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Mobile Application with Voicebot for Detection of Family Violence: A Case Study in the District of Casa Grande, Perú

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Abstract. The COVID-19 crisis, which emerged in early 2020 in Peru, has highlighted challenges in detecting and responding to domestic violence, with the District of Casa Grande being particularly affected. This urgent issue led to the need to develop more effective and faster tools to identify and address these cases. In this context, the presented research focused on the design and development of an innovative mobile application, equipped with a Voicebot, based on the Mobile-D methodology, known for its efficacy in mobile solutions development. To evaluate the utility and efficiency of this tool, a comprehensive and real case study was conducted using a pure experimental design, dividing the participants into two groups: an experimental one, which used the application, and a control group, which received no intervention. Four key indicators were measured: the time needed to detect a violent incident, the speed in connecting victims with nearby help centers, the total volume of cases identified, and the level of user satisfaction. The results obtained were encouraging: the application significantly reduced detection and response times, increased the number of detected cases, and significantly improved user satisfaction, proving to be an essential tool for addressing domestic violence in the District of Casa Grande.

Keywords. Mobile application, Voicebot, domestic violence detection, mobile-d methodology, satisfaction.

1 Introduction

Family violence is a global challenge, and the Casa Grande District has been no exception. In 2022, a significant increase in violent incidents was observed. The pandemic has intensified underlying situations, leading to economic strains, couple disputes, jealousy, and other triggering factors. Early detection of family violence is crucial in today's society.

In relation to this issue, the authors in [1] introduced an article titled “Mobile Phone Apps for Intimate Partner and Sexual Violence Prevention and Response: Systematic Search on App Stores.” Their main objective was to assess the quality of available mobile apps for the prevention and response to intimate partner and sexual violence.

Meanwhile, [2] in their research “Influence of Intrafamilial Violence on the Academic Performance of Adolescents,” examined the

repercussions of intrafamilial violence on the academic performance of adolescents from the Vicente Fierro educational unit in Tulcán. The findings revealed a significant impact of intrafamilial violence on the performance of students in 8th and 10th grades.

In their article "Health Care Counselling Via Voicebot Using Multinomial Naive Bayes Algorithm," the authors [3] proposed a Voicebot software designed to provide answers and solutions to users, as well as to assist in the diagnosis and treatment of patients, displaying symptoms, diagnoses, predictions, and prescriptions. In the study [4], titled "The use of mobile phone applications to enhance personal safety from interpersonal violence – an overview of available smartphone applications in the United Kingdom," 503 applications were reviewed, of which 83 met the evaluation criteria.

While many users found these applications helpful, concerns were also reported regarding the reliability and efficiency of some of them. As reported in [5], "Health Professionals' Experience Using an Azure Voice-Bot to Examine Cognitive Impairment (WAY2AGE)," the experience of 30 healthcare professionals using a VoiceBot to detect cognitive decline was analyzed. In [6], "Development and testing of an fpt.Ai-based voicebot," the authors introduced a voice robot that demonstrated an accuracy of 90.51% in open voice tests.

The author in [7], "Psychological Impact of COVID-19 on Children and Adolescents," addressed the psychological effects of Covid-19 on the youth, noting an increase in negative psychosocial factors during the pandemic. The article [8], "Violence towards Women and Coping Strategies in Family Mothers of Ucayali, Peru," explored the relationship between violence against women and their coping tactics, finding a significant inverse correlation.

In the research of [9], titled "Women who suffer from child maltreatment have a higher likelihood of being victims of partner violence in Peru," the relationship between child maltreatment and victimization by partner violence in Peruvian women over 18 years old was sought. The findings indicated that 49.6% of the women experienced child maltreatment, and 64.2% endured partner violence, highlighting the high vulnerability of women to violence.

On the other hand, the authors in [10], "Intimate Partner Violence in the Americas: A Systematic Review and Re-analysis of National Prevalence Estimates," emphasize that violence against women is a severe public health and human rights issue in the Americas, stressing the need for high-quality information to monitor and prevent violence. Likewise, the authors in [11], "Family Maltreatment as a Risk Factor for Antisocial Behavior in Adolescents," analyzed how the family environment can influence the antisocial behavior of adolescents, concluding that conduct disorder is multifactorial and does not differ between genders. Lastly, in the study [12], "Speech Recognition with Spanish Accent based on an Acoustic Model," an automatic voice recognition system is proposed, finding that the error rate varies depending on the number and duration of the audios, which can influence the model's accuracy.

Mobile applications aimed at detecting violence are essential in today's society, especially considering the increase in these incidents during the pandemic. These tools not only identify potential cases of domestic violence but also contribute to preventing future episodes. Each report entered into the application is meticulously registered by the Casa Grande Police Station.

This entity is responsible for delving into cases backed by evidence and looking for suitable solutions. Through this mobile application with Voicebot, not only are cases of violence addressed, but other requirements can also be channeled to the relevant authorities, ensuring a quick and efficient response.

This research aims to enhance the identification of domestic violence cases in the Casa Grande District through a mobile application with Voicebot, based on the Mobile-D methodology. Specific goals include: speeding up the detection process of violent incidents, accelerating alerts to nearby help centers, increasing the number of identified cases, and enhancing user satisfaction.

2 Theoretical Background

Mobile applications are software specifically designed to run on devices such as tablets and

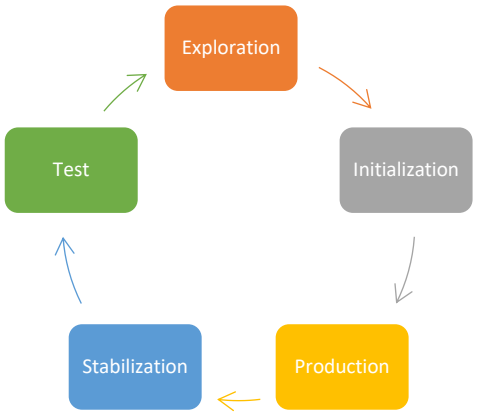

Fig. 1. Mobile-D methodology

Table 1. Operationalization of the dependent variable

Indicator	Index	Unit of Measure	Unit of Observation
Time to detect family violence	[10 - 15]	minutes	Manual Review
Time to alert nearby help center	[5 - 10]	minutes	Manual Review
Number of cases detected	[0 - 6]	days	Direct observation
Level of Satisfaction	[Strongly Disagree - Strongly Agree]	Likert Scale	Observation Cards

smartphones [13]. These programs have incorporated a broad range of functionalities that users of various devices leverage regularly as indicated by [14].

Among these applications, many offer services addressing situations of domestic violence [15]. On the other hand, voice recognition, as described in [16], is a technique that enables machines to decode and transcribe human speech using specific language models. Technology is advancing rapidly, and artificial intelligence, which seeks to emulate human thought, is a testament to this [17]. As services transition from physical to virtual, interactions between humans and technology intensify, leading to tools such as voicebots [18].

In the realm of mobile development, some of the most notable methodologies include Mobile-D, HMD, ASD, and NPD [19]. Regarding domestic violence, in [20] it is defined as harmful actions, be they verbal or physical, perpetrated by one family member towards another.

The study by Gamboa-Cruzado [43] reports that Mobile Applications allowed a significant reduction in access time, an increase in the number of workshop searches and an improvement in customer satisfaction. Finally, in [21] it is highlighted that electronic devices have evolved with the aim of enriching human life. Although their advanced use can be limiting for some, the positive impact of technological progress is undeniable.

3 Research Method

In this section, a detailed description of the methodological approach employed to conduct the research is provided. The procedures, techniques, and tools used are explained, along with the

rationale for their selection. Additionally, the experimental design, participant selection, data collection instruments, and analysis methods are presented.

This section is crucial for understanding the underlying methodology, how the results were obtained, and ensuring the replicability of the study.

3.1 Mobile-D Methodology

The Mobile-D Methodology was implemented following an agile approach for mobile application development in very small teams. According to the Mobile-D methodology, the goal is to obtain fully effective products in a period of less than ten weeks (See Fig. 1):

- Exploration: In this phase, project planning is initiated.
- Initialization: This second phase is dedicated to identifying the necessary requirements to start the project.
- Production: During the third phase, the technique known as Test Driven Development is employed to ensure higher quality in the project.
- Stabilization: In the fourth phase, integration actions are carried out to ensure that the system is complete and functioning correctly.
- System Testing and Adjustments: The objective of this phase is to achieve a stable version of the system that meets the client's needs and functions adequately.

3.2 Applied Research Methodology

In this subsection, the specific methodology applied in the study is delved into. Reasons behind the choice of this methodology, how it was adapted to the research context, and the concrete steps that were followed are discussed. Advantages and possible limitations of this approach will also be touched upon. Clarity in this section is crucial for readers to understand the validity and applicability of the results derived.

3.2.1 Operationalization of Variables

In this section, the way each study variable has been operationalized is defined and detailed. This involves describing how the variables will be measured, categorized, or quantified in practical terms.

Operationalization is crucial to ensure the variables are measurable and that the study can be replicated (See Table 1).

3.2.2 Research Design

The research design is pivotal in understanding how the study was conducted and how the variables were controlled to obtain valid and reliable results.

Research Design: Pure Experimental.

RGe	X	O1
RGc	--	O2

Data obtained from the experimental group (Ge), chosen through a random selection process (R), is based on the representative number of transactions related to the Detection of Family Violence and those who use the Mobile Application with Voicebot (X). Information from the control group (Gc) is also collected, to which the same stimulus is not administered (--).

3.2.3 Universe and Sample

All processes for the detection of Family Violence at the National level were considered as the universe of the study. Hence, N = Indeterminate.

The sample is the process of detecting Family Violence in the district of Casa Grande. Where n=30.

3.2.4 Universe and Sample

In the research, the data collection instrument was the Observation Form; and the techniques used were direct and indirect observation.

3.2.5 Statement of Hypotheses

The following hypotheses were proposed: H1: If a Mobile Application with Voicebot is used, applying the Mobile-D Methodology, then the time to detect complaints is reduced.

H2: If a Mobile Application with Voicebot is used, applying the Mobile-D Methodology, then the search time for help centers is reduced.

Table 2. Functional requirements

	Functional Requirements
RF 1	The mobile application must display a login screen with the company logo with the company logo
RF 2	The mobile application must allow the entry of ID and cell phone number data.
RF 3	The mobile application must perform a quiz using VoiceBot.
RF 4	The application must show a percentage of probability of family violence.
RF 5	The mobile application must alert the police or help centers.
RF 6	The application shall display user data.
RF 7	The administrator shall have access to the app data through a web portal.
RF 8	The web portal shall only be used by help centers.

H3: If a Mobile Application with Voicebot is used, applying the Mobile-D Methodology, then the number of cases detected per day increases.

To contrast the hypotheses, the following solution was proposed for each of the indicators:

μ1 = Population mean (H1, H2, H3) for PostTest of Gc.

μ2 = Population mean (H1, H2, H3) for PostTest of Ge.

where: Ho: $\mu 1 < \mu 2$ and Ha: $\mu 1 \geq \mu 2$

Lastly, a test was carried out to determine data normality, a descriptive statistical analysis was performed (See Figure 13, Figure 14, and Figure 15), and to validate the hypotheses, the Student's t-test was used through the Minitab statistical software (See Table 9 and Table 10).

4 Case Study

In this section, a detailed case study is presented. The context, participants, gathered data, and observations made will be explored. The aim is to provide a deep understanding of a specific situation or problem, drawing from actual evidence and practical experiences.

Through this case study, the intention is to illustrate and validate the concepts and theories discussed earlier in the paper. The Mobile-D methodology was employed for the mobile application's development.

4.1 Exploration

In this phase, the initial process of identifying and understanding the project's requirements, needs, and expectations is detailed.

The activities conducted to gather information, the tools utilized, and the interactions with the stakeholders will be discussed. This phase is pivotal in establishing a solid foundation for the subsequent stages of development, ensuring the project aligns with the identified objectives and needs. Key findings, decisions made, and their justifications will be presented. (See Table 2, Table 3, and Table 4).

4.1.1 Identifying Stakeholders

For the development of this activity, the following stakeholders were defined:

- Thesis author.
- Thesis advisor.

4.1.2 Functional Requirements Definition

Table 2 details the functional requirements of the system under study, specifying necessary operations, inputs, and outputs.

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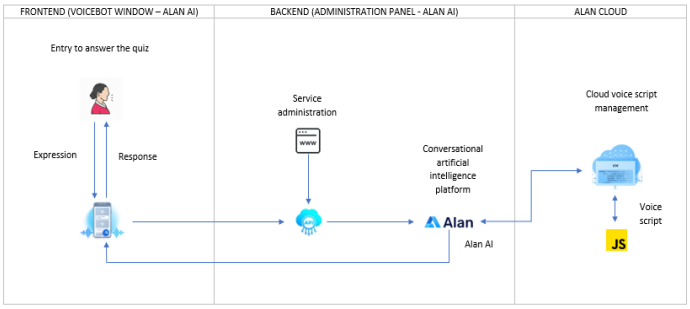

Fig. 2. Solution architecture

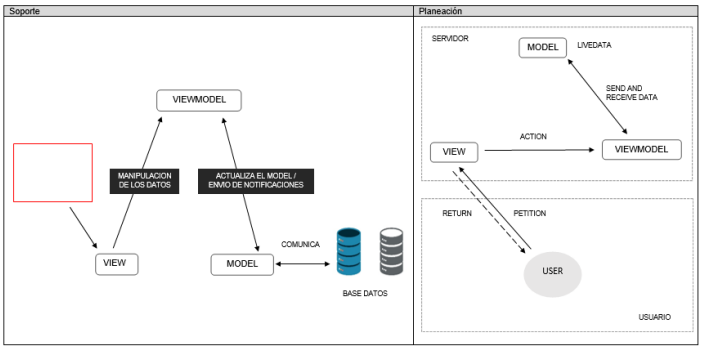

Fig. 3. Project architecture

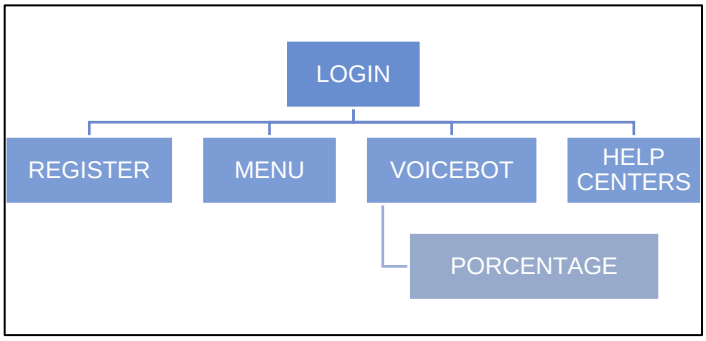

Fig. 4. Navigability scheme

4.1.3 Non-functional Requirements Definition

Non-functional requirements of the system are precisely identified and described. These cover aspects such as performance, security, usability, and compatibility, as shown in Table 3.

4.1.4 Development Tools

Table 4 provides a summary of the software and hardware tools used for the development of the system under study. Specifications of the programming environments, code libraries, version control systems, and testing platforms used are included.

4.2 Initialization

In this phase, the formal commencement of the project is described, laying down the foundation and necessary preparations for development. Initial configurations, role definitions, resource

Table 3. Non-functional requirements

NON-functional Requirements	
RNF 1	The application used the Mobile-D methodology
RNF 2	The database will be stored in SQL Server.
RNF 3	The mobile application was developed with Dart language, Php (Web Services).
RNF 4	The mobile application must be easy to analyze and modify to correct failures.

Table 4. Development tools

Name	Description
Flutter	Flutter
Language	Dart
Visual Studio Code	Source code editor
PHP	Open source code
SQL Server	Relational database management system.
Hostinger	Extensible web server

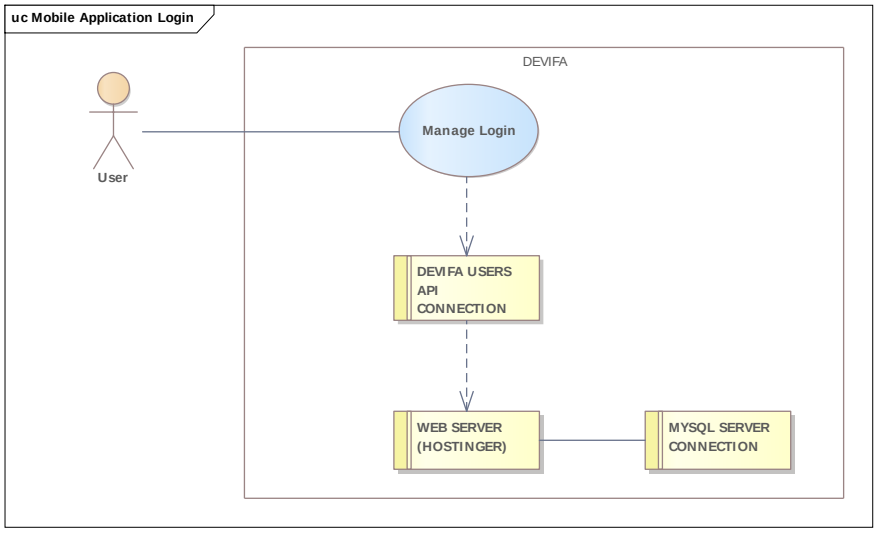

Fig. 5. Use case diagram: mobile application login

allocations, and preliminary planning are addressed.

This phase ensures that the project starts with a clear direction and all required elements in place. The solution's architecture, the project's architecture, and the navigability scheme were established. (See Fig. 2, Fig. 3, and Fig. 4).

For the project's creation, the MVC (Model-View-Controller) design pattern was used, which is divided into three components:

1 **Model**: Represents the data layer.
2 **View**: Represents the user interface.
3 **Controller**: Intermediate layer between data and interface.

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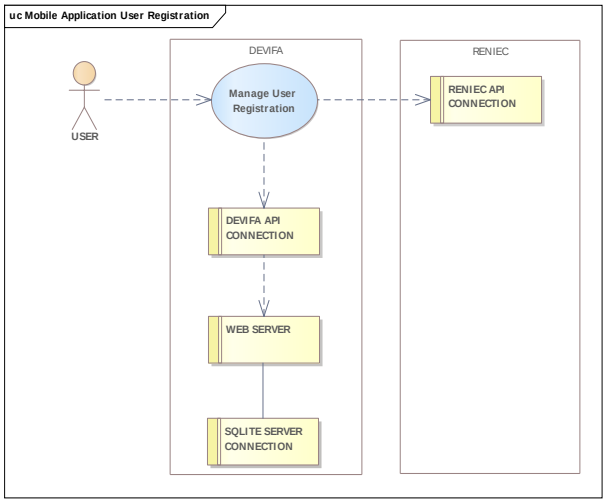

Fig. 6. Use case diagram: mobile application user registration

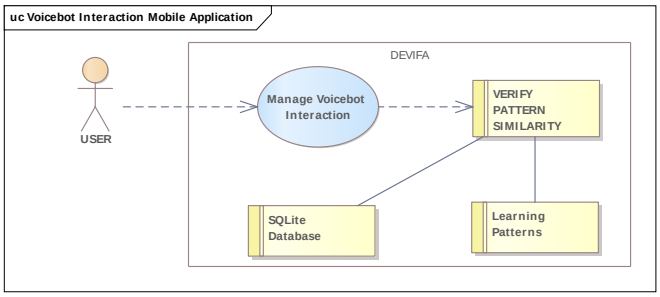

Fig. 7. Use case diagram: mobile application voicebot interaction

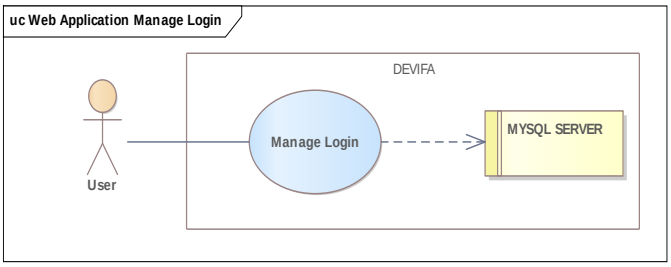

Fig. 8. Use case diagram: web application manage login

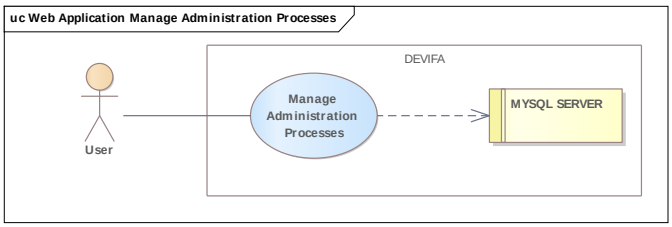

Fig. 9. Use case diagram: web application manage administration processes

Table 5. Dependency installation

Dependency	Description
Dart	Programming language
Flutter	Development framework
Shared_preferences	Add-on for reading and writing simple key-value pairs
Http	Package for HTTP resource consumption (API)
provider	A wrapper around InheritedWidget to make them easier to use and more reusable make them easier to use and more reusable
url_launcher	Flutter plugin to launch a URL on Android and iOS
Progress_dialog	A lightweight package to display the progress dialog.
sqflite	Supports transactions and batches
Rxdart	It is an implementation of the popular reactiveX api for asynchronous programming.
Image selector	A Flutter plugin for iOS and Android to select images from the library.
Type_mine	It is a standardized way to indicate the nature and format of a document.
intl	It is the namespace for the ECMAScript Internationalization API.
Google_fonts	Allows you to easily use any of the 977 fonts (and their variants) from fonts.google.com
Time_picker_date	Provides a calendar as a horizontal timeline.
Cheer_up	An animation package inspired by Animate.css, built using only Flutter animations.

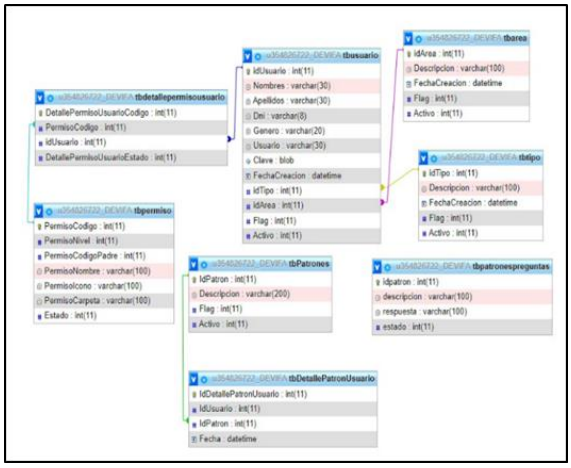

Fig. 10. Database diagram

4.3 Production

This phase is dedicated to describing the process where previous ideas and planning turn into tangible products. Activities related to coding, testing, integrations, and project refinements will be discussed.

The tools used, adopted work methodologies, and milestones reached will be highlighted.

Fig. 11. Login and registration

Fig. 12. Questions and help center

Moreover, a detailed insight into how challenges were managed and how the final product's quality was ensured will be provided. (See Fig. 5, Fig. 6, Fig. 7, Fig. 8, and Fig. 9):

– Use Case Modeling.

4.4 Stabilization

In this phase, the process of refining and optimizing the project is addressed. Activities focused on identifying and correcting errors, enhancing performance, and ensuring the product

Table 6. Results for indicators

	I1: Time to detect Family Violence		I2: Time to alert nearby help centers		I3: Number of cases detected		I4: Level of Satisfaction (Likert scale)	
N°	**PostTest Gc**	**PostTest Ge**	**PostTest Gc**	**PostTest Ge**	**PostTest Gc**	**PostTest Ge**	**PostTest Gc**	**PostTest Ge**
1	1440	12,72	1080	4,51	3	4	Strongly Disagree	Strongly Agree
2	960	11,39	1140	3,74	0	3	Strongly Disagree	Agree
3	780	14,85	1320	3,89	1	3	Neither Agree nor Disagree	Neither Agree nor Disagree
4	1380	13,03	1380	4,76	3	5	Strongly Disagree	Strongly Agree
5	1440	14,68	1020	3,39	2	3	Neither Agree nor Disagree	Strongly Agree
6	1260	13,85	1380	4,46	2	6	Neither Agree nor Disagree	Strongly Agree
7	780	14,98	840	4,12	4	6	Strongly Disagree	Agree
8	1320	14,62	1320	4,05	0	2	Strongly Disagree	Neither Agree nor Disagree
9	780	12,10	1140	4,61	1	1	Strongly Disagree	Agree
10	1200	14,21	1440	4,24	2	3	Strongly Disagree	Strongly Agree
11	600	11,03	1200	4,99	1	6	Neither Agree nor Disagree	Agree
12	700	13,05	1080	4,19	4	5	Strongly Disagree	Strongly Agree
13	1080	13,41	840	3,08	3	5	Neither Agree nor Disagree	Neither Agree nor Disagree
14	1140	14,68	840	4,94	1	1	Neither Agree nor Disagree	Strongly Agree
15	900	12,44	780	3,90	6	6	Strongly Disagree	Agree
16	1320	11,49	720	4,36	3	5	Strongly Disagree	Neither Agree nor Disagree
17	780	14,48	600	4,45	4	0	Strongly Disagree	Strongly Agree
18	900	14,92	1020	3,02	0	2	Strongly Disagree	Agree
19	780	12,44	1140	4,18	2	4	Neither Agree nor Disagree	Agree
20	1140	12,95	1260	3,48	1	2	Strongly Disagree	Strongly Agree
21	600	13,85	1080	4,01	6	3	Strongly Disagree	Strongly Agree
22	1020	12,32	960	3,78	4	6	Strongly Disagree	Agree
23	1380	11,26	900	4,49	3	5	Strongly Disagree	Neither Agree nor Disagree
24	1140	12,79	780	3,29	0	4	Neither Agree nor Disagree	Strongly Agree
25	1140	13,48	600	3,10	3	4	Strongly Disagree	Agree
26	1380	13,21	1080	3,62	5	1	Strongly Disagree	Strongly Agree
27	1080	11,20	1200	4,20	0	4	Strongly Disagree	Agree
28	780	14,71	840	4,50	1	3	Neither Agree nor Disagree	Strongly Agree
29	1380	11,03	720	4,38	5	3	Strongly Disagree	Strongly Agree
30	900	14,04	1200	3,60	2	4	Strongly Disagree	Strongly Agree

meets the established quality standards will be tackled. It's a phase where the project's robustness is tested, and it is prepared for its final launch or implementation. Moreover, it provides a detailed insight into the efforts made to ensure the project is stable, reliable, and ready for delivery or deployment. (See Table 5 and Fig. 10):

– Dependency Installation.

4.5 Testing

In this phase, we detail the set of activities carried out to evaluate and validate the behavior of the developed product. The different types of tests conducted, whether unit, integration, system, or acceptance tests, among others, are addressed. This offers a deep understanding of how it was ensured that the project met the defined expectations and requirements and how it was prepared for its deployment and use in a real environment. (See Fig. 11 and Fig. 12):

- **Login**: Set of methods used to authenticate and enter the mobile application; one must log in using the DNI and cell phone number.
- **Registration**: For the Registration screen, it is mandatory to fill in fields such as: DNI, Phone, Address, and Gender.
- **Questions**: For the questions, there is a VoiceBot which will interact with the user and will ask a series of questions to detect Violence.
- **Help Centers**: On this screen, details of the community Help Centers will be displayed, which will be alerted once the user responds.

5 Results and Discussion

In this section, the results obtained from the experiments are presented and discussed in relation to existing literature and proposed hypotheses. It is vital to remember that the discussion is based on interpreting the results in light of theory and previous research.

5.1 Experimental Results

The results of this study clearly demonstrate that the Time to detect Family Violence, Time to alert nearby help centers, Number of Cases detected, and User Satisfaction Level have improved. 30 results were obtained for each indicator, as shown in Table 6.

5.2 Normality Test

Verifying normality is a fundamental prerequisite for many inferential statistical procedures that assume a normal distribution of residuals. In this study, the normality of data set distributions was assessed using various indicators and statistical tests. The Empirical Cumulative Distribution Function (ECDF) is a vital tool in this process. (See Fig. 13, Fig. 14, and Fig. 15).

Indicator I1: Time to detect Family Violence.

Indicator I2: Time to alert nearby help centers.

Indicator I3: Number of cases detected

For indicators I1, I2, and I3, the analysis reveals a p-value that lies below the set significance threshold ($\alpha = 0.05$). These results confirm that the data fit a normal distribution. Given this evidence, we will select the parametric Student's t-test to verify our hypotheses.

5.3 Discussion

This section plays a crucial role in the contextualization and interpretation of the findings obtained in the study. It aims to offer a deeper understanding and place the results within the framework of existing literature.

5.3.1 Descriptive Statistics

An initial descriptive review of the data clearly shows several trends (See Table 7 and Table 8 for more details).

The results of the Anderson-Darling test indicate that, for most indicators and groups, the data is normally distributed. It is important to note that the indicator I1: PostTest Gc has a p-value of 0.067, which is close to the α (0.05) threshold. Although this value does not completely refute the normality of the data, it suggests that one should proceed with caution when interpreting the results for this indicator. The provided means and standard deviations reflect the central tendency and dispersion of the data, respectively, which is consistent with our observations about the normality of the distribution

Three key indicators, I1, I2, and I3, are presented, along with their respective 95% confidence intervals. For indicator I1, the average post-test time ranges from 12,504 to 13,997 minutes, and the third quartile (Q3) indicates that 75% of observations are below 14,515 minutes.

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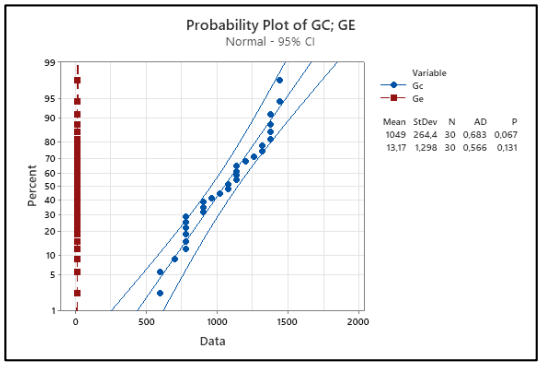

Fig. 13. Time to detect family violence

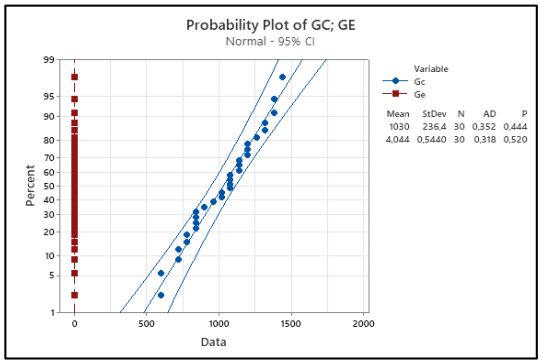

Fig. 14. Time to alert help centers

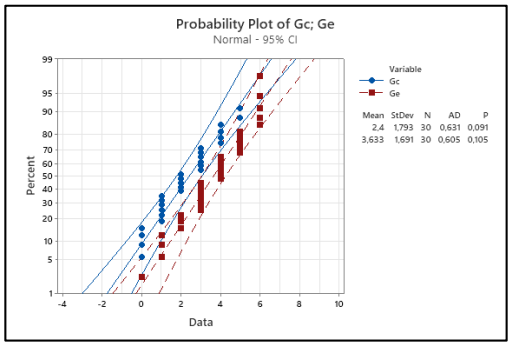

Fig. 15. Number of cases detected

Indicator I2 shows a range from 3,8052 to 4,3754 minutes with a Q3 of 4,4675 minutes.

For indicator I3, between 3,0000 and 4,7713 daily detected cases are reported, and a Q3 suggests that 75% of the records report fewer than 5 cases daily. Notably, the kurtosis values for I1, I2, and I3 are negative, suggesting tails lighter than a normal distribution.

Regarding skewness, all the indicators display negative skewness, indicating a greater concentration of data towards the higher values.

For Indicator 1, the results obtained align with those of [22], which detected a significant 79.3% reduction in the time needed to identify a reported case of domestic violence. Similarly, [23] documented a 72% reduction in domestic violence

Table 7. Results with descriptive statistics

Indicator	n	Mean	StDev	AD	p-value
I1: PostTest Gc	30	1049	264,4	0,683	0,067
I1: PostTest Ge		13,17	1,298	0,566	0,131
I2: PostTest Gc	30	1030	236,4	0,352	0,444
I2: PostTest Ge		4,044	0,5440	0,318	0,520
I3: PostTest Gc	30	2,4	1,793	0,631	0,091
I3: PostTest Ge		3,633	1,691	0,605	0,105

Table 8. Summary of results for the Indicators

Indicator	n	95% Confidence Intervals for the Mean	Kurtosis	Skewness	Q3
I1: PostTest Ge	30	12,504 – 13,997 min	-1,17701	-0,22951 min	14,515 min
I2: PostTest Ge	30	3,8052-4,3754 min	-0,684994	-0,298199 min	4,4675 min
I3: PostTest Ge	30	3,0000 – 4, 7713 cases	-0.666061	-0.292097	5,0000

detection time. In agreement, the authors in [25] confirm this trend, indicating a 32.9% decrease. However, these findings exceed those of [26], where only a 20% reduction in detection time was observed.

Given this evidence and the use of Mobile – D in the current research, the substantial reduction in the time it takes to detect domestic violence is emphasized, suggesting the potential for replicating these results in various contexts.

In relation to Indicator 2, the data gathered resemble those of [27], showing a 33.39% reduction in the time to alert assistance centers. Along the same lines, [28] reflected a 49% decrease, and [29] a 36% decrease. Additionally, [30] and [31] reported a reduction of 63.2% and 32% in the time required to send alerts to assistance centers, respectively.

As a result, based on this study utilizing Mobile – D, it's inferred that we have achieved tangible accomplishments, evidenced by the reduced alert time to assistance centers. It is crucial to consider all participants in the process.

Regarding Indicator 3, when compared with [32], they reported an increase of 5,937 detected domestic violence cases. Analogously, [33] recorded a significant 42% rise in the number of detected violence cases, regardless of their type. Continuing this trend, [34] highlights a specific vulnerability in children, with a daily increase of 47% in reports. Coherently, [35] emphasizes a 12.5% growth in incidents related to domestic violence. Meanwhile, [38] points to a 53.2% surge in the total reported domestic violence situations.

In this light, it's inferred that the study conducted using Mobile – D has yielded favorable

Table 9. Hypothesis testing for parametric indicators

Sample	n	H_0	t-value	p-value
I1: PostTest(Gc) / I1: PostTest(Ge)	30	μ1 ≤ μ2	21.46	0.000
I2: PostTest(Gc) / I2: PostTest(Ge)	30	μ1 ≤ μ2	23.77	0.000
I3: PostTest(Gc) / I3: PostTest(Ge)	30	μ1 ≥ μ2	-2,74	0.004

Table 10. Hypothesis testing for non-parametric indicators

Sample	n	H_0	w-value	p-value
I4: PostTest (Gc) / I4: PostTest (Ge)	30	μ1 ≤ μ2	487.50	0.000

findings, showcasing an increase in identified cases. It's imperative to address these results, giving special consideration to the victims.

5.3.2 Inferential Statistics (Hypothesis Testing)

Table 9 and Table 10 display the findings of the statistical analyses conducted to assess the proposed hypotheses.

Given that all the obtained p-values are less than α (0.05), the results provide compelling evidence to reject the null hypotheses (Ho) and thus give credence to the alternative hypotheses. This implies that the variables analyzed have a significant relationship and that the differences or associations found are not merely due to chance.

In this context, it's crucial to highlight the significance of these findings, as they indicate that the tests conducted are statistically significant, bolstering the validity and potential impact of the conclusions drawn from the research.

6 Conclusions and Future Research

The mobile application developed based on the Mobile-D Methodology has significantly optimized the process of identifying Family Violence cases in the Casa Grande district. We evaluated our main variable through four indicators: time to identify family violence, time to notify nearby help centers, the number of cases identified daily, and user satisfaction level.

After the software's implementation, there was a reduction in the time required to detect family violence, a decrease in the period needed to alert nearby help centers, an increase in the number of cases identified daily, and an improvement in user satisfaction.

For future research, it is suggested to continue using the Mobile-D methodology, given its effectiveness and thoroughness in developing mobile applications of various kinds. It is also advisable for the software to adapt to address more vulnerable cases and to expand its application on provincial, regional, or national scales.

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