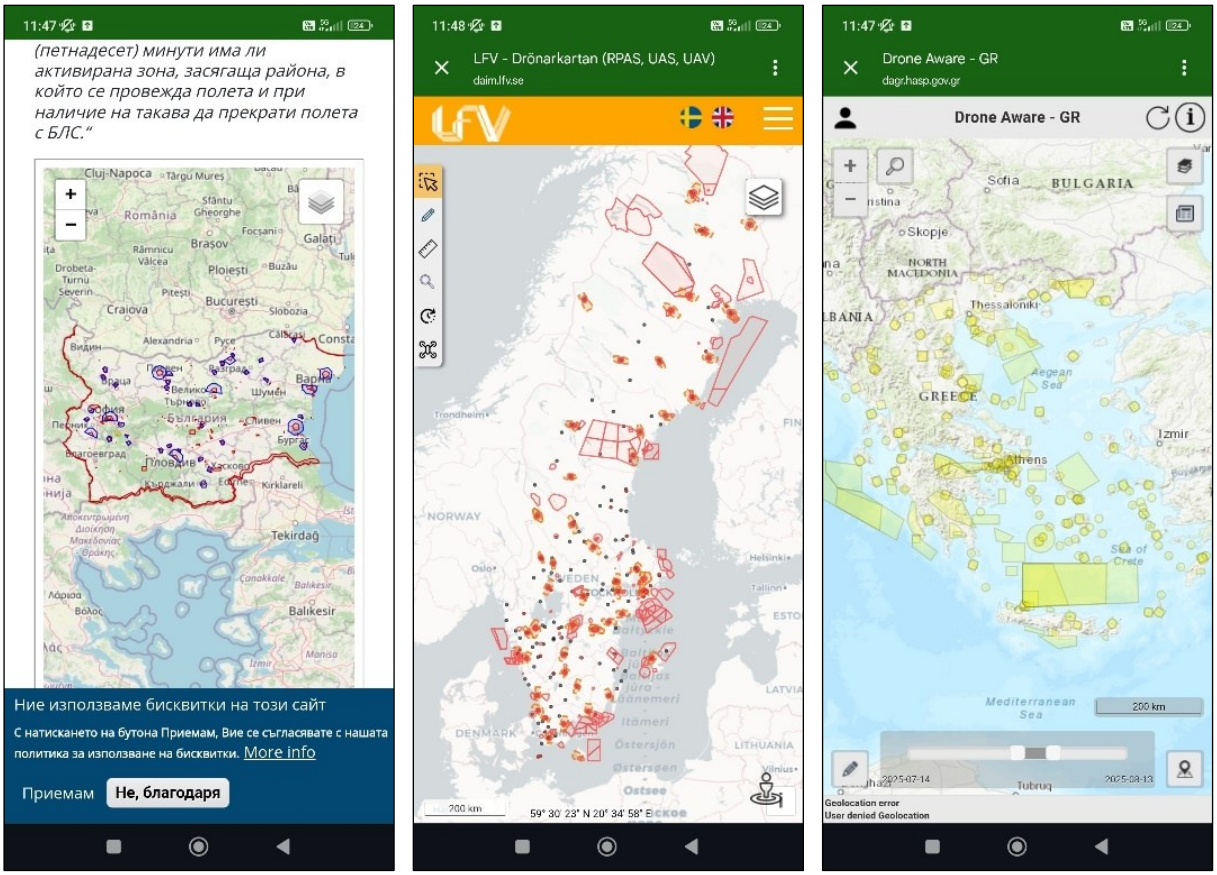

Figure 13: Official web applications of the consortium countries through the Drones4GREEN mobile application

4.4 Multilingual Content Support

The mobile application includes comprehensive multilingual support to accommodate the diverse user base across the countries participating in the consortium. It offers full content translation into all the consortium languages, ensuring accessibility and ease of use for all users. The app currently supports English, Swedish, Bulgarian, and Greek, with appropriate language selection functionality integrated into the settings, as shown in Figure 14. To support accurate display and input, the application is compatible with the basic Latin alphabet as well as characters unique to each supported language, including punctuation marks, numerals, and other relevant symbols. Additionally, the application adheres to region-specific date and time formats to provide a localized and user-friendly experience.

Figure 14: ***The Home Page in all languages from an Android mobile phone***

5. Testing and Results

Based on T3.1.4, after the completion of the Drones4GREEN mobile app development, a thorough beta testing process was undertaken to ensure the final product met the highest standards of quality, functionality, and user experience. This process was designed to systematically identify and resolve any remaining issues and improve the app's overall performance before its public release. It was carried out in four stages, each of which contributed significantly to refining this mobile application. The four stages include Internal Beta Testing, Closed Beta Testing, Open Beta Testing and Post- Beta Testing as shown in Figure 15 below.

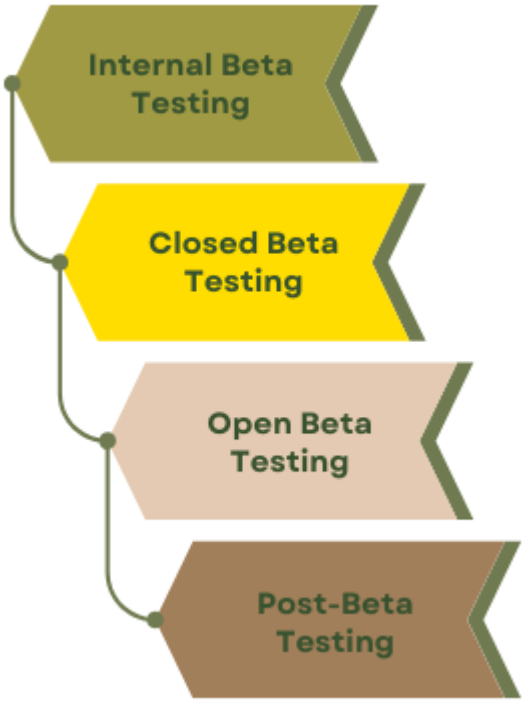

Figure 15: ***The 4-step beta testing***

The first stage of this process was internal beta testing, conducted by the core development team of K3Y. These developers, having been directly involved in the design and coding of the application, achieved to identify and address fundamental issues. During this phase, they tested the core functionalities of the application. For instance, they verified whether the homepage displayed the “Ready for a drone flight” message correctly once all necessary steps were completed. They also ensured that the map page redirected users properly to official no-fly zone web applications based on their selected country.

A significant focus was placed on the weather page. The developers tested the API integration to confirm that real-time weather data was being retrieved accurately for specified locations. They also examined the app's response in cases of invalid input, such as incorrect city names, or when internet connectivity failed, ensuring that appropriate error messages were displayed to the user. Additionally, the handling of customized thresholds was tested. They tried to set their own weather thresholds in order to ensure these

were stored correctly and that real-time weather data would be compared against the new thresholds, thereby influencing the final output message accordingly.

The development team further checked the accuracy of unit conversions, particularly in scenarios where users switched between measurement systems such as metric and imperial. This included verifying that stored preferences were retained across sessions and that the conversion logic between values and thresholds remained consistent and correct. The settings page was also tested, with special attention given to the proper functioning of features such as theme selection and language changes.

The next phase was a closed beta testing round. In this stage, access was granted to a small group of external users, primarily colleagues of the development team who were not involved in the project but had relevant technical knowledge, often with backgrounds in software engineering. This group provided valuable feedback from a more objective standpoint. Their insights highlighted several user interface issues that had not been fully addressed during internal testing. For example, they stressed the importance of having a fixed header and footer, as well as a properly functioning back button, in order to create a more intuitive and user-friendly experience. Furthermore, project partners offered constructive feedback on the multilingual capabilities of the application, especially concerning translation accuracy and the natural flow of language across different sections of the app.

Following the closed beta testing phase, the project moved into an open beta testing phase, where the application was made available to a broader and more diverse group of external users. These testers included colleagues from other departments and external partners who were not necessarily familiar with engineering or software development. Their feedback was focused more on the aesthetic and experiential aspects of the app. Many users commented on the choice of colors, the visual layout of icons and graphics, and the overall ease of use. Their impressions provided a fresh perspective on the application, helping the developers to see it through the lens of an average user rather than a technical expert.

Finally, the post-beta testing phase involved a careful review and consolidation of all feedback received during the previous stages. The K3Y developers systematically analyzed this feedback and implemented a series of updates and improvements. Certain code adjustments followed, particularly in the HTML structure of the affected pages, which resulted in an application that functioned smoothly and efficiently. Layout modifications were made to enhance the overall design and visual coherence of the interface. Several translation corrections were also carried out to ensure consistency and clarity in all supported languages. Once these changes were implemented, the application underwent a final review to confirm that the adjustments had been properly integrated and that the overall user experience had indeed improved.

6. Conclusions

In conclusion, the Drones4GREEN application, developed within the framework of Activity 3.1, is fully functional and meets all required specifications. It has been built using cutting-edge open-source technologies and is distinguished by its ease of use and user-friendly layout. The application covers the full range of features expected from a tool of this type and is suitable for both academic and business use and for both Android and iPhone mobile phones. Furthermore, it has been designed with expandability in mind, allowing for future upgrades if needed.

In terms of content, the application provides all essential information that a drone operator should know before flying, including both safety guidelines and legal regulations. It integrates updated maps to inform users about authorized flight zones and offers weather forecasts to ensure flights are carried out under appropriate conditions. In addition, it includes a dedicated section presenting information about the project, its progress, and detailed instructions for proper use of the application.

Finally, the platform supports multiple languages, as it is translated into all consortium languages, and offers customization options such as theme settings, unit preferences, and configurable limits. With these features, Drones4GREEN ensures accessibility, adaptability, and practicality for a wide range of users.

References

[1] *Widhalm, P., Ritzinger, U., Prüggler, N., Prüggler, W., Strelnikova, D., Paulus, G., ... & Eicken, F. (2025). Community drones: a concept study on shared drone services. Drones, 9(2), 107.*