Design and Development of an Emailing Management System: System Modeling

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Abstract

Developing a software platform that effectively handles email communication is the main goal of creating an email management system. Given the growing importance of electronic communication in various fields, its relevance in today's landscape cannot be overstated. This system encompasses a variety of features designed to streamline the process of sending, monitoring, and organizing emails with the utmost efficiency. Whether it's used for marketing, customer relationship management (CRM), outreach efforts, or internal communication within companies, it offers a comprehensive set of tools to facilitate these tasks seamlessly. Building and maintaining strong customer relationships, generating leads, promoting products or services, and improving an organization's online presence all depend on the presence of a well-designed email management system. In addition, intelligent email management serves to strengthen online reputation and ensure compliance with legal privacy standards. The goal of this effort is to create, refine, and optimize a comprehensive email management system tailored to an organization's unique requirements. Goals include improving the effectiveness of email campaigns, optimizing the successful delivery of messages, complying with privacy regulations, and providing a user-friendly interface. In this work, we will focus on the modeling of the system. UML modeling language is employed to clearly illustrate both static and dynamic aspects of the system, encompassing class, use case, activity, and sequence diagrams. To enhance the tangibility of the proposed solution, we developed four user interface prototypes.

Keywords: *Emailing, Modeling, Prototyping, E-Commerce Management System.*

INTRODUCTION

The creation of an emailing management system involves the development of a sophisticated software platform capable of efficiently managing large-scale email communication. This system is a complex software application designed to simplify and improve the email communication process within an organization, whether small or multinational. It offers a wide range of functionalities aimed at facilitating the efficient and automated sending, tracking, and management of emails (Hudák et al., 2017).

Before looking into an emailing management system, it's necessary to define emailing. Indeed, emailing is a direct marketing tool used to inform, invite, sell, build loyalty, manage customer relations, gather feedback, etc. The term "e-mail" comes from the English word mail. The "e" symbolizes transmission via an electronic channel. E-mailing is therefore: "the mass sending of electronic mail to Internet users. E-mailing most often refers to a campaign to promote a service, brand or product, but it can also be strictly informative". The terms "e-mail", "email", "mail" and even "mél" are widely used, but the exact term used in administrative documents in France, for example, is "courriel". Don't confuse the term "e-mail" with "spam". The term "Mél." can appear in front of an e-mail address, as can "Tél..." (Décaudin & Digout, 2011). As a direct marketing tool, emailing serves a variety of strategic purposes: informing customers, stimulating sales, building customer loyalty, and managing customer relations in a personalized way. Its effectiveness in these areas has been widely documented in academic literature (Kumar & Salo, 2018).

In this context, the project to design and develop an emailing management system is of major strategic importance.

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It aims to design, develop, and optimize a system that meets the specific needs of an organization in a constantly evolving digital environment. The objectives are multiple and ambitious: to improve the effectiveness of email campaigns in terms of open and click rates, to maximize deliverability to ensure that messages reach recipients' inboxes, to guarantee strict compliance with privacy regulations (such as the RGPD in Europe or the CAN-SPAM Act in the USA), and to provide an intuitive, user-friendly interface to facilitate its adoption by marketing and communications teams. In addition, a modern emailing management system must incorporate advanced features such as automated mailing list segmentation, dynamic content personalization, real-time campaign performance analysis, and integration with other digital marketing tools for a consistent omnichannel approach (Chaffey & Ellis-Chadwick, 2019).

In this work, we aim to design a robust and efficient emailing management system. To do this, we use the Unified Modeling Language (UML), recognized for its ability to represent complex software systems in a clear, standardized way (Rumbaugh et al., 2004). Our modeling approach is comprehensive, covering both static and dynamic aspects of the system. In addition to these UML diagrams, we also present a series of mock-ups that illustrate the system's functionality in concrete terms. These mock-ups serve as visual prototypes, offering a tangible insight into the user interface and user experience of the emailing management system. They play a crucial role in validating requirements and communicating with non-technical project stakeholders.

THEORETICAL FRAMEWORK

A well-designed email management system is essential for establishing and maintaining effective customer relationships, generating leads, promoting products or services, and strengthening an organization's online presence. In addition, intelligent email management helps improve online reputation and compliance with legal privacy standards. This topic explores the technologies and practices needed to build such a system optimally. Indeed, the theoretical framework of an emailing management system draws on several disciplines, including marketing first and foremost, which is the process of understanding consumers' needs and desires and providing products and services that satisfy them. In this respect, an email marketing system is considered an essential marketing platform that facilitates the promotion of products and services, the creation of dedicated customers, and the generation of leads (Jallat. & Lindon, 2016; Shaon and Rahman, 2015). Indeed, marketing, and particularly relationship marketing, has recently been gaining ground with the main aim of building loyalty among existing customers and developing lasting relationships between brands and their consumers (Berry, 1995; Ivens and Mayrhofer, 2003). Communication is the transmission of information from one person to another. Consequently, relationship marketing is carried out via several interrelated actions, notably via multi-channel communication defined as the use of several methods to interact with customers (Peelen et al., 2009).

Secondly, psychology is concerned with the behavior and mental processes of individuals. Relationship marketing is said to have a positive effect on customer attitudes and behaviors, such as loyalty (Mayrhofer and Roederer, 2011) or word-of-mouth (Reynolds and Beatty, 1999). Consequently, the management e-mail system can be used to understand customer behavior and differentiate and personalize messages.

Thirdly, the emailing management system is a technological tool that relies on different technologies, such as programming languages, databases, and web servers, and must comply with current emailing laws and regulations, such as the CAN-SPAM law (Federal Trade Commission, n.d.) and RGPD (European Parliament and Council of the European Union, 2026) (General Data Protection Regulation).

System Features

About the main features of this system, we will deal with management and campaign management, the user interface, security, and confidentiality.

On the management side, we cite the contact management functionality, which enables the import, organization, and updating of contact lists, while also offering advanced segmentation capabilities to target specific groups. In addition, the platform includes a library of predefined e-mail templates to speed up the e-mail creation process, as well as the ability to save and manage customized templates. In addition, the system can manage responses and unsubscribes, automate response processing, and comply with privacy and unsubscribe regulations.

When it comes to campaign management, we offer the use of emailing campaigns to organize and automate large-scale mailings. This includes the ability to closely monitor campaign performance with comprehensive statistics. In addition, we provide an intuitive e-mail editor for composing visually appealing e-mails, as well as dynamic personalization options that enable customized content based on recipient information. Our platform also facilitates the tracking and analysis of open, click, and conversion rates, with the provision of analytical reports to assess overall campaign effectiveness.

In terms of user interface, we emphasize the presence of a user-friendly interface that prioritizes ease of use for those without technical expertise. This includes an intuitive design and a centralized dashboard for efficient tracking and management of activities. In addition, our platform offers customization and automation capabilities, enabling the automation of e-mail triggers based on user behavior and providing advanced personalization options to enhance the overall user experience. In addition, our system enables seamless integration with various Customer Relationship Management (CRM) tools and facilitates connectivity with other marketing and analytics platforms.

In terms of security and confidentiality, the system protects sensitive user data and implements security protocols to prevent misuse.

In short, the theoretical framework of an emailing management system is vast and varied. It facilitates an understanding of the challenges associated with marketing, communication, psychology, technology, and emailing law. It also offers the opportunity to select the right technologies and tools to create a high-performance, efficient system.

MODELING THE E-MAILING MANAGEMENT SYSTEM

Static View

When utilizing UML (Unified Modeling Language) to model an e-mail management system, it is possible to employ various diagrams that capture different perspectives and aspects of the system. For this work, our attention will be directed towards the static view of the system. The static view, within the realm of UML, provides a visual representation of the unchanging elements of a system, including classes, objects, components, and their interconnections. This visualization allows for a clear depiction of the structure, object types, and relationships that exist between them. Two commonly used static view diagrams in UML are the class diagram, which illustrates the static structure, types, and relationships of object sets, and the use case diagram, which outlines the behavior and functionality of the system as perceived by the user.

Class Diagram

A UML class diagram represents the static structure of a system by showing the system's classes, their attributes, methods, relationships, and the constraints between them. For an emailing management system, our system's class diagram might include the following classes: User; Manager; Contact; Segment; Click Open Tracking; Email; Emailing campaign; Email template; and Email Service.
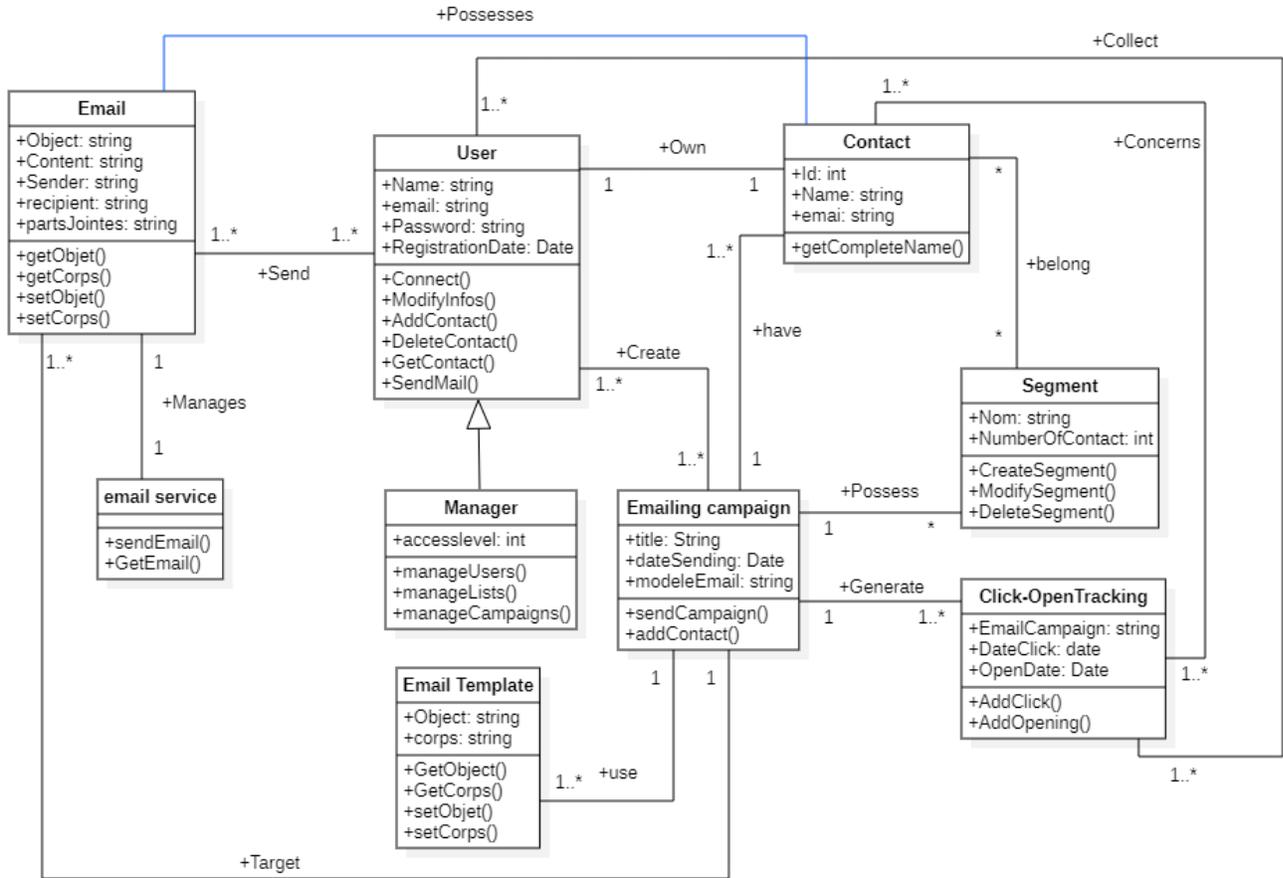
Figure 1: Class diagram

In Figure 1, which represents the class diagram, we have shown eight classes and one inheritance class. The classes shown are as follows:

User: The system allows each user to create a personal account by providing a unique login and password. Once logged in, the user can design, modify, and manage their email campaigns and associated email templates. Key user information includes full name, email address, and account creation date.

Manager: In addition to standard user functionality, an administrator has extended privileges to manage all user accounts and advanced system settings.

Contact: A contact represents a person targeted by email marketing campaigns. For each contact, the system stores data such as name, e-mail address, telephone number, and country of residence. This makes it possible to gather useful demographic and interest information. The same contact can belong to several segments, depending on its characteristics.

Segment: A segment is a group of contacts sharing a common profile or interests, defined by the user according to specific criteria applied to the contact data. Once created, the segment will automatically contain an up-to-date list of all corresponding contacts.

Click-OpenTracking: The system records contacts' interactions with sent emails, including opens and clicks, in a database. This makes it possible to collect detailed analytical data on the performance of marketing campaigns.

Email: as shown in the diagram, plays a central role in the emailing management system. It encapsulates the essential attributes of an email, including object, content, sender, recipient, and parts attachments, all defined as strings. The class provides methods for accessing and modifying the email object and body (getObject(), getBody(), setObject(), setBody()), enabling easy manipulation of the email data. A direct relationship is established with the

User class, indicating close interaction between system users and the emails they manage. This structure enables the Email class to serve as the foundation for all email-related operations in the system, facilitating the creation, modification, and potentially the sending of emails within the emailing management application.

Emailing campaign: An email campaign models the entire process, from creation to execution of an email campaign. It includes the target segments, the email templates used, and the scheduling of mailings. Dedicated functionalities enable the user to design, plan, launch, and analyze the results of the campaign.

Email template: An email template contains the text, formatting, images, and links to be integrated into a campaign's emails. It includes the subject line and body of the email template and can be reused and customized for different campaigns.

Email Service: This technical service establishes the connection with the third-party SMTP servers that deliver the emails. It is responsible for orchestrating the dispatch of emails composed via the campaign management system.

In conclusion, the class diagram is an important tool for the design of an emailing management system. It visualizes the system's classes and their relationships. It can be used to generate system code and document system architecture.

Use case diagram

A UML use case diagram represents the interactions between actors and the system. In the context of an emailing management system, we find two main actors, the user and the system, with 12 different cases as shown in Figure 2.
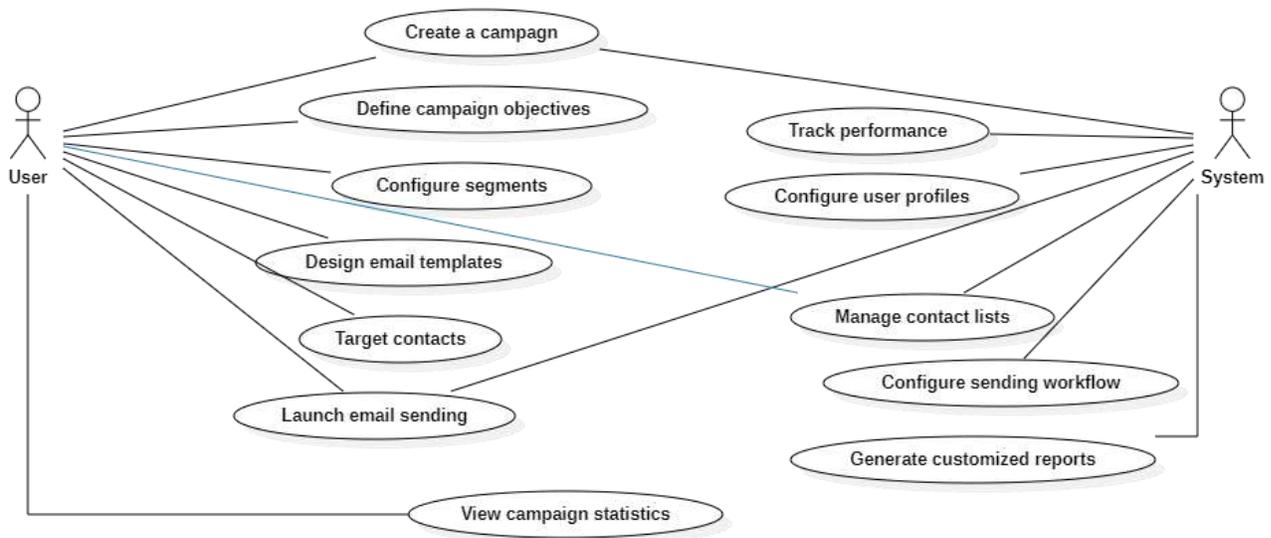

Figure 2: Use case diagram

Some cases are shared by both actors, such as creating the campaign, managing contact lists, and sending e-mails. The "user" actor plays a key role in defining campaign objectives, configuring segments, designing e-mail forms, targeting contacts, and viewing campaign statistics.

On the other hand, the system is responsible for monitoring performance by visualizing the number of clicks and views, as well as the configuration of the user profile and the sending flow, it also manages the contact list and finally generates a personalized report.

In short, the use case diagram is an important tool in the design of an emailing management system. It visualizes the system's functionalities and the interactions between the players and the system. It can be used to generate system specifications and to document how the system works.

Dynamic View

When utilizing UML (Unified Modeling Language) to model an emailing management system, it is possible to employ various diagrams that offer different perspectives and insights into the system. In this particular section, our attention will be directed towards the dynamic view of the system. The dynamic view is effectively captured through behavioral models, which provide a comprehensive understanding of the system's operational dynamics. Among the well-known models, the activity diagram and the sequence diagram are particularly noteworthy. Activity diagrams are focused on illustrating the process, making them an excellent choice for showcasing control and data flow. They visually represent the behavior of a method or the progression of a use case. On the other hand, sequence diagrams are designed to model system behavior, but with a greater emphasis on the interactions between different actors over time. Actors are depicted as horizontal cuboids or lifelines.

Activity Diagram

An activity diagram represents the flow of activities within a process or procedure. It models decision-making, loops, synchronization, and operations specific to task processing.
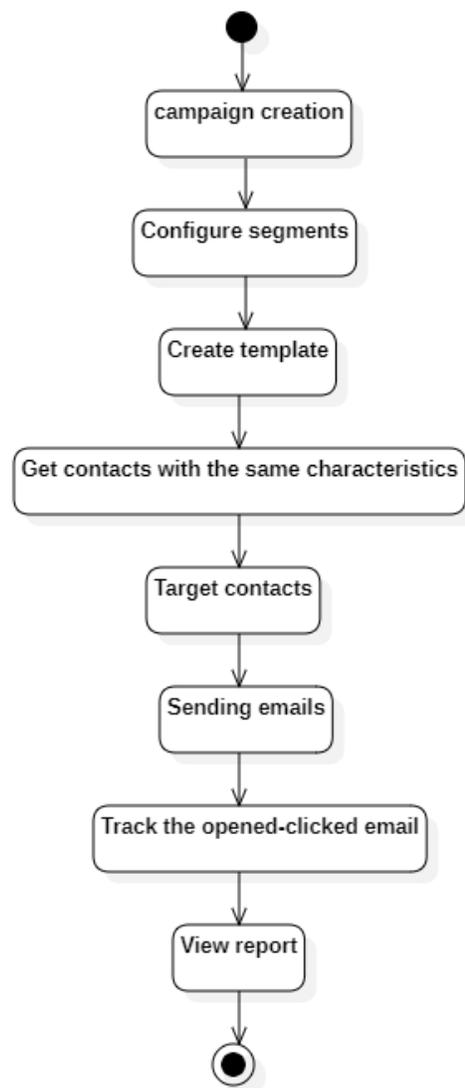

Figure 3: Activity Diagram

When a user wishes to launch a new email campaign, he sends a request to the system, which then generates a Campaign object with a unique identifier. The user designs an initial target segment by specifying the desired criteria, which the system uses to create the corresponding Segment object and identify the list of contacts concerned. The user can repeat this operation to model several distinct segments. The user then proceeds to design the email template(s) for the campaign, initializing the editorial content, visual layout, and elements such as images or links to be integrated. Once the target segments and template have been created. On the other hand, the system takes care of the actual dispatch of personalized emails to all contacts in the targeted segments, using external dispatch services. During and after distribution, the system tracks and records recipient open and click statistics in a database, enabling the generation of detailed analytical reports on campaign performance.

Sequence Diagram

A sequence diagram shows the interaction between objects over time. It visualizes the sequence of messages exchanged between objects to complete a given task or scenario.
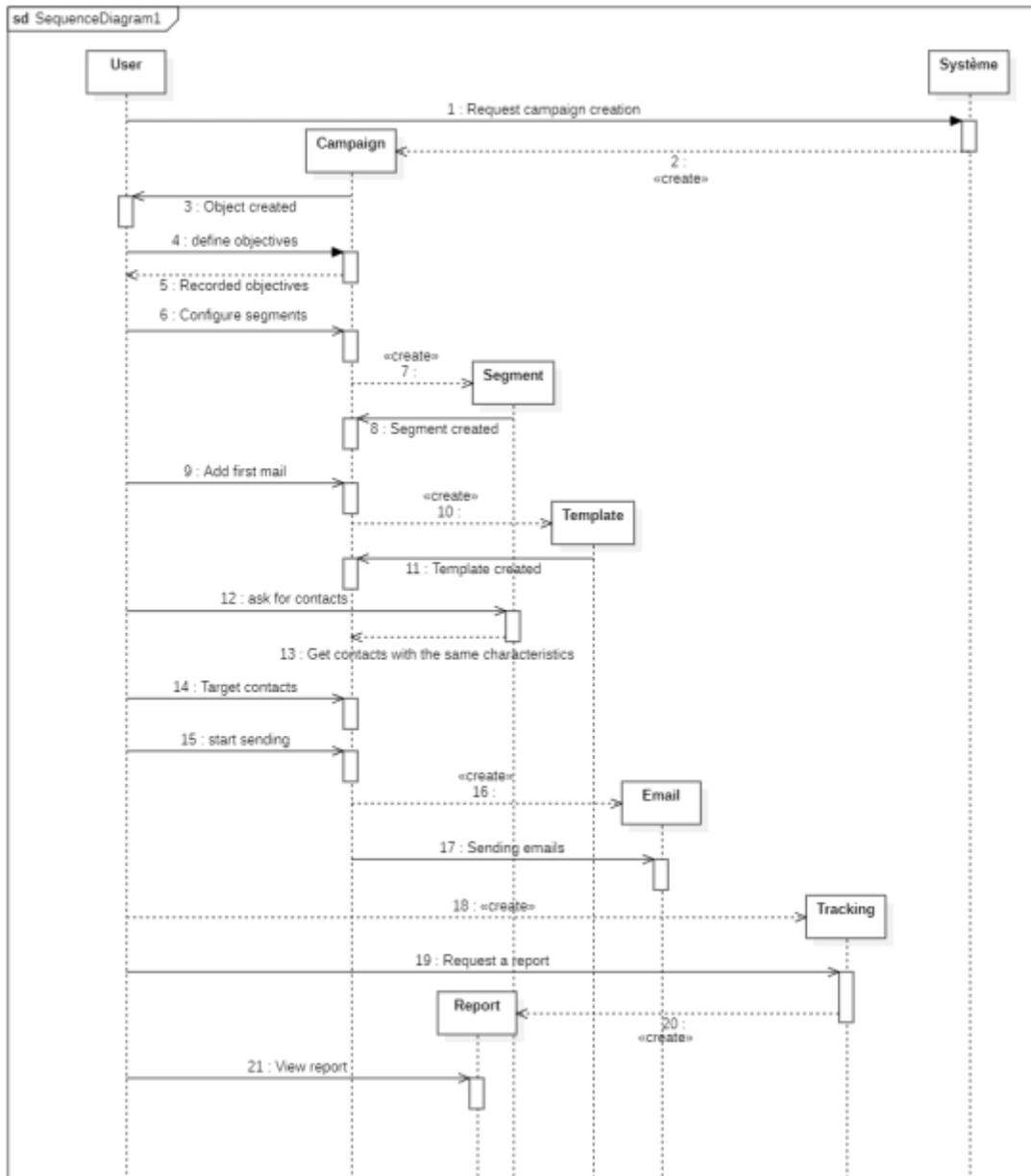
Figure 4: Sequence diagram

The user asks the system to create a campaign, and the system responds by creating a campaign object. At this point, the user defines the campaign objectives and sets up segments to define recipient characteristics. This marks the end of campaign object creation. Next, the user adds his first e-mail, enabling the initial mail template to be configured. The user targets contacts who share specific characteristics, to ensure that the campaign reaches the right people. Once the target has been defined, the user proceeds to send the e-mails. But before the e-mails can be sent, a subject line must be created. This allows each e-mail to be personalized according to the campaign's specific parameters. Once everything is configured, the user can then proceed to send the e-mails. The Tracking object tracks the number of clicks and views, indicating that the campaign has been successful.

To conclude this section, based on the Unified Modeling Language (UML), the focus was on creating visual models to represent the key parts of the system. In all, four different diagrams were created. Two of these were "static" diagrams showing the structure. The first, a class diagram, shows nine main classes. The second was a use case diagram linking two roles to twelve essential tasks. For the dynamic process diagrams, an activity diagram was

used to illustrate the system's step-by-step procedure. A sequence diagram describing the interactions between the various actors involved in the process was also included. The creation of these diagrams provided a visual representation of the system's structural elements and how information flows through the system. The combination of class, use case, activity, and sequence diagrams enabled the system to function effectively.

PROTOTYPING

Human-machine interfaces and computer ergonomics are crucial components of modern technology, capable of significantly improving user experience and productivity. User-centered design (UCD) is a methodology that prioritizes user needs and preferences in the design process, aiming to create products that are intuitive, efficient, and enjoyable to use (Lowdermilk, 2013). The use of prototypes helps teams organize their ideas, facilitating problem-solving and improving collaboration (Deininger et al., 2017).

A functional model or wireframe is a diagram used to define the areas and components of a user interface during its design. Wireframes can be created using a variety of methods, including sketching, paper collages, or digital diagrams. Wireframe modeling is a technique used in user experience (UX) design, enabling usability issues such as layout, navigation, and content organization to be identified and addressed early in the design process. It also helps identify potential conflicts between user needs and application capabilities, as well as gaps in the user interface (Soufiane et al., 2023).

The examples in this section illustrate the proposed models. Photoshop is used to implement these models. In this work, four models are proposed.

Authentication Model

Figure 5 shows the login screen of an e-mail marketing platform called "ADBOX". This interface is aligned with the User and Manager classes described in the class diagram, as it is the entry point for authenticated users to access the system. At the top of the interface, fields are provided for entering the user's e-mail address and password. These credentials correspond to the unique identifiers stored for each user or manager account in the system. Below the password field, there are options for "Remember me" to maintain the login session, and a "FORGOT PASSWORD?" link, which will trigger a password reset flow. The main call to action is the "Sign In" button, which, when clicked, should authenticate the user's credentials and enable them to access their account and the associated functions of the e-mail marketing platform. For new users, an option at the bottom of the page allows "Create an" account, which involves a registration process to set up a new user profile by providing information such as full name, e-mail address, and choosing a password that must be validated by the administrator. This login screen represents the initial authentication stage before users can interact with the main functionality of contact management, e-mail campaign creation, metrics tracking, and other capabilities described in the class diagrams.
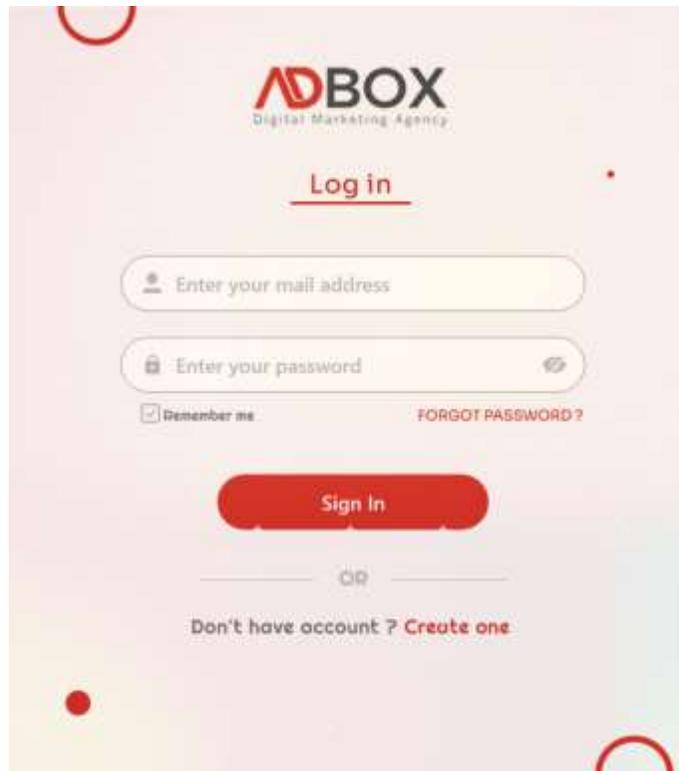
Figure 5: Authentification Page

Dashboard Model

Figure 6 shows a dashboard interface for an e-mail campaign management system called "ADBOX". It displays various metrics and visualizations relating to e-mail campaigns and their performance. At the top, graphs show the total number of opens, clicks, unsubscribed contacts, and complaints over time. Below, a revenue summary graph illustrates total revenues over the past year. On the right-hand side, pie charts display contact satisfaction and click-through rates for the current month. The "Campaign" section of the left-hand sidebar corresponds to the Campaign class, which models the complete process of creating and executing an e-mail campaign, including targeting segments, using e-mail templates, planning mailings, and analyzing results. The "Templates" section, bottom right, presents recently created e-mail templates, such as "E-commerce" and "Vacation". These templates are aligned with the e-mail template class, which contains the content, formatting, images, and links of e-mails used in campaigns. The "Top Countries" section displays the distribution of contacts between different countries, according to Contact and Segment classes. Segments are groups of contacts sharing common characteristics, targeted in campaigns. Graphs showing the total number of opens, clicks, unsubscribes, and complaints correspond to the interaction tracking functionality, which records how contacts interact with sent e-mails, providing performance analyses. The earnings table corresponds to the financial/revenue-tracking aspects of the system, presumably calculated based on performance metrics from executed campaigns.

Figure 6: User dashboard

Campaign Model

Figure 7 focuses primarily on the "Campaign" section, which represents the "Campaign" class that models the entire lifecycle of e-mail marketing campaign creation and execution. The list displays several instances of the Campaign class, such as "N2 Campaign", "Test Day", "Team Greetings" and "N1 Campaign". Each campaign instance provides details such as the launch date, number of targeted subscribers, and current status (running, stopped, or completed). The chart visualizes key campaign statistics over time, including opens (emails opened by recipients), clicks (links clicked in emails), and bounces (emails that couldn't be delivered), in line with the interaction tracking functionality that records how contacts interact with the emails sent. The "Subscribers" column shows the number of contacts or subscribers targeted for each campaign, reflecting the Contact and Segment classes that define and group the targeted audience according to specific characteristics. Although not explicitly shown in this view, campaigns probably use instances of the Email Template class to design and incorporate email content, formatting, and visual elements such as images and clickable links. In addition, the interface displays the "Earnings" section, which shows the total revenue generated by these campaigns, calculated based on the performance and engagement metrics tracked. The "Top Countries" section provides a breakdown of targeted contacts in different countries, corresponding to the geographic data stored in the Contact class. Finally, the "Templates" section presents recent examples of the "E-mail Templates" class used in campaigns, such as "E-commerce", "Holidays" and "New Year", which represent pre-designed e-mail templates that can be customized and reused for different campaigns.
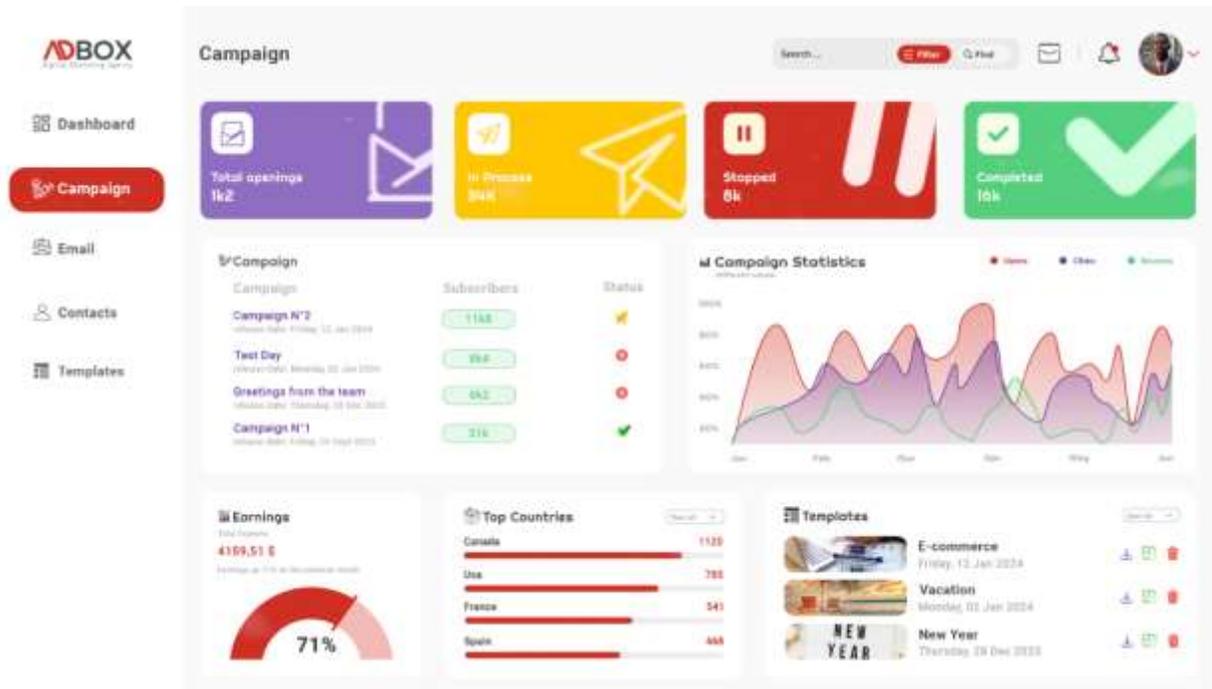
Figure 7: Campaign model

Email Model

Figure 8 displays graphs tracking key e-mail campaign metrics over time, including total opens (e-mails opened by recipients), total clicks (links clicked in e-mails), total unsubscribes (recipients who have unsubscribed), and total complaints (spam complaints received).

The "Delivery" section provides an overview of critical campaign delivery statistics, such as:

Delivery rate (percentage of e-mails successfully delivered)

Bounce rate (percentage of e-mails that could not be delivered due to invalid addresses)

Unsubscribe rate (percentage of recipients who unsubscribed after receiving e-mails)

Spam rate (percentage of e-mails marked as spam by recipients)

The table lists individual email campaigns such as "Healthcare", "Gaming" and "SkinCare". For each campaign, it displays:

Title: The subject/title of the email campaign

Status: The current status (sent, in progress, etc.) represented by icons.

Open rate: Percentage of recipients who have opened the e-mail.

Clicks: Number of clicks/interactions with links from the e-mail.

Unsubscribes: Percentage of recipients who unsubscribed after this e-mail

These metrics align with the interaction tracking functionality, which records how contacts interact with sent e-mails, as specified in the campaign and e-mail template classes. By linking these elements, it is possible to evaluate the performance, engagement, and deliverability of individual email campaigns, as well as the overall trends of several campaigns managed by this email marketing system.
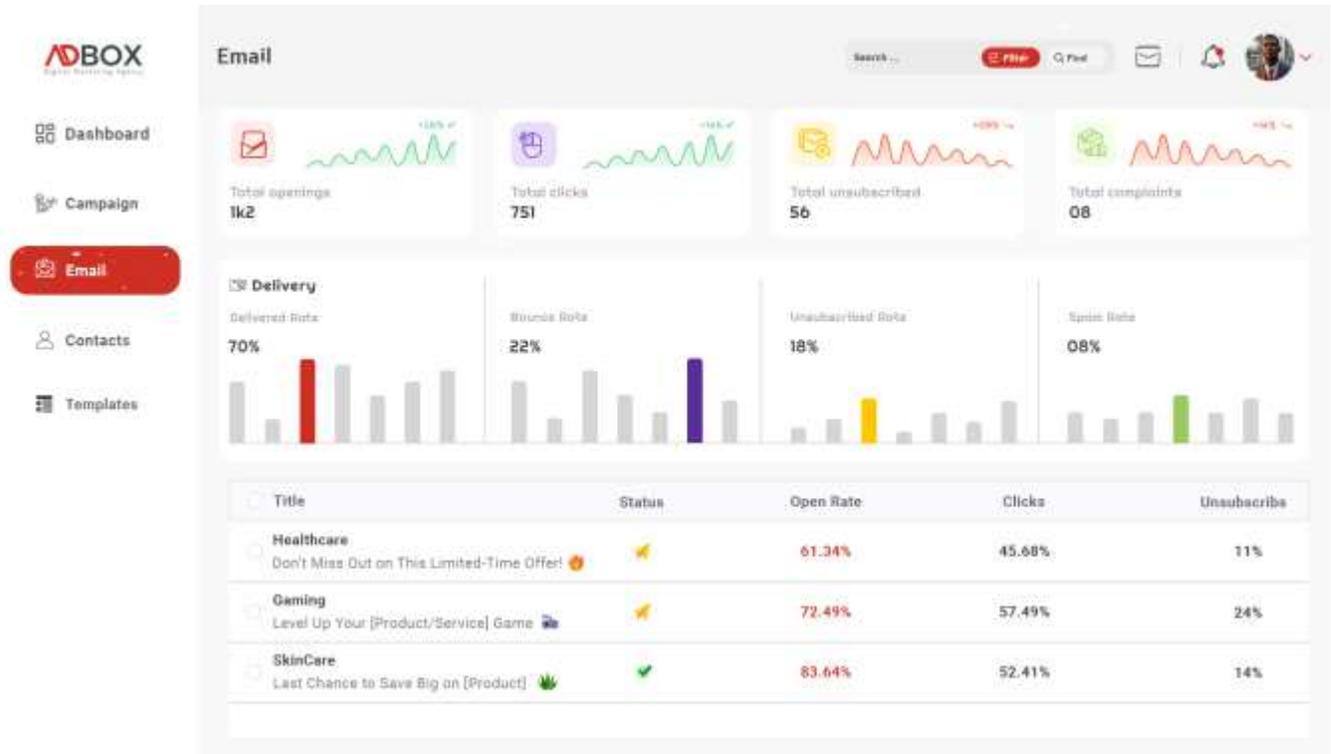
Figure 8: *Email model*

DISCUSSION

The e-mail management system described in this work offers several advantages and opportunities. Firstly, the system's design approach is in line with the principles of relationship marketing, where relationship marketing aims to establish long-term relationships with customers (Berry, 1995; Ivens and Mayrhofer, 2003). The system's ability to segment contacts, personalize messages, and track interactions will ensure that communication is more specific and relevant, thereby strengthening customer loyalty (Mayrhofer and Roederer, 2011). The system's ability to generate detailed analytical reports on campaign performance is a particular strength, enabling users to assess the effectiveness of their marketing actions. The use of UML as a modeling tool has proved highly advantageous for the design of complex systems. UML has the advantage, in this context, of facilitating communication between the various project stakeholders, as it provides a standard visual language. UML diagrams act as a common language between developers, designers, and business experts, helping them understand the system's structure and behavior. This is very important because, in digital marketing (which is by definition highly multidisciplinary), technology must be very closely aligned with business objectives and user needs. The advantages of UML modeling are that it has made it possible to detect and solve many design problems even before the development phase. For example, the direct representation in the class diagram of the relationships between the "Email Campaign", "Segment" and "Contact" classes underlined the need for flexible and scalable mailing list management, an essential feature for an efficient messaging management system. Modeling plays a complementary role in system design. Mock-ups enable the user interface and interaction flows to be visualized before system development is completed, whether at low or high fidelity. In the case of our email management system, mock-ups are useful for designing the campaign creation interface, or the dashboard. These models would not only validate the system's ergonomics and user experience but also ensure that the interface faithfully reflects the structure and functionality modeled in the UML diagrams. This design approach ensures that the system can provide personalized communication and tracking of customer interactions—a concrete implementation of loyalty programs - with access to real-time data - based on key concepts. The combined use of UML modeling and model building in the design of this email management system represents a robust and effective approach. Not only does it enable a technically sound system to be designed with the principles of relationship marketing in mind, but it also ensures that such a system will be

intuitive and enjoyable to use. This design methodology could serve as a model for other types of (obviously more complex) systems to be developed in the field of digital marketing, where technology, user experience, and business objectives need to be perfectly aligned.

CONCLUSION

This study, therefore, ends by suggesting a comprehensive approach that can be taken when trying to come up with an effective email management system. A clear representation of the static and dynamic aspects has been provided through the use case of UML modeling — this includes class, use case, activity, and sequence diagrams. To make the proposed experience more tangible we presented user interface prototypes. Among the many things that the system offers include efficient contact and campaign management which is coupled with an intuitive interface plus advanced customization and automation features as well as robust performance monitoring and analysis capabilities— designed to suit different modern marketers' needs for a powerful yet flexible platform on creating, executing or analyzing effective email marketing campaigns in any organization regardless of size.

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