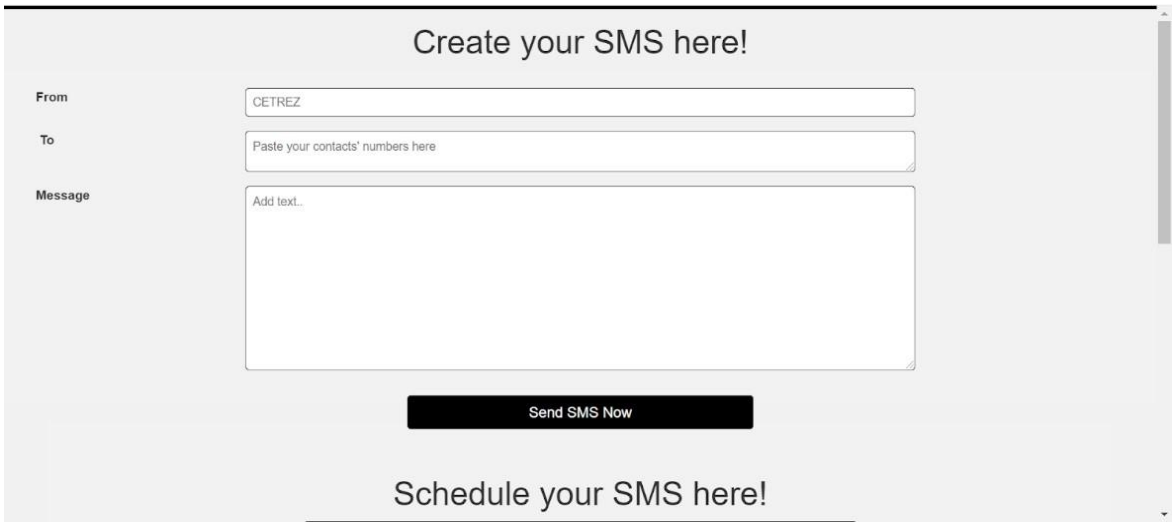

SMS solution

Bachelor's thesis in Computer Engineering

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Gothenburg, Sweden 2021

BACHELOR'S THESIS 2021

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ABSTRACT

SMS texting is quickly becoming a terrific new way to engage with clients as the use of mobile phones grows. An SMS solution system is faster and more readable than email or any other kind of communication. A business can use texting to communicate with customers, offer promotions, respond to inquiries, send reminders, and much more. More importantly, it provides a medium with an extremely high read and response rate when compared to email and phone calls.

Email and SMS are complementary channels that can be used together to create a smooth client communication experience if used effectively, and for this reason, this project involves developing an SMS solution to complement Cetrez's marketing channel C5 PRO. More importantly, it provides a medium with an extremely high read and response rate when compared to email and phone calls.

This SMS-solution summarizes a mix between a technical component that requires programming expertise and a strong emphasis on interaction design that emphasizes the design approach. It also allows the user to determine the optimum user flow, which can be achieved via the use of several approaches like prototyping and wireframing to develop a clear plan to follow before the programming phase begins.

Keyword: SMS-solution, C5 PRO, design approach, interaction design, prototype, wireframing, programming.

Sammanfattning

Som marknadsföringsverktyg har SMS vuxit i storlek, de senaste åren har företagen hittat ett sätt att anpassa SMS och optimera SMS för användning som ett serviceverktyg. I huvudsak på grund av dess många fördelar! När ett företag använder sig utav en SMS-kanal kan företaget i sin tur hjälpa till att: öka kundretentionen, utveckla större, varumärkeslojalitet, ge omedelbar kommunikation, attrahera nya kunder, öka den totala försäljningen...mm.

Tanken med detta projekt är att komplettera Cetrez marknadsföringsplattform C5 PRO med en SMS-kanal för att nå en större mängd av mottagare, och skapa något som gynnar både företaget och kunderna. På detta sätt kan företaget på ett effektivt sätt kommunicera, och få bättre relation med klienterna. Att använda SMS-kanal i företag är effektivt, enkelt att installera och har nästan omedelbar inverkan på svaren och försäljningsmöjligheterna.

Projektet går ut på att skapa en webbsida som man kan skicka SMS ifrån till önskade kontakter. Denna SMS-lösning består av två delar. Den ena är en teknisk utveckling och den andra delen lägger fokus på Interaction Design och koncentrerar sig på användarupplevelse. Detta görs genom att hitta det lämpligaste användarflödet med hjälp av olika metoder såsom ”prototyping” och ”wireframing” för att skapa en klar bild av hur produkten kommer att se ut innan man börjar med programmeringsdelen.

Nyckelord: SMS-lösning, C5 PRO, webbsida, programmeringen, Interaction Design, användarflöde.

PREFACE

This report is a thesis degree in Bachelor of Science in Computer Engineering at Chalmers University of Technology. The work was carried out by Firel Issa and Smedra Touma, during the last reading period in spring term 2021.

First and foremost, we would like to thank and praise God, the Almighty, who has blessed us with innumerable blessings, knowledge, and opportunities, during our three years at Chalmers and allowing us to finally finish our thesis.

This bachelor thesis was supported by the number of people who contributed intellectually, practically, and in other ways. Firel and Smedra would like to express their gratitude to the IT company Cetrez for allowing us to work on one of their systems. Sakib Sistek, the thesis supervisor at Chalmers, deserves special recognition. We can't thank him enough for his unwavering support and assistance. Every time we attended one of his meetings, we felt energized and encouraged.

Last but not least, we want to express our gratitude to our family and friends for their assistance and support during this difficult period. It would be impossible to find suitable words to express our gratitude to those individuals. Many appreciations and heartfelt gratitude to every one of you.

Firel Issa, Smedra Touma, Gothenburg, June 2021

Glossary

C5 PRO	Digital marketing platform for Cetrez.
SaaS	Software as a service is a method of providing software as a service through the Internet. Instead of installing and maintaining software, you just use the Internet to access it, eliminating the need for complicated software and device maintenance.
User experience	Is the way a customer interacts with and uses a product, system, or service. It encompasses a person's views on usefulness, usability, and efficiency.
B2B	Business to business.
B2C	Business to clients, like Facebook.
UX Flow	A diagram that depicts a user's whole route through a product.
API	Is for Application Programming Interface, and it is a software mediator that allows two apps to communicate with one another.
Backend	Everything that happens behind the scenes of an application, such as servers and databases, is referred to as the underlying system.
Fronted	Adds the interface of the website that the user interacts with, as well as the code that runs on the client side, to what the user sees in their browser.

Contents

1. INTRODUCTION

This part will cover an introduction about the background, the goals and purpose of the project, problem description and formulation, and lastly the limitation.

1.1 Background

This degree project is implemented in an IT company named Cetrez. This company is a usercentric software company with a high focus on transforming digital experiences for global brands, primarily within the automotive and the luxury industry.

Cetrez develops web-based application which are offered as SaaS (Software as a Service) products to their clients. Digital marketing, event management, client loyalty, and customer experience are the key focal areas of the product.

Cetrez is working with software development for several automotive companies with a strong UX-first approach (User Experience) for the whole retail chain, and Cetrez is looking to expand their product offering with new functionality.

Cetrez is looking to complement their existing product offering with an SMS solution channel as an add-on for their existing marketing platform called C5 PRO.

The SMS solution will be a web-based software within their existing product framework, and it will be for primary use within a B2B context.

1.2 Goal

The goal of this project is to add an SMS-channel as a web-based application to the existing email marketing platform. This SMS-channel lets the user send out invites to events, campaigns, customer surveys, and other messages in a similar user-friendly manner as the main platform, C5 PRO. One of the most important aspects of the project, as well as a significant challenge, is to ensure that a lean technological solution is combined with an intended design and UX approach that is consistent with the C5 PRO design language. Goals for this project are:

- To reach a similar user behaviour and user experience as in C5 PRO. That means, the user-friendliness of the SMS-solution should be identical to the C5 PRO's.
- Find a balance between technical features versus the design approach, given that technical aspects do not take precedence over design and usability, since Cetrez has user experience as a priority.
- Create a strong offering in product features compared to similar SMS solutions. That means, to attain similar results in SMS solutions, alternative online SMS-solutions must be examined from various angles.

1.3 Purpose

The purpose of the SMS solution is to enable Cetrez B2B clients to communicate with their existing customer base with a strong focus on usability and user-friendliness.

The majority of Cetrez's customers are in the luxury retail market, with worldwide headquarters, local importers, and local shops as users of the product.

1.4 Problem Description and Question Formulation

Email marketing is still the strongest marketing platform for B2B clients and is suitable because it is non-intrusive and more cost efficient than SMS.

However, the email marketing platform doesn't cover or appeal to all B2B clients and the SMS-channel complements the marketing needs for more time critical communication. The SMS-channel is therefore a strong complement to the existing product offering and a natural complement to the client's needs.

The main question formulation is to find out:

What would be the ultimate SMS solution for C5 PRO to fulfill Cetrez's clients' needs?

1.5 Method

Primarily, it is important to have a clear design approach, a UX-flow (i.e. a flow for the usability of the design for the users) and then identify how the entire work will be developed and which frameworks to use for the frontend and backend development. In the first two weeks, the work will be wireframed i.e., to draw an overview of the project early, so that it can quickly be known if the process/work is on the right path. Since it's important to have a clear list to follow when wireframing the process:

1. Find out the right thing in good time and do a plan for the product building from start to end, using prototype methodology.
2. Persona, the type of person who would interact with the product. Based on Persona the owner can effectively design a specific flow, interface and prioritize the product backlog.
3. How to wireframe, which puzzle pieces are needed here:

    1. Miro, which is useful for visualizing the flow of several functions and getting a general picture of the solution.
    2. Trello, to keep track of the project's progress. It's simple to move the cards around when the work is in process, being tested, or being completed.
    3. Figma, for prototyping before coding.

4. For the entire project, there is a UX flow that monitors the user's progress through the product and tracks each action they take from beginning to end.

5. Which frontend and backend frameworks will be chosen, as well as which programming language?

6. Begin by constructing, and then begin to develop based on the preceding processes.

1.6 Implementation

This part is about the data analysis, the researches as well as the source code.

1.6.1 Data Analysis and Research

To have a better understanding of the solution, extensive research into different SMS alternatives was conducted, as well as describing the benefits and drawbacks of each option and this information was compiled in a Miro document. Each proposal was described in detail, including which features that were considered would be useful for the project and which were not.

Each proposal has been analyzed and decided which a functionality and unique designs. The majority of the solutions had one thing in common: they were all simple to use (i.e. easy to interact with the solution and they had basic steps to send or schedule). See Figure 1.1 and Figure 1.2 for some of the SMS solutions that were investigated.

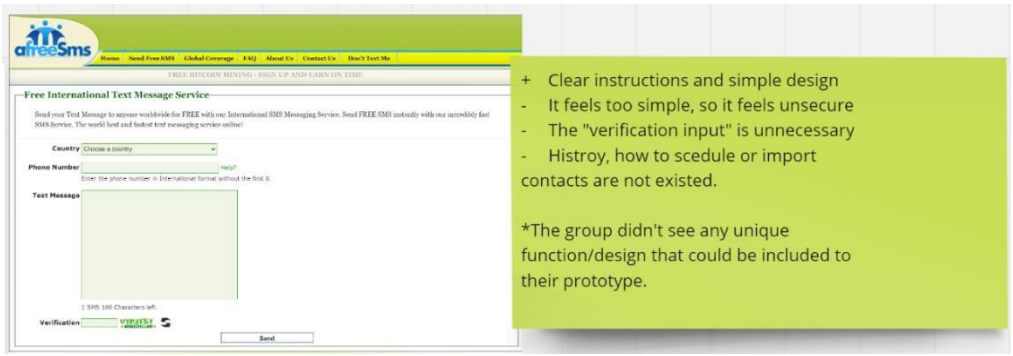

Figure 1.1: Image illustrates the first SMS solution that was found on the web with a short analysis. The analysis to the right, summarize the advantages and disadvantages with the solution.

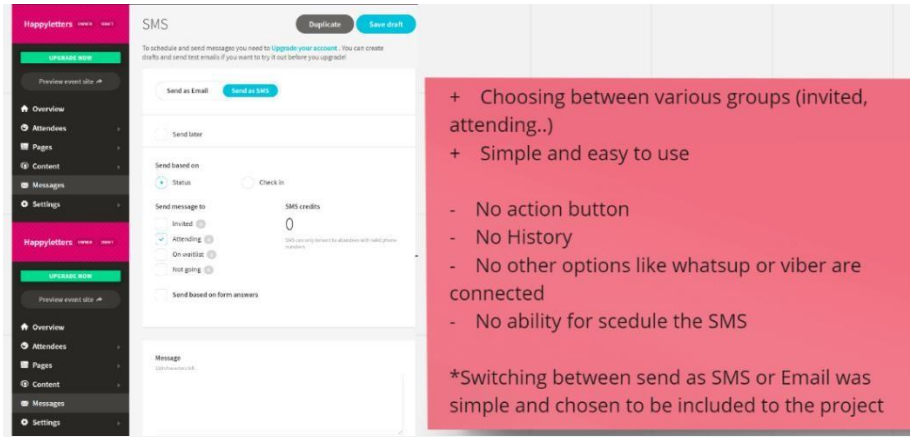

Figure 1.2: Image illustrates the second SMS solution that was found on the web with a short analysis. The analysis to the right, summarize the advantages and disadvantages with the solution.

1.6.2 The Source Code

The source code for the website application can be found in a GitHub repository. Git was used to manage the online download of the latest version of the source code, as well as the saving and uploading of locally generated source code to GitHub. The application's source code was divided into PHP, HTML, and CSS files, each with its own set of responsibilities. Each programming language has a file name that describes the functionality of the file.

In Visual Studio Code, all files were saved in a folder named C-solution, and each file was used for its designated function. Figure1.3 shows how the files were made:

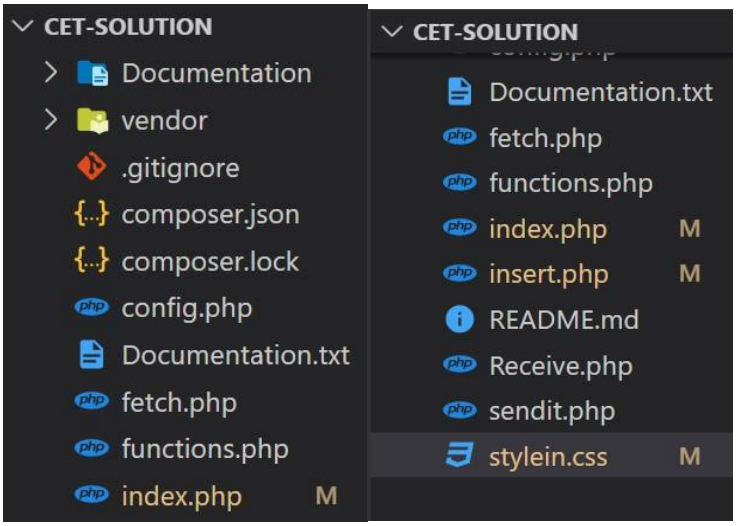

Figure 1.3: Illustration of the different coding files in Visual Studio Code, including vendor and Documentation.

- **index.php:** Here are the main things in the program, connect to other pages.
- **insert.php:** In this file the connection to the database and the data insertion were saved here.
- **receive.php:** Here is the code of how to receive an SMS using Twilio.
- **sendit.php:** This file describes how to send an SMS using Twilio.
- **fetch.php:** This section is responsible for the database's output. (i.e. the sent SMS)
- **stylein.css:** In this file, everything that has to do with style and design was implemented here.
- The map that is called **vendor** was installed automatically when the composer was installed.

1.7 Limitations

- Because Cetrez is more interested in communicating with other businesses than with customers, the SMS solution will focus on B2B rather than B2C context.
- Because web-based software is easier to interface with and use, particularly for customers with basic IT skills, the SMS solution will be created utilizing web-based software rather than mobile-based software.
- This project is being completed remotely rather than on-site because of the current pandemic situation. This project will only involve software development; however, no hardware will be required.

2. THEORY AND TECHNICAL BACKGROUND

This section goes through the software that was used during the project and what it was used for.

The three main programming languages used in this web application are HTML, CSS, and PHP. In addition, the project's version control and web server were also identified, as well as other vital software such as API Integration.

2.1 Programming Languages

PHP is a programming language at its most basic level. It is a widely used language that can be put into HTML, which is a significant benefit for anyone who works on the internet. PHP pages combine HTML with embedded code, which makes them much easier to manage than HTML pages, which can be extensive and contain numerous commands [1].

2.1.1 PHP

The abbreviation PHP stands for Hypertext Pre-processor. It is not nearly as tough to learn as it appears. It allows the user to capture, process, and use data to produce output — in other words, it allows communication with all websites.

PHP is used in three major areas:

- The key area for PHP is server-side scripting. If you want to practice at home as a beginner, this is the way to go.
- Scripting on the command line is ideal for Task Scheduler scripts. Often useful for basic text processing.
- Writing desktop applications – PHP is not the best language for creating desktop applications, but it does provide a lot more choices for experienced web developers than its competitors.

Figure 2.1 illustrates an introductory example of PHP and how it can be embedded in HTML. PHP is straightforward and basic, but it contains a lot of specialized capability for a skilled coder.

test.php > ...

```
1   <!DOCTYPE html>
2   <html>
3       <head>
4           <title>Example</title>
5       </head>
6       <body>
7
8           <?php
9               echo "Hi I'm a PHP script!";
10          ?>
11
12      </body>
13  </html>
```

Figure 2.1. An introductory example about HTML syntax, the output here is Hi I'm PHP Script!

2.1.2 Frontend

The frontend programming language is **HTML,** and it stands for Hypertext Markup Language, it's a markup language for creating web pages. A Web page's layout is described in HTML and is made up of several separate components. HTML components define how material should be presented in the browser, and the elements are used to distinguish between different forms of text, such as "this is a heading," "this is a paragraph" as it described in Figure 2.2 [2].

Figure2.2: Example of the HTML syntax

Some of the HTML features that were used in this project:

- It is a basic and easy to learn language.
- HTML has a lot of formatting tags, making it simple to create an efficient presentation.
- HTML makes it easier for programmers to add links to web pages (via the html anchor tag), which increases the user's interest in browsing.
- It is platform-agnostic, as it can run on any operating system, including Windows, Linux, and Macintosh.
- It allows programmers to easily add graphics, videos, and sound to web pages, making them more appealing and interactive [3].

HTML's advantages and disadvantages that were noticed during the work:

- HTML is a widely used programming language.
- It is simple to comprehend and use.
- Because it comes installed by default in every browser, it is no need to purchase any additional software.
- HTML can only create static and plain pages, so it is not possible to utilize it to create dynamic pages.
- The security mechaniSMS of HTML are inadequate [4].

CSS stands for Cascading Style Sheets and is a system sheet language that allows web designers to control how an internet site interacts with web browsers, including the formatting and display of HTML documents. CSS is a text-based coding language that defines the formats of websites and how they interact with web browsers, as it is illustrated in Figure 2.3. Web developers may use the language to control various style elements and functionalities,

such as colors, layout and fonts as it is shown in Figure 2.4 and thus HTML document formatting and display [5].

```
test.css > ...
1   body {
2       background-color: lightcoral;
3   }
4   h1 {
5       color: white;
6       text-align: center;
7   }
8   p {
9       font-family: verdana;
10      font-size: 20px;
11  }
```

Figure 2.3: Example of the CSS syntax

Figure 2.4: The Figure Illustrates how CSS can be used to make a variety of Figures with various colors and fonts.

CSS's advantages and disadvantages that we discovered through this project:

- CSS is significant because it allows you to create a repeated style for an element once and use it several times since CSS automatically applies the relevant styles.
- A variety of websites employ the same design. The ability to govern several locations with a single command is beneficial.
- CSS makes website design and maintenance easier by influencing the entire website and reducing maintenance time with a single line of code change.
- The customer can easily customize their internet page.
- When it comes to CSS, what works in one browser may not function in another. The web developers must test the program's consistency in various browsers.

- If any incompatibilities emerge after the changes are made, the user must validate compatibility. The same update affects both browsers.
- Cross-browser difficulties might arise while using CSS [5].

2.2 Backend

This section is about the technical work, namely the database, other programs that had been used during the project, as well as design methods.

2.2.1 Database

A database is a logically ordered collection of organized data stored in an electronic format in a computer system. A database is usually managed using an information management system (DBMS). A database system, which is commonly reduced to just a database, refers to the files, the DBMS, and the applications that go with it. The most prevalent forms of databases in use today are modelled in rows and columns in a sequence of tables to make retrieval and data searching more effective. After that, the data may be easily read, managed, edited, monitored, and structured. Most databases employ the structured query language for data writing and querying (SQL) [6].

To maintain the integrity of a database, each shift or transaction must adhere to a set of criteria known as ACID:

- Atomicity: when updating data in a database, if one part of the update fails, the complete update fails, and the data remains untouched; this prevents the creation of incomplete entries.
- Consistency: before data can be updated in a database, it must be checked against a set of rules.
- Isolation: multiple modifications can be made at the same time in databases, but each one is distinct from the others.
- Durability: even if the code fails after an update, the data remains secure [7].

2.2.2 Table

When the SMS is sent, the data is stored in a Table in the database. A single database can hold large number of tables that can be linked together. A relational database is made up of tables that are linked together. A database with only one table is referred to as a flat-file disk. Because flat-file databases are simpler to create and comprehend [8]. Data can be stored in the database and displayed on the web program using queries.

2.2.3 MySQL

MySQL is an open-source relational database management system based on SQL. It was designed to run on any machine and was built with web applications in mind. As the internet grew, new and diverse standards evolved, and MySQL became the portal of choice for software developers and web-based apps. MySQL is a popular choice for ecommerce businesses that need to process large number of money transfers because it is designed to

manage millions of requests and thousands of transactions. The essential aspect of MySQL is its on-demand adaptability.

When developers talk about databases, they are usually referring to MySQL, a popular database management system that can handle projects of any size. MySQL's capacity to process large volumes of data without breaking a sweat is one of its main selling advantages. MySQL is the database management system used by Airbnb, Uber, LinkedIn, Facebook, Twitter, and YouTube, among other famous websites and web-based apps.

2.2.4 PhpMyAdmin

PhpMyAdmin For database creation, SMS-solution employs phpMyAdmin. PhpMyAdmin is a free PHP-based software platform for remotely managing MySQL databases. It can handle a wide range of MySQL and MariaDB activities. You can use the user interface to manage common activities (such as databases, tables, columns, connections, indices, accounts, and permissions), but you can also run SQL queries directly from the command line [8].

Some of the features of phpMyAdmin include:

- Web app that is easy to use.
- Most MySQL features are supported:
    - Databases, tables, views, fields, and indexes can all be dragged and dropped. ○ Databases, tables, fields, and indexes can be created, copied, dropped, renamed, and altered.
    - server, files, and tables, as well as server interface suggestions.
- Data can be imported from CSV and SQL files.
- It allows you to manage several servers [8].

2.3 XAMPP

The **XAMPP** web server was ideal for the PHP scripting language that was utilized. XAMPP stands for Cross-Platform, Apache, MariaDB, PHP and Perl. XAMPP is a popular crossplatform web server that allows programmers to build and test their code on a local web server. It was created by the Apache Friends. It includes Apache HTTP Server, MariaDB, and interpreters for PHP and Perl, among other programming languages. Until releasing a website or client to the main cloud, XAMPP allows a local host or server to try it on the computer [9].

2.4 API

API Integration stands for Application Programming Interface. In other words, a messenger that handles requests and enables business networks to run. APIs enable data pipelines, software, and computers to connect, which is critical to any online business infrastructure. For an illustration, see Figure 2.5. It also makes it possible for businesses to send and receive data between multiple APIs. API gives the ability to:

- Messages may be sent and received in a variety of ways.
- Enter the recipient's answer without requiring a pin.
- Check the status of all your SMS [10].

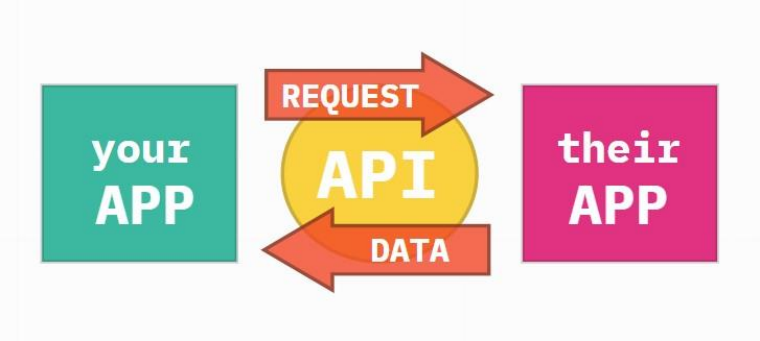

Figure 2.5: Illustration about how the API works. The green square sends a request to the user using the API and therefore the user can send back data to the sender.

2.5 Twilio

Twilio is a communication platform that lets programmers send and receive SMS, phone calls, and MMS messages, as well as leverage its web service APIs to perform other collaboration tasks. Using Twilio's REST API, users can send SMS messages to cell phones all over the world using a Twilio phone number [11]. See Figure2.6 for an illustration.

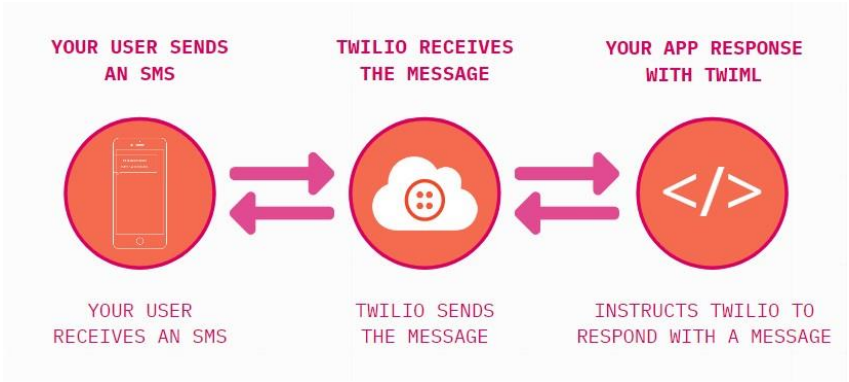

Figure2.6. Illustration about how Twilio works. Here it shows that Twilio works in the same way as the API where Twilio moves the data between the sender and the recipient.

2.6 Composer

Composer is a PHP utility for managing dependencies. It assists you in declaring which libraries your project relies on, and it will install and update them for you. Composer helps you to add the necessary setup libraries to your project [12]. See Figure 2.7.

```
1  $composer require phpmailer/phpmailer
```

Figure 2.7: Illustration about how Composer installation works. The user only needs to perform this on the command to utilize the Phpmailer-library.

2.7 Git

Git is an open-source version control technology that lets developers manage projects and access files, updates, and other project-related data from centralized hosting sites like GitHub [13].

Git allows you to branch out from the source code. This allows you to collaborate with other programmers more effectively and provides you with a ton of workflow versatility, as is shown in Figure 2.8.

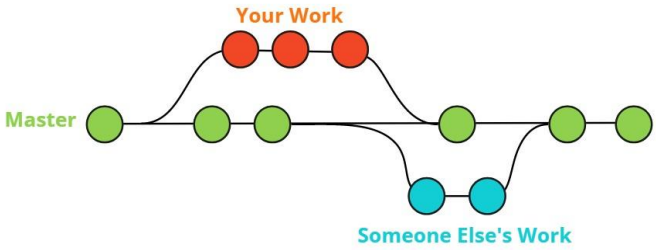

Figure 2.8. Illustration about how a branch in Git works, two people can work at the same time (orange and blue), each one can push the code to Git to Master (green).

2.8 Visual Studio Code

Visual Studio Code is an open source-code editor developed by Microsoft and includes number of different programming languages, including Java, JavaScript, Go, Node.js, Python, PHP, HTML, CSS, and C++. Visual Studio Code comes with a lightning-fast source code editor that is ideal for everyday use. Syntax highlighting, bracket-matching, auto-indentation, box-selection, snippets, and more are all available in VS Code, which supports hundreds of languages. You can navigate your code with ease thanks to intuitive keyboard shortcuts, simple customization, and community-contributed keyboard shortcut mappings [14].

2.9 Prototyping

Prototyping is a technique for testing a product before coding it and fast improving fewer good ideas. Prototyping is also a simple model of any solution that can be quickly tested, validated, and modified. Prototyping can be done by first drawing with a paper wireframe, or by using various means to represent the chosen solution. While sketching, these strategies allow the user to uncover various options and alternatives to improve some functionality.

Prototyping allows the designer to interact with the user or stakeholders and develop deeper intuition and experiences that will aid in the design decision [15].

2.10 Wireframing

Wireframing is an approach to model how a user interacts with a product's interface. It is a strategy that UX designers frequently employ to clarify their design concepts for any desired product, website, or app [16]. Wireframing is another important schematic that allows the designer to consider the skeleton of the product they are building. Wireframing also saves you a lot of time and effort in the long run [17].

When it comes to wireframing methods, there are a handful of options. Although wireframing is not the initial stage in the process, it is critical to gather as much data as possible to understand who your target audience is, create user personas, and determine use cases. Some designers begin with low-fidelity (low-fi) wireframes, which are essentially just a simple background with lines and labels. The process is known as Pen-and-Paper wireframing. It focuses on the architecture of an app or website interface and comprises both hand-drawing and digital sketches.

There are generally three types of wireframes:

- Low-fidelity wireframes are the first step of wireframing, focusing on the User Flow. The purpose of these wireframes is to use simple forms to establish the structure of the UX designer's ideas. Pen-and-paper drafts or simple digital software wireframing, with only a white background and black sketches, are both options for developing those wireframes.
- both Midi-fidelity wireframes: The next phase is to focus on the functionality of the UI elements. This step builds on the Low fidelity wireframing but refines it further. These wireframes can be drawn on paper or on a computer [18].
- High-fidelity wireframes: These wireframes are built on midi-fidelity schematics, which allow the designer to add professional functionalities to the project's user flow. The major goal of these wireframes is to show the user flow of the product in its ultimate form.

2.10.1 Figma

A web-based graphics editing and user interface design program. The user can design anything from wireframing to prototyping, whether it is for a web or mobile application [19].

2.10.2 Miro

Miro is a program for visual communication; the work was planned here in conjunction with Trello to provide an overview of how everything will be completed, including distinct tasks and subtasks for each Epic, User Story, Task, and Subtask. Miro is also utilized for teamwork, allowing for seamless cooperation and project planning [20].

3. DESIGN METHOD

This section discusses the recipe for the project as well as the method(s) employed during the time-period and data analysis.

The work started by searching after other SMS-solutions to get a better understanding on how the solution will be designed in an approximate way, and even how easy/hard it can be to interact with these solutions. In this case, for Cetrez the important thing is to find the ultimate communication solution and find a UX-flow that satisfies the customers' needs and that's why other solutions can be important to us.

3.1 Prototype Design

The project began with the creation of a prototype in Figma, because of previous experience in the Human Computer Interaction course, that application was picked to provide a more accurate preview of the site being constructed. The design process began with viewing YouTube videos to have a better grasp of how Figma works, as well as experimenting with different sketching methods before completing the final prototype [21].

The prototype design took around three days to complete. The first day was spent learning how to work with Figma. The focus was on design rather than User Flow, which is the central concept and therefore more important. The concept of User Flow was ignored for some reason, and the focus was solely on the design rather than the functioning. The following days were spent beginning the prototype and focusing on the product's colors, sizes, and typefaces. See Figures 3.1, 3.2 and 3.3 to get a deeper understanding.

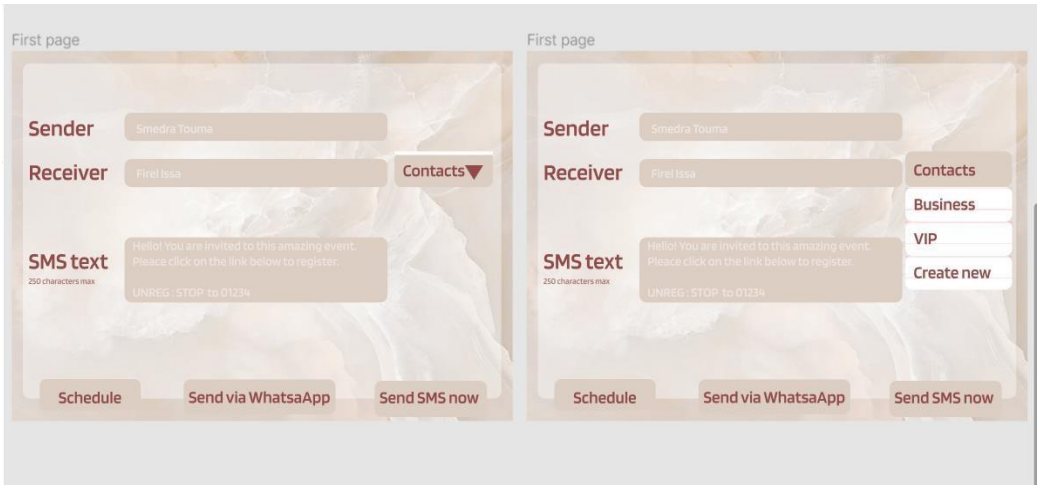

Figure 3.1: How to send/ schedule a message and choose between different contacts (from the first prototype). Three fields that can be filled, the user can use contact from the dropdown list and to write a text. The user is also able to choose to send the SMS using Whatsapp.

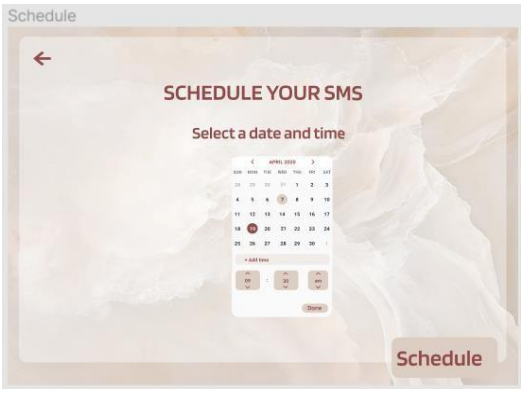

Figure 3.2: How to schedule (from the prototype). The user can choose between different times and dates to schedule the message.

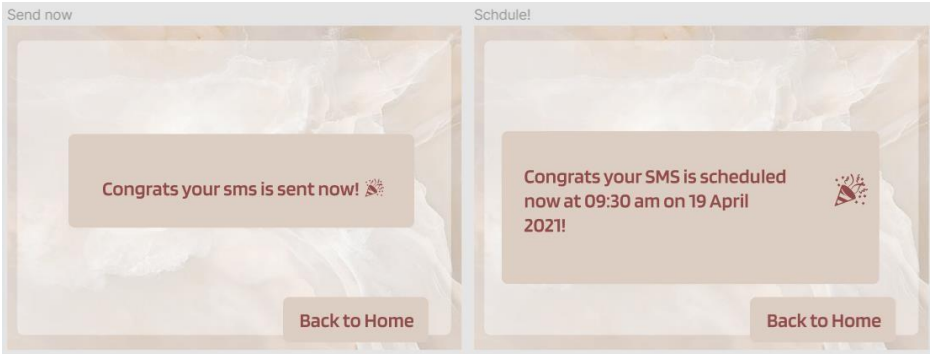

Figure 3.3: Confirmation of the sent/scheduled message (from the prototype).

3.2 Wireframe Design

This chapter describes different types of wireframing and different Use Cases.

3.2.1 Pen and Paper Wireframing

Because the prototype was not discussed in detail and did not follow a User flow methodology, the company was dissatisfied with the result of the project prototype, which is discussed in the prototype design section above. The focus of the prototype design section was on how to design general prototypes for the project; therefore, comments and development ideas were offered to the project. These suggestions were for building a user flow for the project to gain a better knowledge of each wireframing process.

The sketch prototype method was utilized in this project's wireframing to obtain a thorough description of how the desired thing will appear. Many significant pieces of information regarding the issue, such as publications and YouTube videos regarding wireframe sketching, had been obtained before drawing. It was tough to find an appropriate method of sketching because there are so many. It began by sketching, utilizing Pen-and-Paper wireframing, that is, sketching a user flow with pen and paper, as it is illustrated in Figure 3.4.

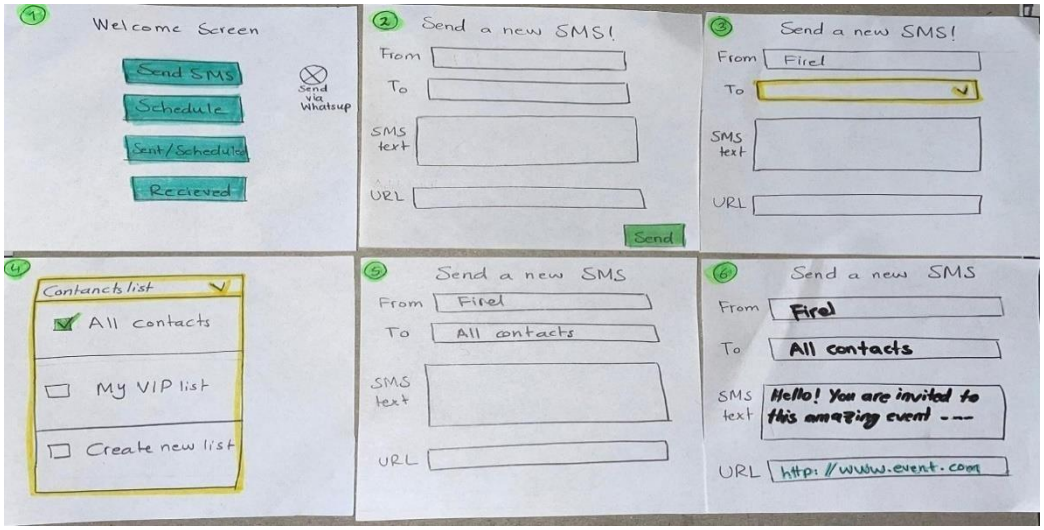

Figure 3.4: How to sketch using the "paper wireframing" (from the wireframing). Starting from nr 1, a welcome screen with buttons, nr 2 fields that can be fielded by the user to send the SMS, nr 3 and 4 a dropdown list with different groups, nr5 and 6 the fields are filled.

3.2.2 Wireframe Fidelity

It decided to begin with Pen-and-Paper wireframing because it was enjoyable and simple to learn and apply, implying that you do not need to engage skilled graphic designers to execute it. Furthermore, this process fosters innovation by allowing designers to freely express fresh design concepts and ideas. On the other hand, Pen-and-Paper wireframing takes a lot of time and effort because you spend so much time designing the sections that you can then clip and paste using digital software. As a result, the team chose to go with digital wireframing [22].

Later, the work shifted to a digital platform that used high-fidelity (hi-fi) wireframes, which means the designer can do things like wireframe functionality, visual design components, and colors that are not possible with low-fidelity wireframes. See Figure 3.5 for an illustration. After a lot of searching on YouTube and Google, it was discovered that there are a lot of great wireframing applications out there to use, such as Miro, wirefram.cc, Sketch, and so on. Finally, Miro became the preferred program. The sketch design was broken into pieces to help with the overall design. Miro has useful features that aided in creating beautiful sketch wireframes.

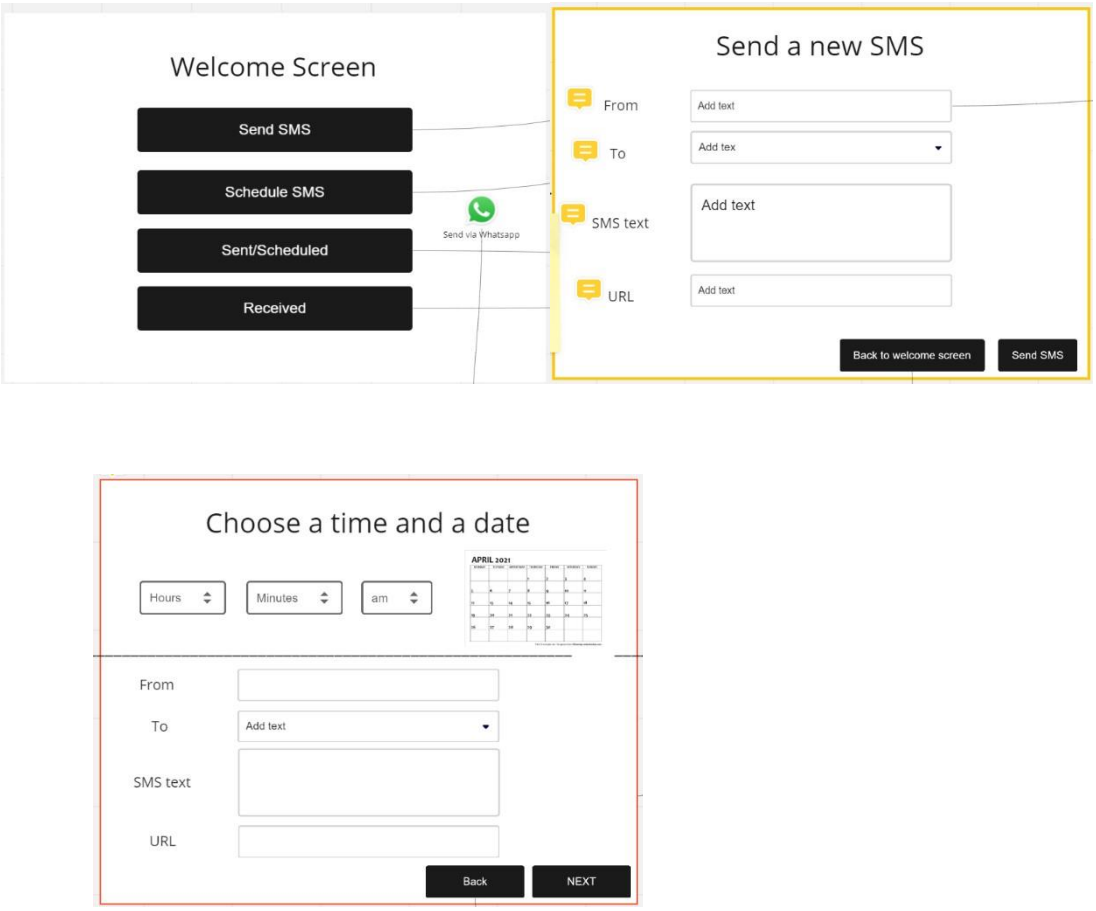

Figure 3.5: Illustration of the old user flow. Many flows were done here, starting with the Welcome screen, to Send a new SMS and finally choose a time and a date.

3.2.3 The Final Wireframing

It was needed to decrease the user flow after receiving comments on the initial wireframing, as it is shown in Figure 3.6. The home screen was the focal point, with both the scheduling and sending operations on the same page. The number of elements in Miro was also decreased from 535 to 164, resulting in a more compact and tightly packed result.

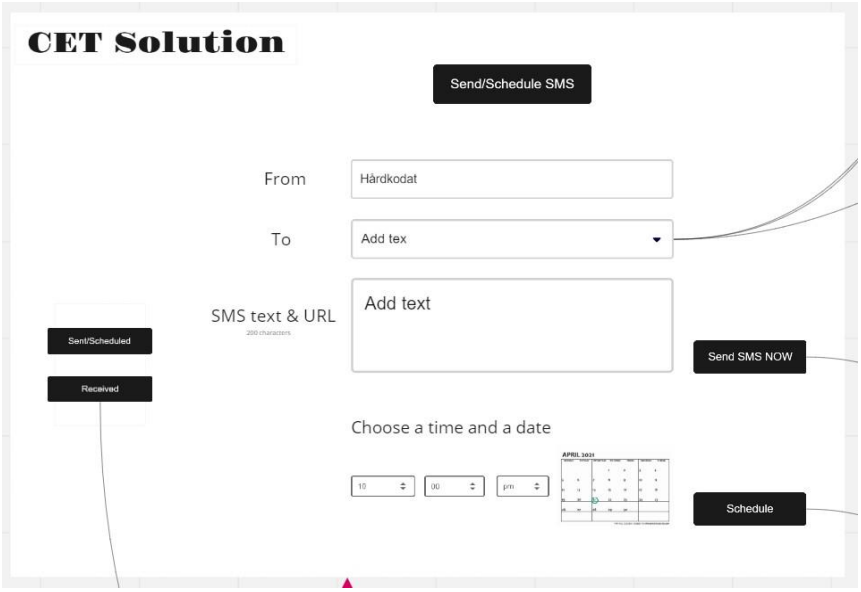

Figure 3.6: Illustration of the updated user flow. The flow from Figure3.5 was minimised to this one. The user can send and schedule from the same page. The user can also see the different buttons here.

3.2.4 Use Cases

Use Cases concentrate on the interaction between the user and the product, and it also captures the specifics of that interaction. Use cases offer value since they describe how the system should act during the process and assist discuss potential problems. The functional needs that are required through human contact with the product are the subject of use cases.

The solution can be fulfilled in a variety of ways, since each detail in the solution has a sense that the user can deduct from the title, fields, buttons, and colors. To determine if the solution is user-friendly, several tests were conducted for non-technical individuals to provide feedback and tips about what can be improved to make it simpler. In this way the developer can reach the goal by making a product that meets the needs of the customers.

Use Case 1
The user wants to send an SMS.
Actor: Unskilled old person.
Precondition: Need a laptop or a computer, access to the internet.

Step 1: The user wants to open the homepage.
Step 2: Fulfil the required fields.
Step 3: Send the SMS by clicking on the Send button.

Outcome: The SMS is sent.

Use Case 2
The user wants to see the sent SMS.
Actor: Unskilled old person.
Precondition: Need a laptop or a computer, access to the internet.

Step 1: The user opens the homepage.
Step 2: Search after the Sent button.
Step 3: Click on the button.
Step 4: See the needed information.

Outcome: The user can now see.

Use Case 3
The user wants to select contacts from an Excel file.
Actor: Unskilled old person.
Precondition: Need a laptop or a computer, access to the internet and an existing excel file.
Step 1: The user opens the homepage.
Step 2: Choose an Excel file.
Step 3: Upload the file.

Outcome: The user has now selected the contacts from the wished Excel file.

3.3 Epics in Miro

After finishing the wireframing work, the next step was to use Miro.com to define the project's epics, which were divided into three epics, starting with Epic1. Each epic was broken down into User Stories, smaller tasks, and eventually subtasks to make work easier for the participants. Certain duties, such as ability to write and the Send button, were recognized as Must Haves in this scenario. Other nice features, such as the ability to use emoticons, may be introduced if time allows. See Figures 3.7, 3.8 and 3.9 to get a better understanding.

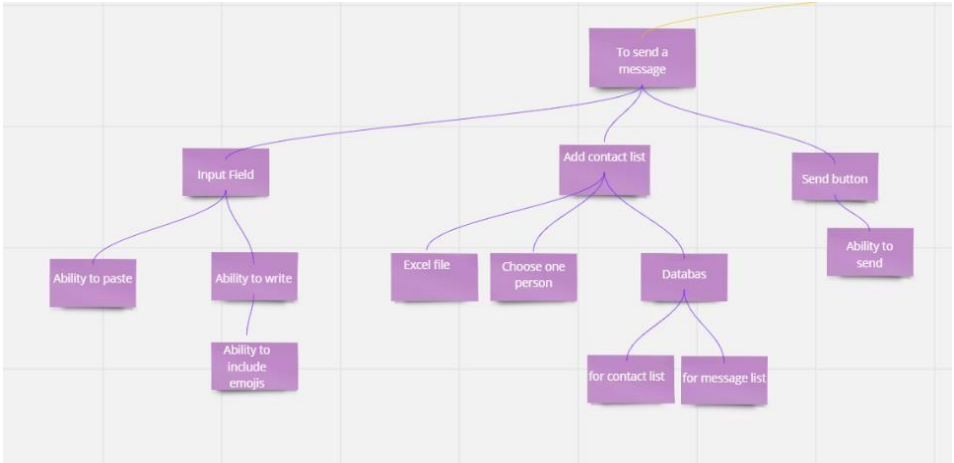

Figure 3.7: Illustration of Epic 1. This Epic is the first and the prioritized Epic for the project, since it contains the main functions for the project.

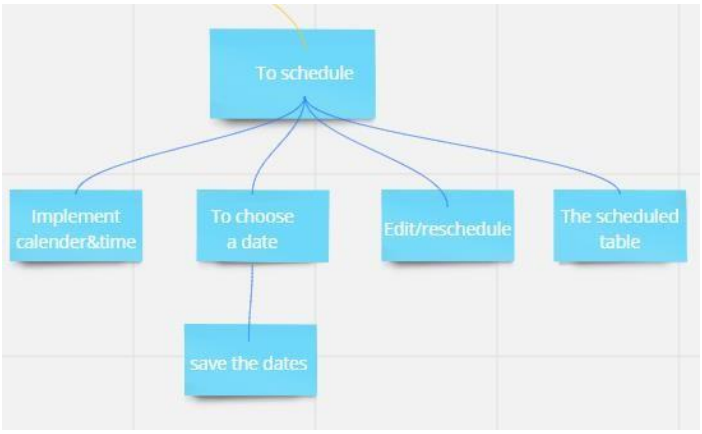

Figure 3.8: Illustration of Epic 2, here are some added functions like the ability to schedule.

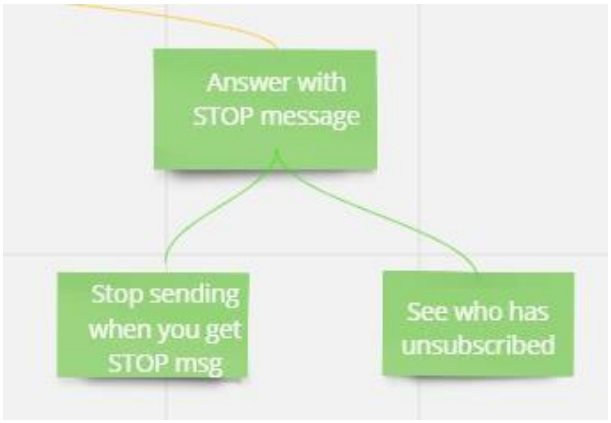

Figure 3.9: Illustration of Epic 3. The receiver here is able to unregister from getting SMS.

3.4 Scrum

For the Scrum Board Trello was used. Trello organizes your cards into categories and gives you quick overviews of the front and back. As previously stated, the development environment is tailored to the Agile technique. Each Sprint will last one week, and the Scrum Board will be updated at the start of each week. The concept is that the card will be sent to In Progress at the start of development, then to Testing, and finally to Completed when the code is considered fully developed [23].

3.5 Trello

After finishing the division in Miro, everything was sent to Trello, where each member's card could be swiftly selected and moved to the relevant list (Epics, Backlog, User Story, Tasks, In Progress, Testing, and Completed). So, if a member takes on a task, the user can choose it in Trello, and once it's taken, the user may move the card to “in progress”, then testing, and eventually Completed, when the task meets the Definition of Done parameters. See Figure 3.10.

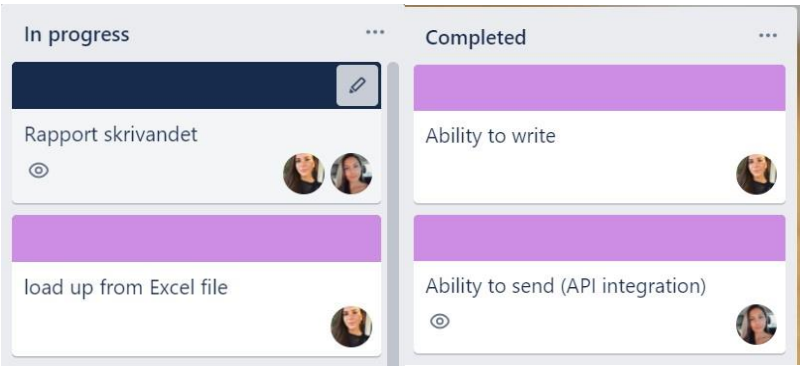

Figure 3.10: Illustration of the usability of Trello. The column In progress describes the ongoing work, the Completed column shows what function has been completed.

3.6 Agile Software Development Methodology

This methodology has recently acquired traction both within and outside of the IT community. It produces working software in a timely and high-quality manner by breaking down the job into smaller jobs to make the process easier. Because Agile emphasizes the importance of group work, the Agile method allows for any new or changing idea to be implemented at any time during the project [24].

The participants agreed on the following principles of the social contract and requirements for group members to follow: It is needed that group members respect and obey the rules that will assist the project succeed as much as possible. The major KPI is in addition to that.

The technical work began with the installation of PHP on Visual Studio Code, as well as the appropriate extensions for PHP, HTML, and CSS. After that, XAMPP for the web server was installed, and everything was ready to go. A GitHub repository was created to make it easier for members to version control and follow the progress of the project.

4. CONSTRUCTION

This section describes the development environment, and graphical user interface used to create the program.

4.1 Development Environment

The program is web-based and comes with resources that enable it to work on a variety of websites. The backend programming language is PHP, and the frontend programming languages are HTML and CSS.

To send an SMS using the API Integration section, a composer must be downloaded, and by doing so and then running the appropriate setup, two files (composer.json and composer.lock) will be automatically added in the project, enabling API Integration.

In addition to registering a Free Trial account with Twilio, you can get a number and verify your own phone to send and receive SMS. See Figure 4.1. Because the free trial only allowed for 15$ to be utilized in this way, group members could only transmit to one confirmed mobile number via Twilio.

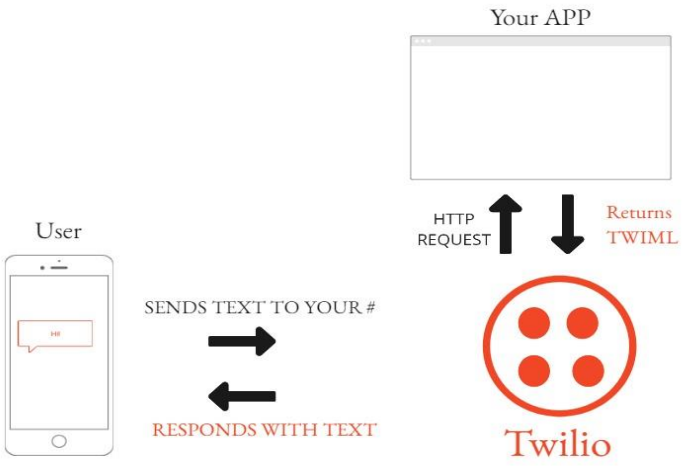

Figure 4.1: Illustration of how Twilio works. The user sends information to your application via Twilio and in the same Your App sends data to the user by Twilio.

Figure 4.2 shows a short flow scheme is described for the project:

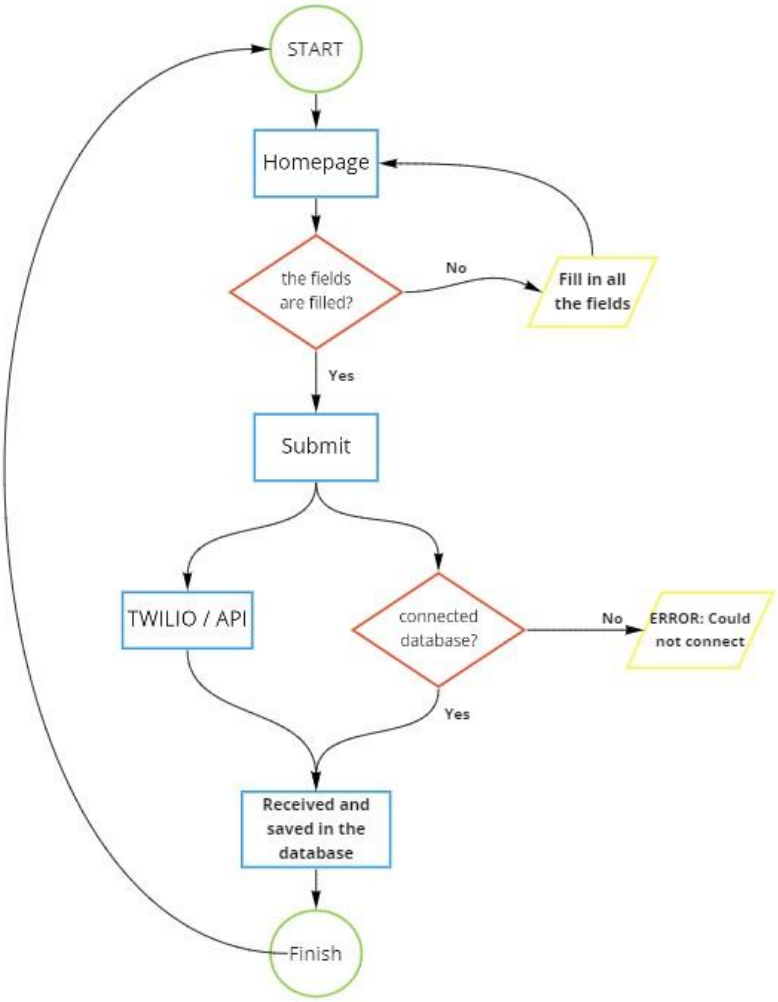

Figure 4.2: Illustration of the workflow scheme. Clicking on start, the landing to the home page and there the user must fill the required files. By clicking on submit, the database connection and the API integration will be controlled. If true, the SMS will be sent and saved into the database.

Figure 4.3 shows an example of how data was inserted into the database using a query:

```
// Attempt insert query execution
$sql = "INSERT INTO sms_sent (time_stamp,sms_status,message )
VALUES (CURRENT_TIME(),'".$sms_status."','".$message."')";
```

Figure 4.3: Illustration of a query in insert.php. Sms_sent is the name of the table.

It started by using phpMyAdmin to build a database called cetdb, which was later expanded to include three tables. As well as to connect the database to Visual studio, described in Figure 4.4.

insert.php

```php
<?php

$link = mysqli_connect("localhost", "root", "", "cetdb1");

// Check connection
if ($link === false) {
    die("ERROR: Could not connect. " . mysqli_connect_error());
}
```

Figure 4.4: Illustration of the connection to the database, cetdb1 is the name of the project's database. A control is also done with an if statement.

4.2 Graphical User Interface

XAMPP, HTML, and CSS programming languages were utilized to create the interface for this online development. With the assistance of CSS, HTML is utilized to program the software's interface. The HTML code is contained within the PHP code, and CSS uses it to determine where and how the various sections of the interface should be placed. This is combined with XAMPP, and everything is integrated in a smooth and easy-to-navigate manner. XAMPP connects information from several areas of the software in development.

The HTML code decides what should be shown in the interface when navigating through the program where CSS can call a specific part of the HTML code and decide how it should look, where it should be on the page, what colour etc. There is some information that is shown in the interface that requires information from the database. The XAMPP program extracts the data from the database and transmits it to php (the application's backend), where it may be displayed using HTML and styled with CSS. XAMPP is a tool that takes all the components that make up the user interface and connects them in a straightforward manner.

4.3 Excel-File

The solution also includes an Excel file. This functionality makes it possible for the user to upload an Excel file that contains telephone numbers of the wished contacts into the SMS (see Figure 4.5). The user has also the ability to see the contacts that have been uploaded from the Excel file by fetching the data from the database by a function called get_all_records. It was also needed to connect the file to the database, as well as creating a table for it.

Figure 4.5: The Figure explains how the implementation was done in the project. By clicking on the blue button Choose your file, the user can choose between various files, and then by clicking on Upload it will be possible to upload the contacts from the file.

5. RESULTS

This part would include a summary of the project's outcome as well as responses to the Goals.

5.1 Goal Analysing

The first goal “to achieve user behaviour and experience similar to C5 PRO” has been achieved, because this SMS-solution is user-friendly and has a straightforward design, which was exactly what Cetrez desired. The functions of the solution, for example, would be central so that the user could discover the search functions more easily.

The second goal, which was to find a balance between technical features and design approach, is also met. In this SMS solution, design has taken precedence over technical functionality; for example, instead of generating many functions and making it more difficult for the user to engage with the software, it was vital to establish a straightforward flow with a few features.

The project was designed to be simple to use while also giving the functionality needed to approach the important features. The button and field sizes and colours, as well as the right explanation of each aspect to ensure that the user understands it. To avoid confusion, there were no photographs or other unneeded clutter, which was the intention from the beginning.

The third and last goal which was “Creating a strong offering in product features compared to similar SMS-solutions” has also been achieved. After evaluating a variety of options, assessing them, and describing the advantages and disadvantages of each, a first sketch was constructed using the feature that had been chosen. The solution has features of any other solution, as well as the ability to upload an excel file containing all the user's contacts. In addition to being for Cetrez and completing the required requirements, the product includes other qualities that will be explained below as part of the purpose.

5.2 Final Result

By typing localhost and then the project name into XAMPP, it is possible to run the software straight on the website, as is shown in Figure 5.1.

Figure 5.1: Picture of how to run the program on browser.

After launching the application, the user will see a screen with from, to, and message boxes. The From field is hard coded and cannot be changed, while the To field allows the user to choose who the SMS will be sent to by pasting phone numbers from an excel file. As shown in the image below, the message body can also be filled, see Figure 5.2.

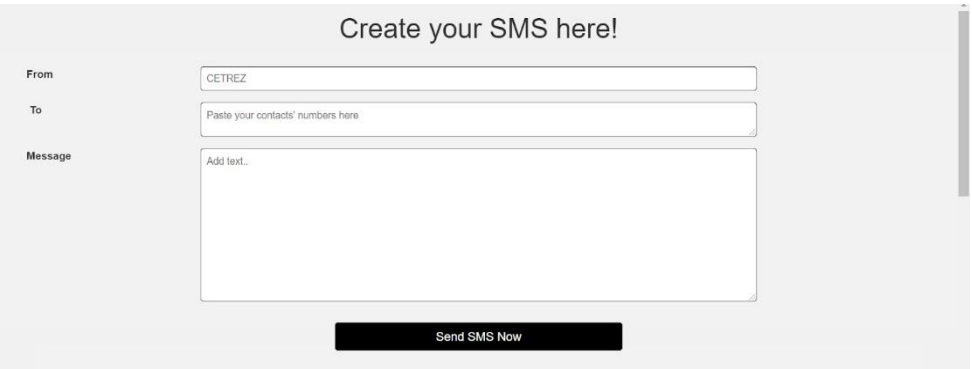

Figure 5.2: Illustration of the result after running the program. Three fields, the first one is hardcoded, the second one contacts can be copied and pasted to, the last one is the body of the message.

Figure 5.3 shows that the recipient can see the SMS when it arrives, and because Twilio offers a Free Trial, the SMS must include any obligatory text Sent from your Twilio trial account.

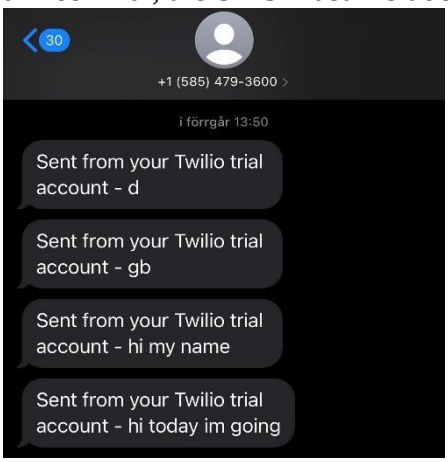

Figure 5.3: Illustration about output of the program. The recipient got an SMS from the sender to the mobile.

When the SMS is sent, the data is saved in the database with a unique Id client, a time stamp based on the time the SMS was sent, a SMS status, and the message. Each column is described in Figure 5.4.

id_client	time_stamp	sms_status	message
1	2021-05-13 19:12:58	1	Hello
2	2021-05-13 22:34:20	1	Hola

Figure 5.4: Illustration of the database when an SMS has been sent. Unique id_client, timestamp, sms_status and message body. The data is saved when the SMS is sent.

6. ANALYSIS AND DISCUSSION

This section will cover the analysis of the solution, the framing of the question, and the aim, as well as environmental and ethical considerations.

Overall, the goals were met efficiently because the previous six processes that were named in the method were followed, which included preparing the correct item at the appropriate time and developing a product strategy. The Persona also aids in the comprehension of the user's behaviour and the improvement of the sketching. Miro and Trello were helpful tools for not only facilitating user flow but also for planning. Finally, the backend was programmed in PHP, while the frontend was coded in HTML/CSS.

6.1 Solution Analysis

To analyze the outcome, the application's aim should be understood. Cetrez sought a custom SMS application that was tailored to their needs and prioritized usability and userfriendliness. The app needed to have a function that allowed users to send a message from the program to the recipient's phone through SMS. A feature that allowed the user to upload contacts via Excel was also required for the project. As a result, the objective was to create a general-purpose SMS system (a standard SMS software) that matched these needs as well. Businesses will be able to communicate with their customers more easily.

The requirements were satisfied in the final product. The program does a good job of sending messages to the receiver's phone and the user can upload an excel file to upload the contacts and due to the company's decisions, it was recommended to wait with the functionality of uploading an excel file to make it less complicated for the users.

Feedback was also recommended by the supervisor that the design of the interface of the program needed to be easy to use, and it was meant for people with no technical background. To make this possible any unnecessary clutter was avoided, adding that would make the usability and learning process of the application harder to use. Any unnecessary colors and pictures were also avoided to not confuse the user which made the result satisfactory.

After doing the several tests in a form of Use Cases, the following changes have been done with a goal to improve the product and the user experience of it:

- Have the fields function in the middle, i.e. centrics.
- Delete unnecessary images in the solution.
- Dropdown list for the contacts was removed and had a write field instead to minimise the confusion.

6.2 Question Formulation Discussion

The question formulation: **What would be the ultimate SMS solution for C5 PRO to fulfill their clients' needs**? is the main issue that should be fixed and answered. The ultimate SMS solution to fulfill Cetrez's clients' needs is that the approach should be as user-friendly as possible, to meet the client's requirements, which is why design problems have been updated and improved after some conversation with Cetrez. To make the answer as straightforward and basic as possible, so that someone with no professional or technical experience will use it without difficulty or even hesitation. Cetrez reflects on the customer interface as a critical and serious topic and that is a part of the thesis.

6.3 Ethical Aspects

In SMS-solution there are many ethics issues that can be discussed. If the system became hacked or tampered with the information of the users could be used against the company or the people using the application. The application will be mostly used by Certrez to communicate with their potential clients or other businesses.

The application will most likely be used to communicate about the product that will be sold, so there will be no crucial classified or protected information shared through the application between the users. So even if SMS-solution became hacked, the damage would be minimal. Absolutely to make a product that is desirable you need to make it safe for the users and some people would argue that it is the developer's moral duty to make it so, but because of the nature of the usage of the application this is not a problem.

Another ethical dilemma when it comes to communication programs that are used like email and SMS is the fact that some companies can use it to spam or send repeated ads to the user without their consent, this is also a problem that is avoided with this application due to the fact that it is primarily used be Cetrez to communicate with their clients about the product that they have agreed on, or to send additional information through it. The ethical dilemma is in the hands of the users and not with the program itself because it was built to serve the purpose of communication between Cetrez and their clients.

Another ethical problem that the industry faces in recent years is the information gathering by big companies. When using let's say Facebook or google or a similar application there will be most likely an algorithm that tracks your activities when using their application to then sell or use against you in the future. The moral problem with this is individuals will lose autonomy when using the internet and whole profiles will be made about them without them knowing about it. This is also a problem that the application does not have to deal with, because it is only targeted to be used by Cetrez's clients and not normal people for everyday use.

In addition, there is no tracking of the user's activities in the database to then be later used by an algorithm. There is a possibility that Cetrez can implement an algorithm that tracks what the clients do to learn from what a client wants and does not want so that they can be more efficient in the future. If they decide to do which they will have to be transparent with the client and tell them exactly how the information that is gathered about them will be used.

The society is heading into a more digitized future where everything you do on the internet will be tracked and then used in some fashion against you, every programmer and developer

needs to keep this in mind and try to find a way to negate the malicious or harmful practices used against the users of their programs, applications, or websites.

6.4 Environmental Issues

The environment is always affected by new technologies, and it is the developer's job and duty as a human being to try and negate the negative effects the technology imposes on the environment. Luckily, the technology required to develop SMS-solution is mainly software and not hardware which means there are no physical parts needed except for the computer and the phone you send the message to. But there still needs to be a physical computer to be able to use the program. This makes it so that the user needs to be aware of where the parts of their computer come from and how they affect the environment.

There is no easy way for developers to impose rules to force the user to be environment friendly, so the user will have to only follow the rules and regulations imposed by Sweden's government. Still as a developer that needs to constantly work towards greener and environment friendly solutions to new technologies. One way to do that is by working for companies that share the same eco-friendly ideas.

7. CONCLUSION AND SUGGESTION FOR CONTINUED WORK

This part will cover a conclusion of the project and a short summary of self-improvement.

A lot of knowledge was gained each week by utilizing various tools and thinking in a new manner, so if the opportunity of doing a similar project is given, it would start in a different way since it was possible to learn how to prioritize things and work in a smart way. This way would allow us to catch up with additional functions because changes have been made not only in programming but also in how to begin work, think, and design.

If the project started over, Miro would only be used to design the project because Figma was a tough application to deal with and did not help doing the design much with the project. It would also consider keeping the application simple, with only a few critical and fundamental features, rather than having numerous sophisticated features. It also recommends continuing with the application with features such as the client being able to unregister themselves, the ability to schedule SMS, as well as other nice to have functions such as emojis.

A lot of meetings with the supervisors from Cetrez and Chalmers were also done, both led in the right direction which it benefited from due to their feedback and response. The meetings were done constantly, to make sure that the deadline was met. Using the Agile methodology helped to have clear and easy plans to follow as well as enhancing the thinking, and the Scrum methodology has facilitated in dividing the project.

To sum up, the project has resulted in an SMS solution that can send SMS to a client using Twilio API integration, when the SMS is sent the information about the SMS is stored in the database PhpMyAdmin. The user can see all the information about the sent messages by clicking on the Sent button. The from field is hard coded so no one can change it, the to field can be field by paste numbers from Excel.

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APPENDIX

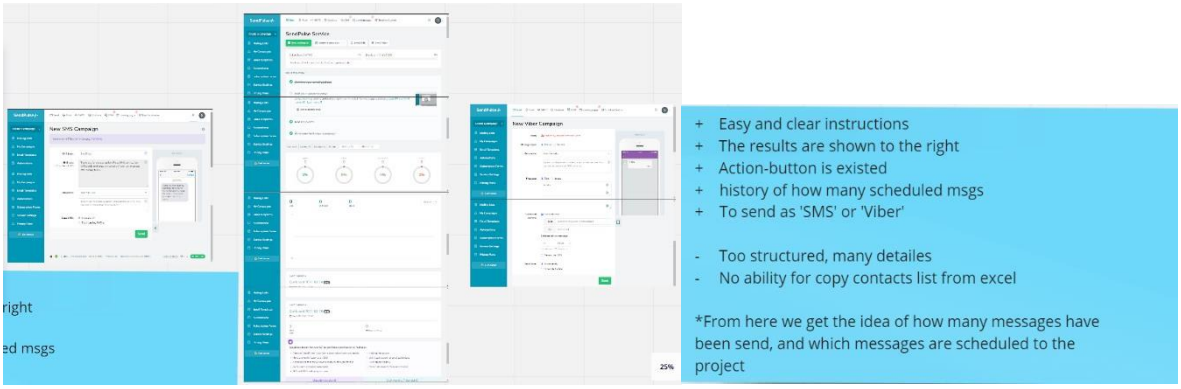

Figure 1: Image illustrates the third SMS solution that was found on the web with a short analysis. The analysis to the right, summarize the advantages and disadvantages with the solution.

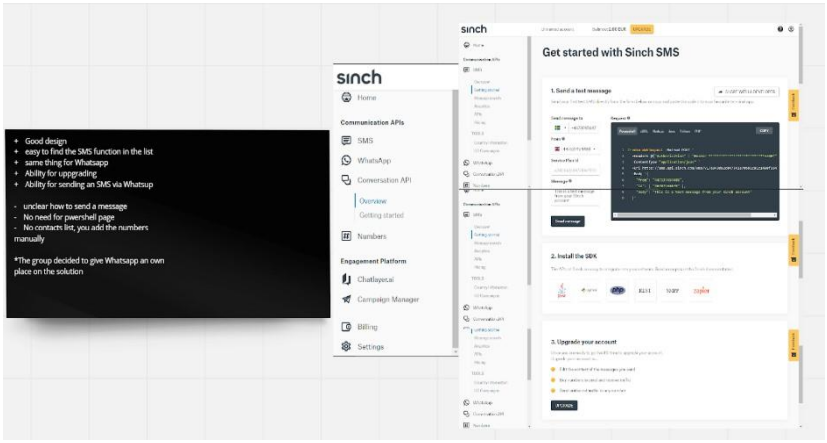

Figure 2: Image illustrates the fourth SMS solution that was found on the web with a short analysis. The analysis to the right, summarize the advantages and disadvantages with the solution.

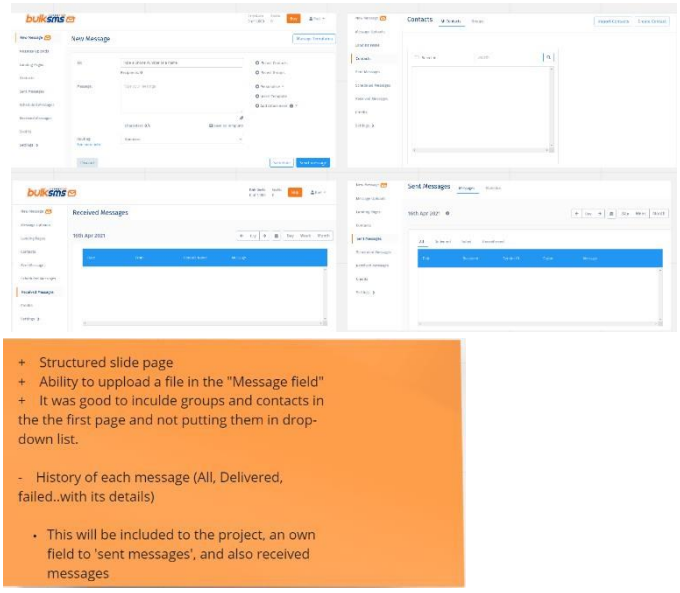

Figure 3: Image illustrates the fifth SMS solution that was found on the web with a short analysis. The analysis to the right summarizes the advantages and disadvantages with the solution

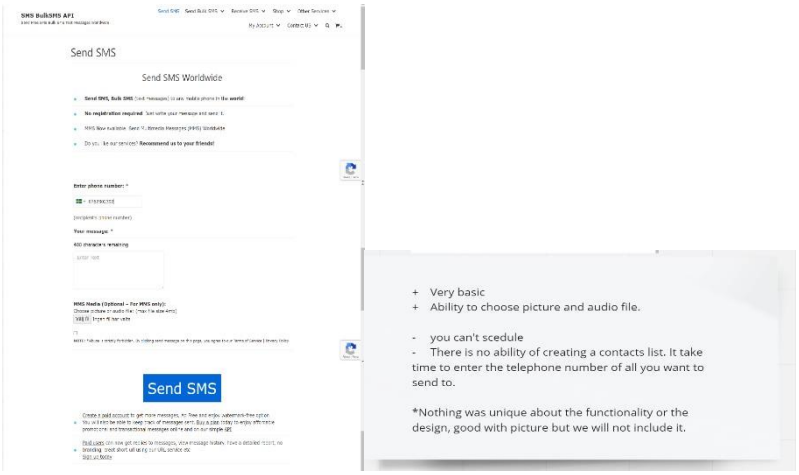

Figure 4: Image illustrates the sixth SMS solution that was found on the web with a short analysis. The analysis to the right, summarize the advantages and disadvantages with the solution.

Link to the wireframing in Miro: https://miro.com/app/board/o9J_lKIehQ8=/

Link to the Figma prototype: https://www.figma.com/proto/SWb47VGZ2J7DeuEadH97kc/Untitled?nodeid=0%3A3&scaling=scale-down&page-id=0%3A1

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