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Improving real estate CRM user experience and satisfaction: A user-centered design approach

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ABSTRACT

Despite the growth in CRM installations, e-CRM projects still have a significant failure rate, even after substantial investments in CRM technology. High rates of failure mean that the current requirements for developing and designing CRM need to be analysed. It's not enough to just look at data related to a service's efficiency; it's also crucial to consider the impact on the user experience and their overall level of satisfaction. Given that CRM is a people-centric business strategy, it's pertinent to wonder how much progress may be made in a similarly people-centric field like Real Estate through the development and use of a user-centred design approach. This study aims to seamlessly integrate a mobile customer relationship management (m-CRM) system with an electronic customer relationship management (e-CRM) system to increase customer loyalty, satisfaction, and performance through a user-friendly interface. User research, preliminary interviews, five usability interviews, and satisfaction surveys confirmed the functionality implemented and for each iteration, an expert was used to evaluate it. For this artifact's creation and assessment, the DSR technique was used, with each interview serving as a data point for the model. It was determined that the Desktop interface solution may improve this CRM's ease of use and user satisfaction, thereby benefiting the real estate industry through strengthened connections and more straightforward oversight of professionals' performances.

1. Introduction

In the 21st century, the ability to interchange and transfer data through the internet and online services has had a noticeable impact on our culture (Purbowo et al., 2017).

Acquisition costs are five to ten times higher than retention costs (Alotaibi and Rigas, 2012), therefore contemporary firms are constantly on the lookout for strategic advantages. There is an ongoing requirement to build client-focused activities to strengthen long-term customer relationships (Jelonek, 2015; Kimiloğlu and Zarali, 2009). However,

this objective is becoming increasingly difficult due to rapid technical advancements (Alotaibi and Rigas, 2012; Kimiloğlu and Zarali, 2009).

Thus, each company must invest in a customized business strategy and information system (IS) to comprehend its customers' needs and desires (Jelonek, 2015). These include identifying the most profitable clients, lowering costs connected with online customer administration, developing a targeted and individualized marketing campaign, and generating in revenue (Goy and Magro, 2012; Jelonek, 2015).

CRM, a subset of RM, acquired prominence in the 1990 s, although its definition has evolved over the ensuing two decades. In the 1990 s,

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CRM was viewed as a management concept or strategy that assisted businesses in retaining consumers (Lanka et al., 2014). The continued use of manual procedures for gathering and storing customer data resulted in poorer performance, decreased productivity, and subpar customer suggestions and interactions (Purbowo et al., 2017). In the twenty-first century, it transformed into IT-related software, an e-commerce component, or a customer relationship management function. In the 2010 s, it stabilized as a client acquisition, retention, and collaboration approach to increase customer value and business profitability. It enhances marketing, sales, and customer support (Kakeesh et al., 2021; Lanka et al., 2014).

Rapid internet expansion required a CRM adjustment, known today as eCRM (e-CRM). E-CRM uses the internet to store, acquire, and process data (Kakeesh et al., 2021). Identifying the most lucrative clients, reducing online customer management expenses, executing a focused and individualized marketing approach, and increasing revenues are some of its benefits (Goy and Magro, 2012; Jelonek, 2015).

The internet's capacity to transfer information conveniently has led many firms to e-commerce. E-commerce provides an improved environment for communication and transactions between stakeholders and customers (Cherif and Grant, 2014). Before the Internet, the real estate business was confined by geography and print media, limiting its expansion and success. The internet helps real estate address these challenges by allowing for international development and efficient, dynamic partnerships between brokers, buyers, sellers, and financiers.

E-business models communicate how a corporation creates, delivers, and captures value. Understanding what business models will benefit the organization and how to implement them is necessary for successful e-commerce (Cherif and Grant, 2014). Since real estate thrives on client interactions, transactions, and marketing, e-CRM can benefit the industry's business model. Proper implementation of an e-CRM is critical since client loyalty is harder to create online (Kakeesh et al., 2021; Lanka et al., 2014). Therefore, it's important to understand the dynamics and best practises of an e-CRM.

In 2002, Hammill and Stevenson discovered that 65% of e-CRM programmes failed, and that number may reach 85%. Even though numerous resources are put in CRM systems, failure rates are high, according to reports (Kimiloğlu and Zarali, 2009). Since the beginning of the new century, analysts like as Gartner, AMR, and Forrester Studies performed research that revealed CRM failure rates of up to 70% and unfulfilled expectations of over 50% (Yohans et al., 2023).

Due to significant failure rates, CRM's present development and design prerequisites need to be examined (K., N, 2015). Currently, the focus is on why and how customers use services, rather than their performance, usability, and satisfaction (Kimiloğlu and Zarali, 2009). CRM is a human-centred business technique, thus it's crucial to question how much value creating and executing a human-centred design (HCD) methodology will offer (Al-Weshah, 2019).

According to literature, the limitations of the adoptions of enterprise software usages as CRMs may include:

- Lack of user focus: Too often, enterprise software is designed based on functional requirements rather than the needs of the end user. This can lead to solutions that are difficult to use and do not meet user expectations (Padhee et al., 2023).
- Over-complexity: Enterprise software can be extremely complex, with many features and functions that users may not need or understand. This can make the software difficult to use and increase the learning curve for users (Wolf et al., 2020).
- Lack of innovation: Many enterprise systems are built on legacy technologies or existing processes. This can limit the software's ability to adapt to new needs or changes in business operations (Morrison & Hughes, 2023).

Design thinking can help overcome these limitations by enabling companies to focus on user needs, simplify complexity and incorporate

innovation into the software design process. Design thinking can help ensure that software is easy to use, intuitive and meets the needs of users, while providing features that improve business efficiency and effectiveness. This research analyses how the real estate industry may use design thinking to build new CRM services and better align consumer demands with technical capabilities and market opportunities. Design thinking empowers the person, and psychological empowerment increases work performance (Roth et al., 2020). A real estate mobile app with CRM was converted to a web interface over a year. Five Portuguese real estate firms and a master's student developed a fully interactive desktop prototype to deliver cutting-edge, tech-enabled real estate services. Nine experts repeatedly reviewed the artefact's development to guarantee consistent input, allowing the IS to be declared an optimal CRM for CRM. This secured the artefact's validity, cohesiveness, and progress.

This research looked at how design thinking may lead the way for fresh value propositions while putting the client front and centre, enhancing retention, happiness, and production through an accessible, user-friendly interface (UI). The findings show how design thinking may be used to improve corporate management software. By using expert-supervised interview-based iterations, this interface helped fill a gap in the literature and led to the creation of a scientific desktop interface.

Here's the outline for this paper. The literature research analyses and summarizes the theoretical frameworks of CRM, e-CRM, and human-centred creative solutions to these frameworks. Methodology describes research strategy. The article finishes with a discussion of the study's findings, limitations, and suggestions for additional research.

2. Literature review

To overcome the discrepancy and lack of knowledge on UX/UI good practises during initial study, a Systematic Literature Review (SLR) was undertaken to analyse CRM, its functionalities, and the relevant UX and UI techniques and methods. This section explains the sectors embracing CRM and its characteristics, advantages, and concepts. It also seeks to determine if UX/UI is an issue in the area and, if so, what approaches and best practises have been used. The following material was retrieved and compiled from 18 SLR papers to aid the artefact's research and development.

2.1. Electronic customer relationship management

CRM aims to systematize client contacts to promote long-term relationships (Alotaibi and Rigas, 2012). Determining customer and shareholder value by analysing customer data with the right tools enables quicker service improvements and a targeted marketing strategy for each client, which promotes customer loyalty, attracts, and retains profitable customers, and boosts profits (Alotaibi and Rigas, 2012; Purbowo et al., 2017). CRM's customer-centric company strategy improves marketing, sales, and service (Santy, and Hardiyanti, V. P. M, 2019; Xu, Liang, 2010).

According to the Pareto Principle, 80% of a company's revenues come from 20% of its consumers (Student et al., 2014). Since it costs 5–10 times more to recruit a new customer than to maintain an existing one, the firm must focus on the top 20% of current customers to prioritise customer retention over acquisition. CRM is built on the idea that not all customers are treated equally; it focuses on the most lucrative customers and has three stages: recruiting new customers, boosting customer value, and maintaining existing customers (Purbowo et al., 2017). A good CRM facilitates communication, transactions, and relationships (K., N, 2015). Creating a CRM includes combining front/back office, business connections, and CRM data analysis (Xu, Liang, 2010). Given the competitive atmosphere for maintaining customer relationships today, this competence is a must for a company's success.

E-CRM extends CRM's customer maintenance and retention ideals to

e-commerce. The objective is not to replace CRM, but to enhance it with the aid of the internet (Kakeesh et al., 2021; Purbowo et al., 2017). A website integrating e-CRM may simplify access to a company's products and services, manage and offer more targeted and intimate encounters with potential customers, and increase long-term client ties through faster online interactions (Santy, and Hardiyanti, V. P. M., 2019). By automating the standard CRM with concepts, tools, and procedures that enhance online sales and plan e-business investments via websites, e-mail, and contact centres, E-CRM streamlines customer relationship management (Purbowo et al., 2017).

In this sense, e-CRM may be seen as an improvement on Sales Force Automation (SFA), a collection of sales operations that provides an electronic automated workflow to better analyse client purchasing behaviour through sales activities (Alotaibi and Rigas, 2012; Al-Weshah, 2019). To boost sales, SFA is frequently used with other promotional strategies (Purbowo et al., 2017). Using an e-CRM allows you to take use of both CRM and e-commerce. Because e-CRM is based on the user, it's essential to consider the convenience and satisfaction of your clientele and research on user interfaces and user experiences could be useful.

2.2. Human-centred design

ISO 9241-210:2019 describes an HCD as focusing on the user's wants and concerns to design meaningful and useable interactive systems using ergonomic and usability methodologies. By reducing negative impacts on health, performance, and security, this can boost human well-being and enjoyment and improve user efficiency and accessibility. This technique takes human factors/ergonomics and usability expertise into account to ensure the design's efficacy. For this purpose, the following two sections, respecting UI, and UX, serve as a conductor to funnel the fundamental information to administer a HCD in an e-business scope.

2.3. User interface

UI connects users to programme functionality, making it a vital component of software applications. Enterprise applications, such as CRM, need complicated UIs since they must accommodate to users' needs, features, and layout choices (Akiki, 2013). Usability and user satisfaction deteriorate in these programmes due to failure to meet user demands (Akiki, 2013).

Rayipangesti and Fajar (Rayipangesti and Fajar, 2019) describe UI as a system, product, or service that a certain group of users may use to fulfil established goals efficiently and effectively in each environment. A context of use includes tasks, assets, objectives, users, and environment, which must be technical, physical, social, cultural, and organisational [ISO 9241-11:2018, 3.1.15].

An interface's usefulness must be analysed. Usability is a quality that gauges how smoothly and painlessly a UI may be used (Rayipangesti and Fajar, 2019):

- Learnability: How easy it is to execute a task using the interface.
- Efficiency: How quickly a user can finish a task using the interface.
- Memorability: The system must be remembered enough for the user to utilise it successfully after a short period without having to re-learn everything.
- Errors: Evaluate how many mistakes the user makes and how easy it is to remedy them.
- Satisfaction: Assess the user's interface satisfaction. Usability determines satisfaction.

Socially rich UIs increase the perceived utility, convenience of use, content quality, and trustworthiness of an e-service, which increases adherence (Alotaibi and Rigas, 2012). A well-built interface also fosters relationships with potential online clients, who rely on initial

impressions to determine whether to continue browsing or switch to a rival (Alotaibi and Rigas, 2012).

2.4. User Experience

UX is built on a human-system interaction that comes from a goal-oriented activity done in a specific context of use (Rayipangesti and Fajar, 2019; Urrutia et al., 2017). UX is impacted by subjective elements like user inclinations and environmental factors like where, when, and how an experiment was done (Rayipangesti and Fajar, 2019).

UX may be determined by social, cultural, user, context, and product attributes, according to Urrutia and Brangier (Urrutia et al., 2017). Three characteristics can convince UX:

- The user's internal state of mind: which can be influenced by their predispositions, assumptions, needs, motivations, and dispositions.
- The system's characteristics: which can be influenced by its intricacy, purpose, usability, and performance
- The context in which the experiment is conducted: which can be social or organizational, conducted voluntarily or not, meaningful experience or not, etc.

UX helps organise usability testing, since users strive to complete activities in a certain setting while researchers observe, overhear, and take notes. The purpose is to discover usability flaws and collect quantitative data on user satisfaction. Usability testing will present previously identified concerns to the design and development teams before any code is written (Rayipangesti and Fajar, 2019).

CRM is a human-centric practise; hence it should be undertaken to improve relationships. Appropriate UX testing will reveal consumer conflicts, which will enhance e-business platform retention rates. Consequently, talking with experts before developing the CRM web interface will give a very valuable insight to already existing struggles that can be taken into consideration from the start.

2.5. Preliminary research

To better understand the mobile application's fundamental features and functioning, interviews with real estate specialists were used for project discovery and scope development. During the construction of the mobile artefact, 15 agents were interviewed for feature prioritising and competitive analysis, while seven real estate specialists evaluated its usability. In addition, during the creation of the desktop interface, two informal interviews were conducted with specialists to confirm the existing data. Real estate professionals' priorities and grey literature (GL) relevancy were used to determine the most advantageous mobile app features (Antão, 2020).

The findings confirm the importance of defining which mobile aspects were suitable to a desktop environment, and features were ranked accordingly. Quick prioritizing allowed rigorous assessment, optimal resource allocation, and full transparency into usability and intended objectives (Kirakowski and Bevan, 2016).

Using the findings from the preliminary study interviews (Antão et al., 2021), the ranking of features from 1 (most significant) to 12 (least significant) was determined (see Table 1). According to the same authors, these features follow on from a number of interviews with real estate agents. Additionally, to produce a completely functional page for each iteration of usability testing, their significance was also dependent on the six primary web components determined by aggregating each preceding feature. Each module affected feature distribution, increasing their relative importance. Thus, the web application would consist of the following modules: Contacts; Client Profile Page; Calendar; Dashboard; Goals and Analytics; Business Funnels and Notifications.

Table 1
Features prioritization (Antão et al., 2021).

Web Component	ID	Features	Priority
Contacts	F1	Contacts integration	1
	F2	Smart lists	2
	F3	Lead Aggregation	3
Client's Profile Page	F4	Client qualification	4
	F5	Client's documentation management	5
Calendar	F6	Agenda integration	6
Dashboard & Goals	F7	Individual performance management and statistical information	7
	F8	Customizable template messages	8
Business Funnels	F9	Client's pipeline	9
	F10	Automated Action Plan	10
	F11	Campaigns	11
Notifications	F12	Notifications and reminders	12

3. Research methodology

3.1. Research design

Design Thinking was used to address user experiences and interactions at every step of design. The employed design thinking technique was created by the Hasso Plattner Institute at the University of Potsdam in Germany, which is associated with Stanford University and IDEO.

This approach provides a structured framework that encourages empathy, creativity, and iterative problem-solving, which are crucial elements for enhancing user adoption in CRM systems within the real estate domain. By employing Design Thinking methodologies, such as user research, ideation, prototyping, and testing, the project can gain valuable insights into user needs and preferences. This user-centric approach allows for the development of intuitive and user-friendly interfaces that address specific pain points, resulting in an enhanced user experience. Moreover, Design Thinking fosters a collaborative and interdisciplinary environment, enabling stakeholders to contribute diverse perspectives, innovative ideas, and effective solutions. Overall, describing the importance of Design Thinking in this project highlights its pivotal role in shaping the UI/UX design and ultimately enlivening user adoption of CRM systems in the real estate industry.

It is depicted as five phases, with curving lines connecting them to emphasize its iterative nature. It fosters experimentation, model development and prototyping, feedback collection, and revision (Razzouk

and Shute, 2012). Thorough and comprehensive research is vital in DT, and includes evaluating the artefact's utility, quality, and effectiveness using the correct evaluation methodologies to explain changes or improvements in the system, people, or organization's behaviour (Razzouk and Shute, 2012; Zabaleta Etxebarria et al., 2012). As shown in Fig. 1, interviews with professionals who utilize real estate platforms, low- and high-fidelity prototypes, and a final artefact were done. Regular usability testing introduced and improved new features and needs.

Adobe XD's free basic plan, version 44.0.12, was used to build the web vector-based interface. The prototype's components and states allowed a feature to be specified once and consistently disseminated across all instances without manually altering each board. This minimised canvas clutter and art board requirements for user flows and visual attractiveness. Scroll groups, anchor links, and triggers were introduced to increase prototype interaction.

A high-level information architecture was designed after studying the desktop interface's components, features, and needs. It requires organizing structures and data to aid user discovery, decision-making, consumption, and behaviour modification (Soares et al., 2022), hence a site map was used. Site maps are often hierarchical, with links to the most essential parts at the top (Garrett, 2011). Ours was generated through stakeholder interviews and used throughout the project's development.

After Ideation, fifteen 1920x1080px art boards were made to match the wireframes' aspect ratio and relative proportions. Wireframes are brief, black-and-white renderings of a web page and its components that compress early design choices (Garrett, 2011). Since they lacked a colour palette, they were meant to simplify data-intensive jobs, improve space efficiency, page layout, and content management.

Table 2 prominently displays the artefact's creation processes. In the last iteration, a saturation point was reached, and all applied concepts were professionally validated.

3.2. Data collection

A single real estate expert was consulted every design sprint iteration for review. Due to the worldwide pandemic situation, certain iterative processes were accomplished remotely while others were performed in-person; each iteration lasted around 60 min. Despite the distance, the user was allowed to freely explore the interface by requesting live access to the other participant's computer screen. To ensure remote interviews' credibility, the interviewee had full control over the interface and access to all interactive features, just as if they were in the same room as the interviewer. This ensured the artefact's legitimacy, cohesion, and expansion.

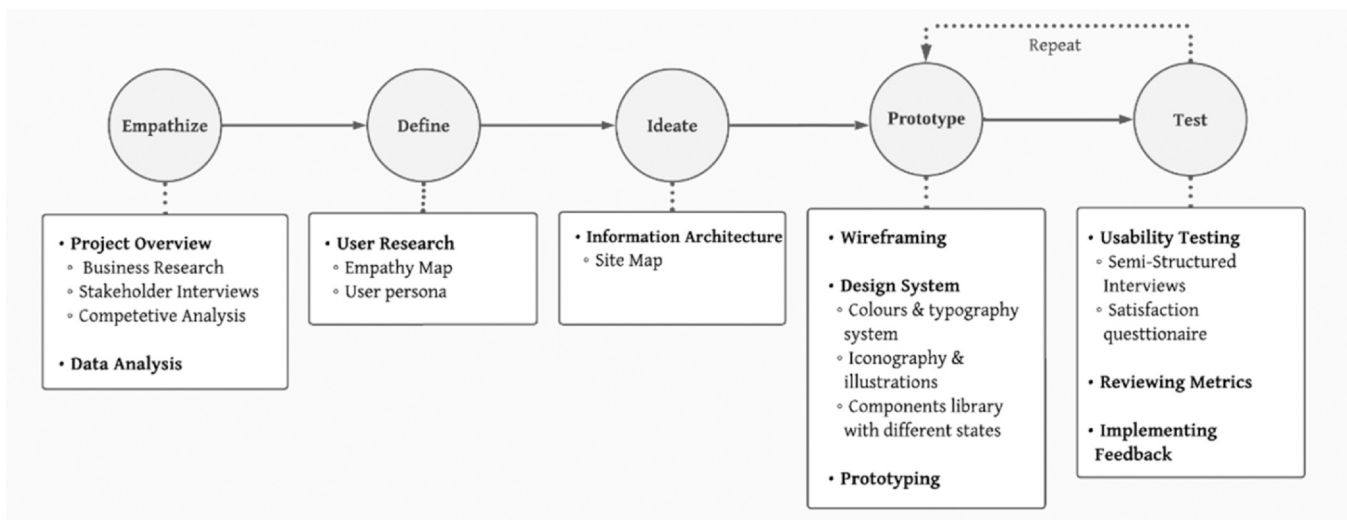


Fig. 1. Design Thinking.

Table 2
Iteratively added features.

DSR Iteration	Features	ID
First Iteration	Contacts integration; Smart lists; Lead Aggregation.	F1, F2, F3
Second Iteration	First iteration feature improvement; Client qualification; Client's documentation management; Agenda integration; Individual performance management and statistical information.	F4, F5, F6, F7
Third Iteration	Second iteration feature improvement; Individual performance management and statistical information; Customizable template messages.	F7, F8
Fourth Iteration	Third iteration feature improvement; Client's pipeline; Automated Action Plan; Campaigns; Notifications and reminders.	F9, F10, F11, F12
Fifth Iteration	Fourth iteration feature improvement.	-

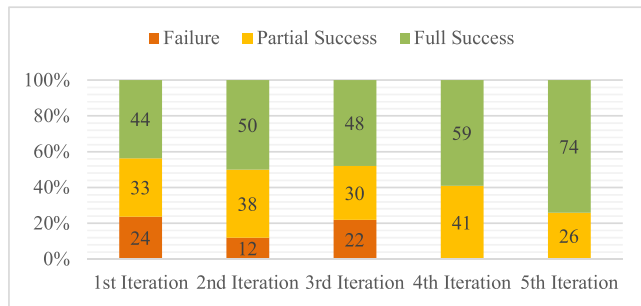


Fig. 2. Percentage of each task completion status, by iteration.

Displaying the informed consent letter and providing a brief explanation of the research helped participants understand the experiment and provide consent. For each iteration, a semi-structured interview was constructed to outline the essential processes for assessing the artefact's usability. When further information or clarity was needed, the author strayed from the standard interview format. After finishing the script, the interviewee was given a questionnaire to gauge their satisfaction with the modules they had just examined.

3.3. Data analysis

We analysed the task's success with nominal data and simple descriptive statistics (counts, frequencies). This strategy makes it easy to judge a wide range of tasks. If a user performed a job in less than 20 s, it was judged successful, if it took more than 20 s and/or users had extra usability complaints, it was termed partially successful; and if the user was unable to complete the task, it was declared a failure.

Interval data measured client satisfaction. Interval data has no natural zero point, but descriptive statistics can be computed based on the range of values (including averages and standard deviation) (Tullis and Albert, 2013). As one of the most prevalent methods for collecting self-reported data in UX research, a Likert scale rating was employed for users to indicate their level of satisfaction. The satisfaction survey questions were inspired by Jim Lewis, 1995 Computer System Usability Questionnaire (CSUQ) (Lewis, 1995), in which every statement was presented from a positive perspective, as opposed to the System Usability Scale (SUS); the main change was using a five-point scale of agreement rather than a seven-point scale. The scale went from a Strong disagreement (1) to disagreement (2), to neither agreement nor disagreement (3), to agreement (4), and finally a strong agreement (5). The CSUQ measures user reactions to a product's usefulness, information quality, usability, and overall satisfaction.

4. Findings

Figure 2 displays the task's success rate as a function of iteration, with green denoting full success, yellow indicating half success, and orange indicating failure. The failure rate remained high throughout the first

three iterations but reduced during the final two, indicating that by the fourth iteration, most usability issues had been fixed. The failure rate rose after the third iteration because the prototype went from static to dynamic, making usability issues easier to see. By the fourth iteration, failure was practically non-existent, but partial success had increased. This illustrates that the first three iterations focused on accuracy and completeness (such as space allocation and semantics) rather than usability (such as visual hierarchy and colour schemes), which influenced the last two rounds. Since 74% of attempts were successful in the most recent cycle, we can anticipate that this proportion will increase as the number of cycles increases.

The Satisfaction Survey provided information about the assessment of the system's information, its learnability, and its integration into daily life. As seen in Figure 3, the mean increased significantly during the third round, when static components became dynamic, and an enhanced colour scheme was chosen. Despite a minor variation between the fourth and fifth iterations' means, the fifth iteration had the greatest median and mode scores (5). Therefore, increasing user satisfaction with o'Riley's UX Laws (Crum, 2020) and an iterative approach in which professionals reviewed each stage of interface creation was successful.

5. Discussion

The user-centered approach focuses on understanding user needs and preferences, ensuring that solutions are tailored to their requirements (Ravelino, Susetyo, 2023). In the context of Open Innovation (Yun et al., 2020), involving external stakeholders and collaborating with diverse partners can bring fresh perspectives and expertise to the innovation process. By combining these approaches, organizations can leverage the valuable insights gained from user research and engagement to fuel the innovation process (Michael Tushman, 2012). In the realm of CRM projects in the real estate sector, the user-centered approach can provide valuable insights into the unique needs and pain points of users, guiding the development of innovative solutions. For example, conducting user interviews and usability testing can uncover usability issues or identify new features that enhance user adoption and satisfaction within a CRM platform.

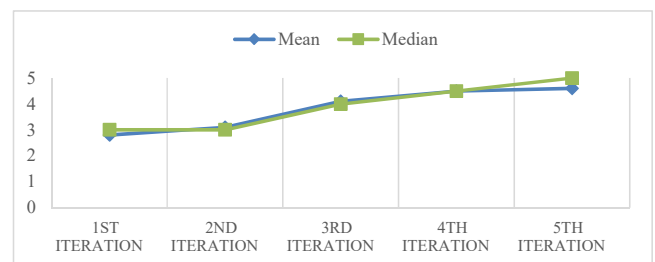


Fig. 3. Descriptive statistics compiled from the responses to the Satisfaction Survey, relevant to the whole application.

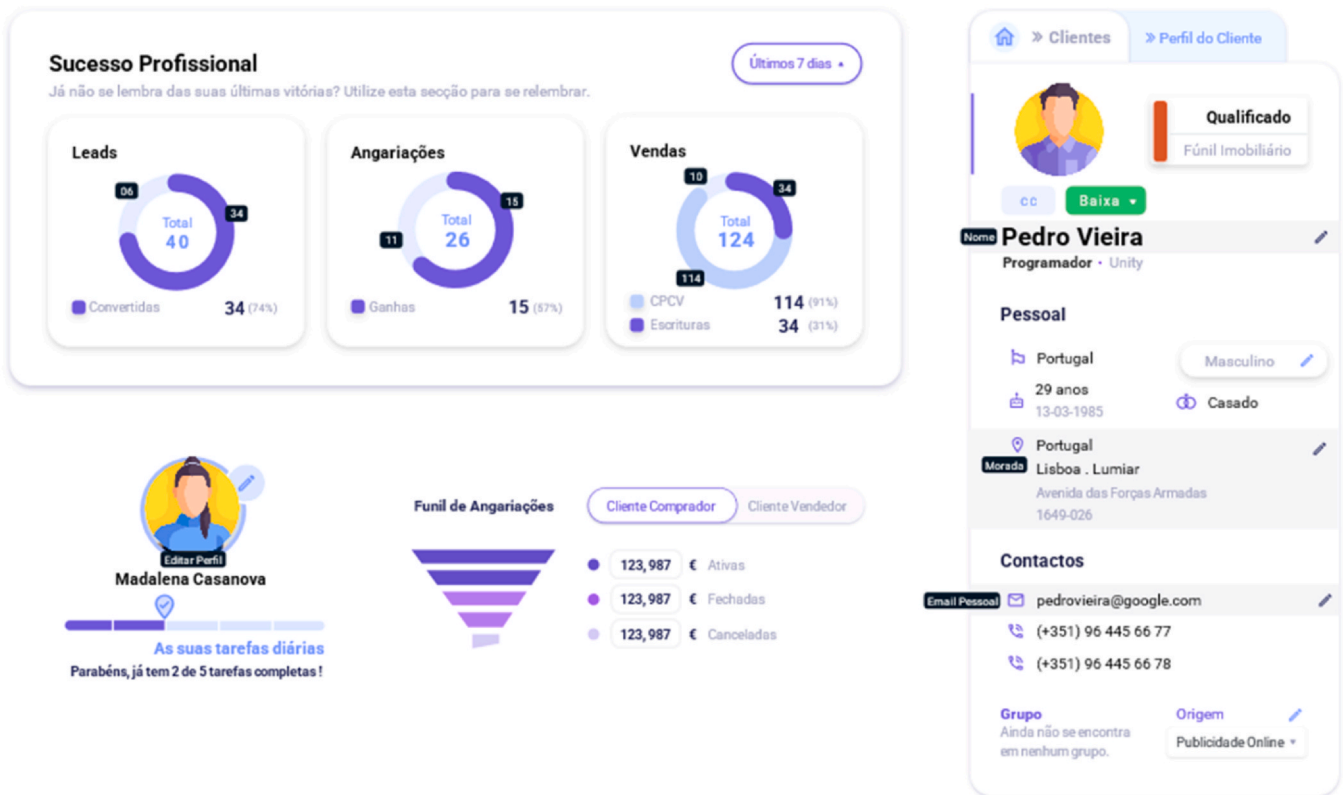


Fig. 4. Enhancements made to the artefact by the fifth iteration (DPI4.1, PI4.2, DPI4.3 and GPI4.2).

At the conclusion of the five rounds, it was possible to get a list of significant suggestions for enhancement, which are contained in Appendix A, as well as positive and negative comments, which will be discussed further below. From a total of 52 suggestions for improvement, 50 were proposed by professionals and two by the author. Of the total of the suggestions, the majority was successfully accomplished, and only 13 proposals remained to be implemented for future research.

The first artefact was presented on 30 art boards. Early versions lacked states, components, and Auto Animate, restricting interaction. The interviewee was asked to evaluate four contact module features: filtering, favourites, column state readability, and nested row extraction. The expert then graded customer profile aspects such as personal information, availability, client motives, social connections, and event planning and management.

After first validation, five negative comments, four positive comments, and thirteen improvements were made. Favourable features include the ability to call or email clients directly from the contact list and the presentation of previously hidden client data in nested rows. The expert deemed the application's colour scheme unattractive since transparent values and lighter hues failed to showcase important material. There was difficulty locating the filtering mechanism and nesting point of the contact list. In addition, it was established that the client profile had an excessive amount of information and that consulting professionals must assure semantic correctness at every level.

The second interview inquired about the newly additional pages, leaving confirmation for the future session. To prevent interviewer fatigue and time overruns, the size of the artefact required two rounds of thorough data verification. The interviewee was given context from earlier modules, and 29 static displays were designed and tested.

The initial two prototypes followed Occam's Razor (Crum, 2020), which prioritizes utility before aesthetic, so later revisions may focus on aesthetics without sacrificing functionality, accessibility, or stability. Customer qualification, client paperwork, and event chronology were analysed using a client's profile. The calendar's monthly presentation,

event information, task-based filtering options, event creation, and availability were analysed. Last, dashboard elements such as birthday cards, recently filed documents, user history, canvassing, sales, leads, scriptural outcomes, and real estate listings were commented on. The interview highlighted the transparent creation and retrieval of stored events and the value of these modules' data. The use of a unique colour to each online activity helped visually differentiate the card's function. However, superfluous interface information remained a problem.

Due to COVID-19, the third interview occurred through Zoom. The activities script used first and second script's failed or partially successful tasks. By concentrating on past difficulties, we could see if the modifications worked. Third prototype contained components, states, and animations, but no new functionality.

Considering the Aesthetic-Usability Effect (Crum, 2020), which argues that people's brains favour visually pleasing designs, an ambitious UI design was built to offset the aversion of pastel colours and transparency. The agency liked the colour scheme but was concerned about the light navigation bar. Agent suggested darkening it for both genders, but men weren't tested until version 4. Due to a lack of white space, the interface was difficult to read and harmonize. To boost space allocation, a daily agenda slider was added to display the daily calendar. The visual hierarchy and colour palette were also changed to emphasize the event's kind, date, and description. We clarified procedures using new terminology and rephrased terminology.

In the fourth online iteration, the usability of 34 art boards was evaluated, and the goals and statistics modules were included. The drawbacks identified pertained to a lack of information, i.e., only minimal modifications were required to the already existing content, suggesting that all previous critiques were handled in this iteration.

Using Gestalt concepts of grouping (Crum, 2020) and colour, more aesthetically pleasing and readily discoverable information was developed in the Client's Profile. The Law of Common Region (Crum, 2020) converted the client's bar graph of availability into a tabular format, with each square indicating a separate time, making the component

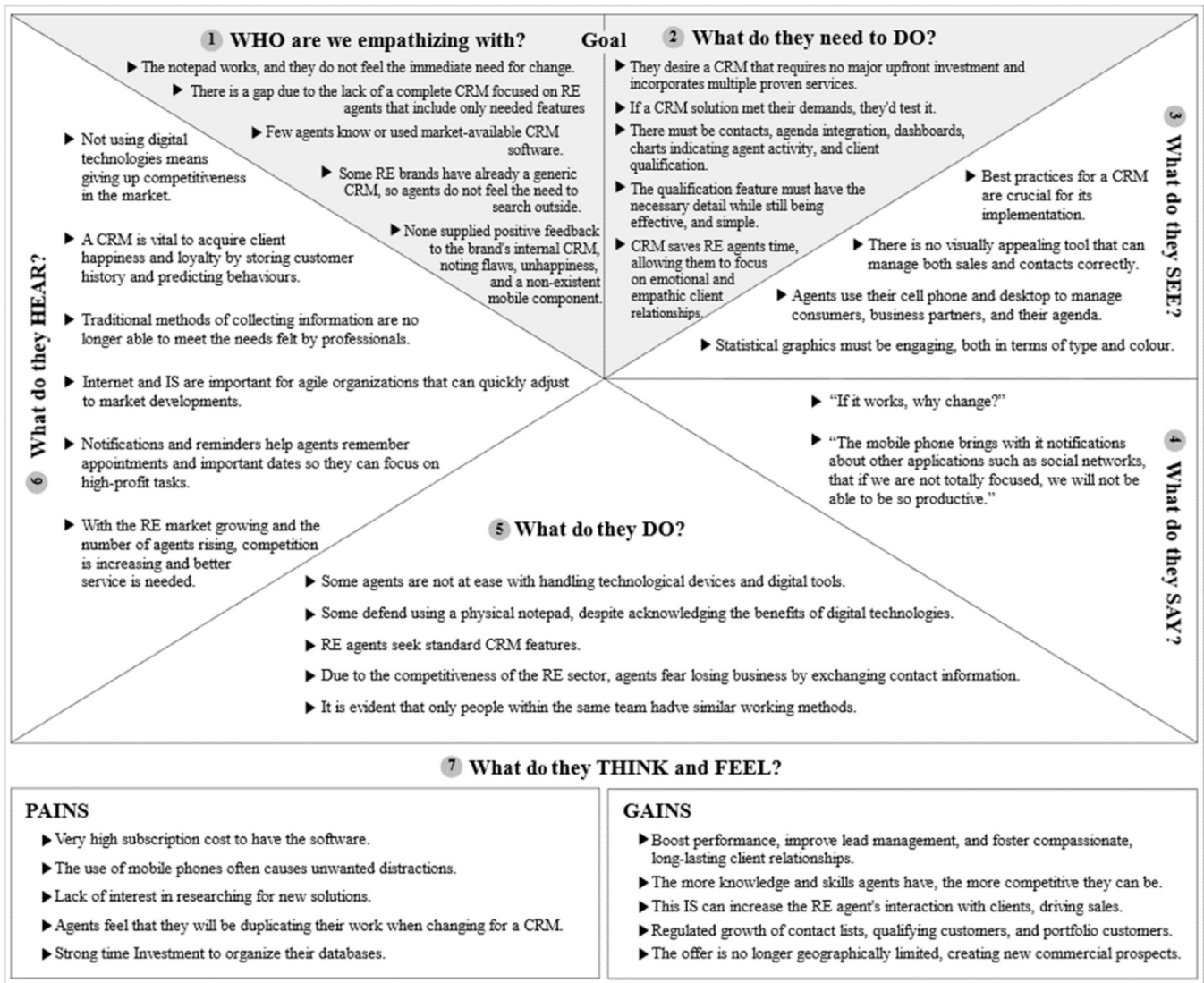


Fig. 5. Empathy Map.

easier to understand and alter with fewer mouse clicks. To access nested information in the contact's module, a window that emerges when the line is clicked was proposed, however, this violates Tesler's Law (Crum, 2020) and the initial demands (CPI.3 and CPI1.3), hence it was denied. The alphabetical order is now possible, and it is evident which contact is being seen because the icons are no longer stacked vertically but horizontally, and the second symbol is 50% visible. Finally, study (Institution, n.d.) revealed that horizontal filters contribute more to tables with a lot of data in the page's key content section.

The last iteration included a face-to-face usability interview and the implementation of the business funnels' module. Since business funnels were the only new feature in this iteration, they were subjected to intensive examination throughout the interview. Except for Business Funnels, all recommended platform improvements were data additions. Examples include a broader examination of the real estate sector, increased customization, the ability to track additional devices, and enhanced coordination of alerts via the app's mobile interface.

The final edition focused more on aesthetics than content, as can be seen on Figure 4, therefore content layout and visual upgrades were included. No one suggested upgrading the website's semantics, layout,

or content. Therefore, these modules agreed, and no extra analysis was needed, showing that the artefact approximated the proper answer. The offered product engaged real estate agents and evoked sentiments of impact, enthusiasm, and joy not generally connected with the other CRMs for real estate.

Also, with these iterations and knowledge about the market it was possible to generate an empathy map and identify clearly a persona for this type of system. Figure 5 shows the empathy map template (Lang and Howell, 2017) used during the "Define" phase. An empathy map helps users observe, uncover research gaps, and personify the intended audience by pooling customers' aims, thoughts, feelings, and behaviours. Goals are classified by who one empathizes with and what they must accomplish. Questions on what possible real estate agents see, say, do, and hear circle the map clockwise. The study ends with questions about respondents' thoughts and emotions, classified as losses and gains (needs, wants, desires).

For analysing and deciding upon empathy map data, a user persona was created. As seen in Figure 6, a fictional persona was created to simulate the group research by including the group's principal objectives, frustrations, personality features, and skills (Cornie, 1991). By giving

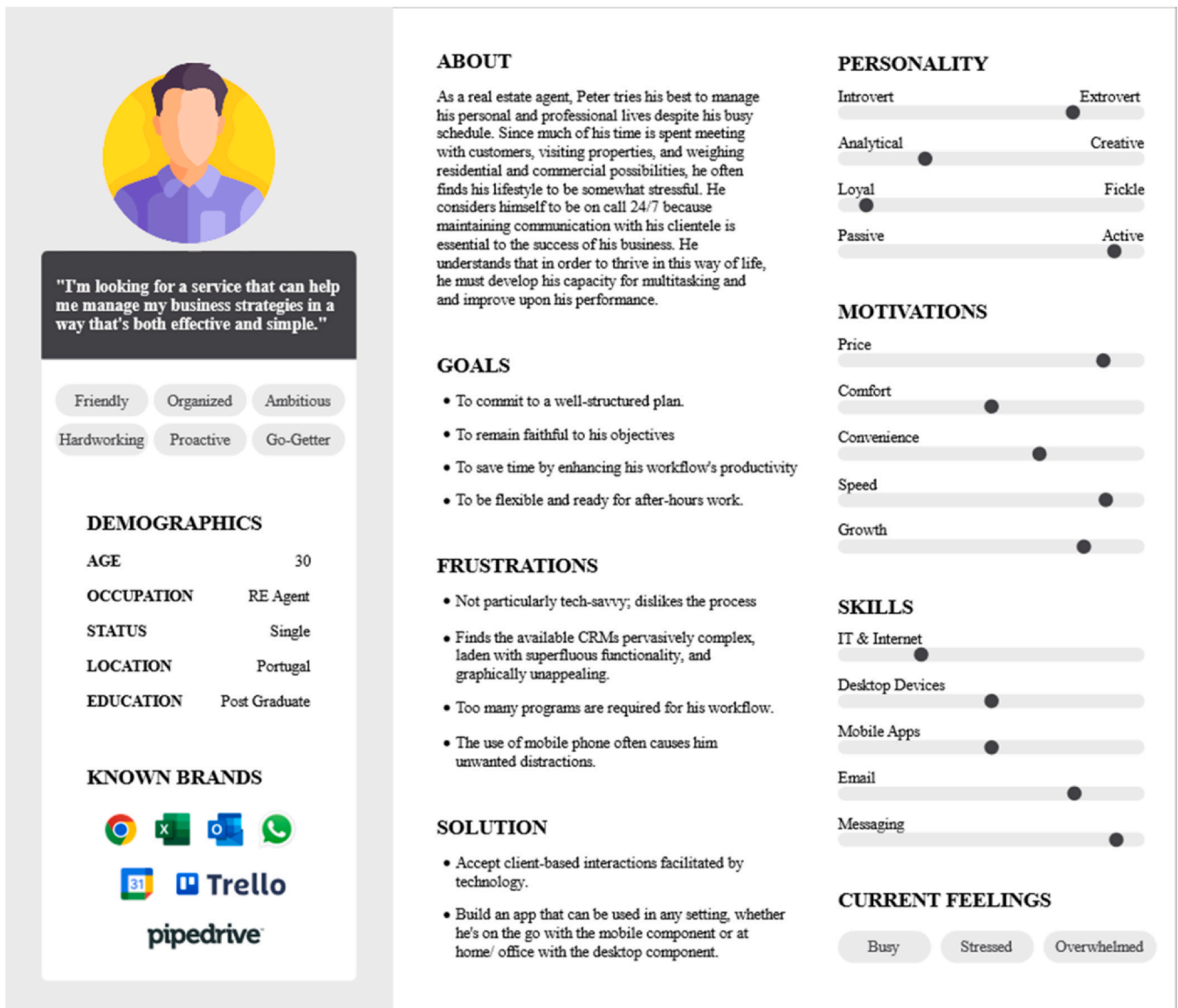


Fig. 6. User Persona.

user research data a face and a name, personas may assist in keeping the target audience in mind from the beginning (Garrett, 2011).

6. Conclusions

This project aimed to adapt a mobile app for real estate that uses CRM into an online interface, with a focus on enhancing client satisfaction, loyalty, and productivity – more detail about the end artefact can be seen here and also the investigation of it can be seen here. All features implemented in this artefact were the ones described in Table 1. The use of Design Thinking principles, including strict monitoring of usability interviews, led to the development of a desktop application with a solid scientific base and assessment of its needs. The resulting interface features filterable calendars and contact lists, real-time agent performance tracking via dashboards and analytics, client qualification tools, and business funnels.

Usability concepts defined during exploratory research helped build an agent-friendly desktop interface. The interface's simplicity and pleasant colour palette were praised for their utility, as the Aesthetic-Usability Effect states. The task's use of colour was complimented for its ability to provide quick, clear visual clues. The app's great level of customization may improve its user base since almost every function

can be customized. Its flexible interface demonstrates the tool's efficiency.

The use of Design Thinking in this study provided significant practical and theoretical contributions. The user-centred approach, combined with a scientific methodology, resulted in a desktop interface that prioritizes the needs of real estate agents. This interactive approach allowed them to test and validate their hypotheses throughout the research process, ensuring that the end result is best suited to the user's needs.

The study also highlights the importance of adopting innovative technological solutions and giving up outdated manual-labour tools like notebooks. Although it may require some time and effort to learn how to use this system initially, it was deemed easier to understand than more conventional real estate CRM solutions.

The practical implications of this study are significant for real estate agents and businesses. The development of a user-friendly and customizable desktop interface for a Real Estate CRM showed the potential to improve the day-to-day lives of agents, enhance their productivity and efficiency, and foster stronger relationships with returning customers. By understanding the users' perspectives, needs, and behaviours, organizations can better align their innovation efforts with user expectations and preferences. This user-centric approach not only increases the effectiveness of innovation but also enhances user adoption

and satisfaction, ultimately leading to improved business outcomes in the real estate industry.

6.1. Limitations

This study has certain limitations that open the door to future research opportunities. First, the present pandemic has led to an increase in online interactions, which account for about half of all contacts in our research, which may impact the development of empathy and comfort among interviewees. Second, the candidates were unable to use the application until the day of the interview, which prevented them from establishing the app's credibility in their day-to-day lives and gave them very little time to assess such a comprehensive tool. Thirdly, because just a fraction of user cases was integrated into the prototype, it is possible that certain usability concerns were not reported despite their existence. Lastly, when asked for self-reported data face-to-face, people are more inclined to give positive comments than in an anonymous online survey, which may affect usability testing findings. Social desirability bias is when people give answers, they think will make them look good to others. Due to the small sample size every iteration, the survey couldn't be considered anonymous, even if the moderator wouldn't see the user's responses until after the participant left. This may have decreased honesty.

6.2. Future work

Whether a person must use this CRM on their own depends on whether their agency uses a comparable system. If the agency already

has a CRM system, this person must utilize both, duplicating work. This CRM is ideal for small businesses, individual salespeople, and corporations without CRM solutions. Thus, larger organizations require an additional layer of administration and hierarchy to integrate their customer relationship management systems and corporate locations. Larger firms may benefit from a tiered strategy to monitoring the CRM Manager's work.

Agents also noted that business studies give statistical solutions for how many clients a consultant must call to get a specific number of leads. Despite this research, assessed CRMs don't supply this data, forcing agents to assemble it manually along with their goals. Adding quantitative data to this CRM may be a competitive advantage.

For the sake of future research, it is instructive to note that numerous agents did not seem interested in utilizing a CRM, even though they were given a free copy of the software by their agencies. As a result, several organizations began offering free CRM training courses, a perk that inevitably led to a greater rate of adoption. Therefore, a dedicated training area should be a future primary focus of the application.

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Appendix A: Iteratively proposed enhancements for the artefact

ID	Proposed Improvement	Type	Implemented?	Suggested By	Figures
First Iteration (1st Iteration folder)					
CPI1.1	"Delete the left-hand vertical sidebar."	Space Allocation	Yes	Interview	6
CPI1.2	"Social media information is not required."	Space Allocation	Yes	Interview	6
CPI1.3	"Nested list should be user-friendly."	Content Structuring	Yes	Interview	7
CPI1.4	"Abbreviations should be avoided."	Semantic	Yes	Interview	7
CPI1.5	"Use familiar field-specific semantics."	Semantic	Yes	Interview	6,7
CPI1.6	"Add mass emailing capabilities."	Content	No	Interview	6
PPI1.1	"Replace client's motivations."	Space Allocation	Yes	Interview	1
PPI1.2	"Don't distinguish activities into tasks and events."	Content Structuring	Yes	Interview	8, 9, 10, 11
PPI1.3	"Comments must be added to an event."	Visual Hierarchy	Yes	Interview	3
PPI1.4	"Client's sources should be predefined."	Content Structuring	Yes	Interview	1
PPI1.5	"Restructure the visualization order for the user's availability."	Visual	Yes	Interview	1
PPI1.6	"Set up mobile alerts for important occasions."	Content	No	Interview	1
API1.1	"The existing colour palette is not flattering."	Visual	No	Interview	1
Second Iteration (2nd Iteration folder)					
PPI2.1	"All information must be displayed by default."	Content Structuring	Yes	Interview	1
PPI2.2	"Iconography needs to be updated."	Visual	Yes	Interview	1
PPI2.3	"Client's qualifications must be flexible."	Content Structuring	Yes	Interview	3
PPI2.4	"Documents must be easier to navigate."	Content Structuring	Yes	Interview	5
CaPI2.1	"Have a slider for the daily calendar view."	Space Allocation	Yes	Interview	9
CaPI2.2	"Reconsider visual hierarchy."	Visual Hierarchy	Yes	Interview	9
CaPI2.3	"Bold colours instead of pastel colours."	Visual	Yes	Interview	9
DPI2.1	"Rethink recent activity's structure."	Visual Hierarchy	Yes	Interview	12
DPI2.2	"Swap areas of interest with an additional goal card."	Space Allocation	Yes	Interview	12
DPI2.3	"Content must follow natural eye movement patterns."	Visual Hierarchy	Yes	Interview	12
DPI2.4	"Use field-specific language."	Semantic	Yes	Interview	12
Third Iteration (3rd Iteration folder)					
CPI3.1	"More intuitive filtering system."	Content Structuring	Yes	Interview	18
CPI3.2	"Change the info column to an automatic hidden feature."	Content Structuring	No	Interview	16
CPI3.3	"Discern groups of contacts visually."	Visual	Yes	Interview	17
CPI3.4	"Differentiate archived contacts from closed deals."	Content Structuring	No	Interview	15
CPI3.5	"New presentation for the view button."	Visual Hierarchy	Yes	Interview	18
PPI3.1	"An editable table for the client's availability."	Content Structuring	Yes	Interview	1
CaPI3.1	"Make it clear that there are different calendars to choose from."	Visual Hierarchy	Yes	Author	20, 21
DPI3.1	"The goals' card must be structured differently."	Content Structuring	Yes	Interview	26
DPI3.2	"Aligning content according to natural eye movement."	Content Structuring	Yes	Interview	26
DPI3.3	"Fix section's names that are not intuitive."	Semantic	Yes	Interview	26
Fourth Iteration (4th Iteration folder)					
CPI4.1	"Sort by latest contacted, not alphabetically."	Content Structuring	Yes	Interview	8

CPI4.2	"The partnership icon should be neutral."	Visual	Yes	Interview	13
PI4.1	"Use consistent design on the client's profile page."	Visual Hierarchy	Yes	Interview	1, 3, 4, 5
CaPI4.1	"Move the "Create Events" button."	Visual Hierarchy	Yes	Author	14
DPI4.1	"Offer time intervals."	Content Structuring	Yes	Interview	15
DPI4.2	"Link pie charts and goals."	Content Structuring	Yes	Interview	15
DPI4.3	"Modify the completed tasks' visuals."	Visual Hierarchy	Yes	Interview	15
GPI4.1	"Goals data must be collected automatically."	Content Structuring	Yes	Interview	16
GPI4.2	"Remodel the Sales Funnel."	Content Structuring	Yes	Interview	16
Fifth Iteration (5th Iteration folder)					
CPI5.1	"User should be able to set the table's viewing options."	Content	Future Work	Interview	9, 10
CPI5.2	"User should be able to set tags."	Content	Future Work	Interview	-
CPI5.3	"Understand real estate agent's preferences."	Content	Future Work	Interview	-
PPI5.1	"Incorporate WhatsApp monitoring."	Content	Future Work	Interview	-
DPI5.1	"Log completed tasks through notifications."	Content	Future Work	Interview	-
GPI5.1	"Improve statistics by relying on previous studies."	Content	Future Work	Interview	-
BPI5.1	"There is a lack of clarity on existing funnel states."	Semantic	Future Work	Interview	18, 19, 20
BPI5.2	"To complete the first RE funnel, additional states are required."	Semantic	Future Work	Interview	18
API5.1	"Include in-app training seminars as an option for users."	Content	Future Work	Interview	-

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