

Comprehensive monitoring police system to manage the complaint process on gender violence in Peru

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Abstract– In this article, a technological police system is proposed that allows optimizing the complaint process in cases of Violence Against Women in Peru. Gender violence is a cause of death and disability among women between the ages of 18 and 44, affecting all social and cultural groups in the world. In Peru, 222 234 complaints of family violence were registered, of which 65 000 cases correspond to the Women's Emergency Center requesting judicial, psychological and social help. Based on the study carried out, it was identified that the National Police of Peru receives complaints about gender-based violence, but it takes time to provide comprehensive follow-up since some of the tasks in the process are carried out manually. For this reason, the project proposes a technological solution to reduce the time for registering complaints about violence against women. The solution presented consists of four components: 1) A mobile application, focused on female citizens who are victims of gender violence, 2) A web application, aimed at those responsible for the process, 3) Back-end, and 4) Integration with devices of early warning. The proposal was functionally validated by a sample of 15 women between the ages of 19 and 43 who were victims or witnesses of violence against women, an officer from the National Police of Peru and a worker from the Women's Emergency Center. Likewise, 20 simulations of complaint registers were carried out using the proposed solution. The preliminary results obtained during the validation phase showed that the average time used to register the complaints was reduced by 95.9%.

Keywords-- Violence against women; Information and Communications Technology; Women safety; Cloud technology.

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Abstract– *In this article, a technological police system is proposed that allows optimizing the complaint process in cases of Violence Against Women in Peru. Gender violence is a cause of death and disability among women between the ages of 18 and 44, affecting all social and cultural groups in the world. In Peru, 222 234 complaints of family violence were registered, of which 65 000 cases correspond to the Women's Emergency Center requesting judicial, psychological and social help. Based on the study carried out, it was identified that the National Police of Peru receives complaints about gender-based violence, but it takes time to provide comprehensive follow-up since some of the tasks in the process are carried out manually. For this reason, the project proposes a technological solution to reduce the time for registering complaints about violence against women. The solution presented consists of four components: 1) A mobile application, focused on female citizens who are victims of gender violence, 2) A web application, aimed at those responsible for the process, 3) Back-end, and 4) Integration with devices of early warning. The proposal was functionally validated by a sample of 15 women between the ages of 19 and 43 who were victims or witnesses of violence against women, an officer from the National Police of Peru and a worker from the Women's Emergency Center. Likewise, 20 simulations of complaint registers were carried out using the proposed solution. The preliminary results obtained during the validation phase showed that the average time used to register the complaints was reduced by 95.9%.*

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I. INTRODUCTION

In 2013, the World Health Organization declared violence against women a public health issue [1]. Two years later in Peru, on November 24, the Law No. 30364 - "Law to prevent, punish and eradicate violence against women and members of the family group"- is enacted, a norm that defines violence against women as any act and / or conduct that may cause harm, death or physical, psychological or sexual suffering to women, due to their condition of race, religion, culture or social class [2]. In 2020, a total of 185 548 inquiries were registered on cases of violence against women reported through the "Línea 100" [3]. In the report "Violence against women: perspectives of the victims, obstacles and quantitative indices", it was identified that there is a lack of logistics and work overload in police stations and family courts [4]. Likewise, it is estimated that 76% of the police stations do not have the necessary infrastructure to deal with cases of violence against women and 75% of the women who made a complaint

were unaware of the Law No. 30364 [4]. In this regard, an opportunity to improve the time for registering a complaint was identified, since many victims of gender violence are not cared for or have to wait long periods of time for the authority in charge to follow up on the case. Likewise, it should be noted that women who are victims of violence are in a very delicate emotional situation and require special attention.

Although violence can be addressed in preventive ways through the use of alert systems, a gap has been identified related to solutions that inform and allow users to make complaints without having to go to the police station. According to the authors of the article [5], Information and Communication Technologies positively influence the behavior and attitude of women facing acts of violence and inequality. In articles [6] and [7], the authors identified that the willingness of the victims to report acts of violence is related to the information they have about their rights and laws. On the other hand, in the article [6], the authors propose the design of a solution that allows users to make complaints about violence against women and receive an answer from the police through a website. Likewise, in article [8], a low-cost device was developed for the early warning cases of femicide.

The motivation of this project is to contribute in the fight against gender violence through the implementation of technological tools. The general objective of the project is to reduce the time associated with the process of reporting violence against women in Peru. Therefore, a technological solution supported by a mobile and web application that can be integrated into alert devices is proposed. The solution is called "Comprehensive Complaint System", which consists of 4 modules: (1) the registry of complaints about violence against women and the follow-up of these cases, (2) a geo-referential map that allows the police to locate the victims, (3) information on Law No. 30364 and (4) a space where women can share their testimonies. Likewise, a web application has been developed to enhance the attention to the complaints reported by users. Finally, a module was implemented that allows integration with alert devices. Therefore, in the present study a simulation was performed with the device developed in the article [8].

This article is organized as follows: We will begin with a review of the literature on the use of solutions, methods and tools in violence against women. Then, the section of the

proposal with the analysis and development of the proposed system. The following section details the preliminary results of the case study carried out for the validation of the proposed solution, and the last section presents the conclusions of the study.

II. LITERATURE REVIEW: SOLUTIONS, METHODS AND TOOLS

Violence against women is a sociocultural problem that is out there in many societies around the world. This act undermines the freedom, well-being and rights of women regardless of their age, culture, religion, race or ethnicity to which they belong. However, multiple efforts have been made to develop solutions, methods and strategies that allow addressing the problem from different perspectives. In the present study, numerous scientific articles related to Violence Against Women and Information and Communication Technologies were analyzed under the PICOC methodology, which allowed the production of a knowledge matrix to subsequently identify the existing gaps in these fields.

A. Complaint process in Peru

The complaint process for cases of violence against women is carried out in accordance with the provisions of the Procedural Scheme of Law No. 30364, which consists of two stages. [9] The proposed solution is designed under the regulations established in Law No. 29733 - "Personal Data Protection Law". This study takes the "Protection Stage" as a baseline, which provides special attention for victims in order to obtain protection and precautionary measures in a time no longer than 96 hours.



Fig. 1 Complaint process - Protection Stage

As shown in Fig. 1, the complaint process begins when a victim files a complaint for physical, psychological, sexual, economic or patrimonial violence. The police then carry out the investigation of the case within a maximum period of 24 hours in order to determine the validity of the case. Once the police investigation has been completed and the authenticity of the accusation has been verified, the case is referred to the family court or its equivalent for its respective investigation within a maximum period of 72 hours. Finally, the family judge calls an oral hearing to dictate precautionary and protection measures.

B. Mobile operating system evaluation

Designing a mobile application was the decision to make since 79.1% of women in Peru access internet services from mobile devices. Likewise, as shown in Table I. 90.69% of mobile devices in Peru have an Android operating system

[10]. For this reason, the mobile application has been developed with the Kotlin language for Android.

TABLE I
MAIN MOBILE OPERATING SYSTEMS IN PERU

N°	Mobile Operating Systems	
	OS	Percentage
1	Android	90.96%
2	iOS	8.92%
3	Samsung	0.30%
4	Windows	0.03%
5	Unknown	0.03%
6	Playstation	0.01%

C. Available solutions evaluation

There are many tools, methods and strategies that help to fight violence against women in the world. In Peru, most of the solutions have been developed and implemented by state entities, most of them being national programs and plans that seek to inform citizens about gender violence and how to handle these cases quickly. Then, in Table II. some of the solutions that have been developed and that are currently in force in the Peruvian market are shown.

TABLE II
AVAILABLE SOLUTIONS IN PERU

Characteristics	Available solutions			
	Central Única de Denuncias	Chat100	Línea 100	Yo denuncio
Owner	Ministry of the Interior	The Ministry of Women and Vulnerable Populations	The Ministry of Women and Vulnerable Populations	Public Ministry
Type	Mobile & web platform	Web platform	Phone Central	Mobile & web platform
Usability	Public	Public	Public	Public
Functionality	Management of complaints about corruption, organized crime and human trafficking	Provide information and guidance on family, sexual and dating violence	Provide information and guidance on family and sexual violence	Management of complaints about family violence, human trafficking, robbery and theft
Integration with alert devices	No	No	No	No
Accessibility	Free	Free	Free	Free

1) Central Única de Denuncias

It is a digital service of the Ministry of the Interior that allows you to make complaints about acts of corruption, organized crime or human trafficking. This solution allows users to register complaints through the web or a mobile application, however, the validity of the complaint must be made in person at the police station. Likewise, complaints of violence against women are relegated to the category of

organized crime and can be decisive for users not to report when they are victims of violence.

2) Chat100 and Línea 100

Services offered by the Ministry of Women and Vulnerable Populations that provides guidance on 4 levels, admission, psychological, legal and social to victims of violence against women. Chat100 is a digital channel, through which the user can request these services through a chat [11]. Likewise, “Línea 100” has the same characteristics through a telephone line [12]. Unlike the the Complaints Center, Hotline 100 and Chat100 do not allow registering a complaint, but rather accompany and advise the victim to make a complaint to the police station.

3) Yo denuncia

It is a digital service of the Public Ministry - Public Prosecutor's Office that allows complaints to be made in general, for which it requests authentication using the data of the National Identity Document. In this case, the steps to follow and the way in which a report is made is very demanding, which can be confusing for users.

Although, in Peru there are different solutions related to violence against women, these lack functionalities, but they can complement each other, as is the case of the support provided by “Línea 100” with “Chat100” to users and the service to carry out a Complaint from the “Central Única de Denuncias” or “Yo denuncia”.

D. IaaS providers evaluation

Cloud Computing is a set of services that allow actions to be carried out within a virtualized environment (the cloud), this type of service provides agility and scalability, among other benefits. According to a study carried out by Gartner in 2019, the main Cloud service providers were: Amazon Web Services, Google Cloud Platform and Microsoft Azure [13], companies that have gradually positioned themselves in the market. Cloud Computing plays an important role in this study, since IaaS was implemented to execute the Back-end and Front-end processes of the technological solution. Then, in Table III. Top cloud infrastructure service providers are shown.

TABLE III
MAIN PROVIDERS OF INFRASTRUCTURE AS A SERVICE

Characteristics	IaaS Providers		
	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Product	EC2	Compute Engine	Azure Cloud Services

For the choice of the infrastructure-as-a-service provider, a prioritization matrix was made based on the following criteria: Price, resources, compatibility, security and support. In this regard, the EC2 product from Amazon Web Services was chosen, since it obtained a greater weighting in relation to

the products of other providers according to the established criteria. In addition, EC2 enables better security management and greater scalability in the product.

III. COMPREHENSIVE MONITORING POLICE SYSTEM: PROPOSED TECHNOLOGICAL SOLUTION

A. Description of the solution

The proposed solution is aimed at two types of users: victims of violence and those responsible who intervene in the complaint process. The Front-end was developed with the VueJs framework, the mobile application with Kotlin and the Back-end with NodeJs. The solution was deployed on the AWS EC2 service. Complaints are made through the mobile application and are subsequently reflected in the web application using a hazard map. Likewise, the Back-end events module allows integration with other alert devices. For the present study, the device developed in the article [8] was used. The architecture of the solution allows tropicalization and agility, that is, it can be replicated in other scenarios and easily adapted according to the requirements of the environment. Consequently, the proposal of the present study can be considered as a replicable model. Then, in Fig. 2 the integration architecture belonging to the solution is shown.

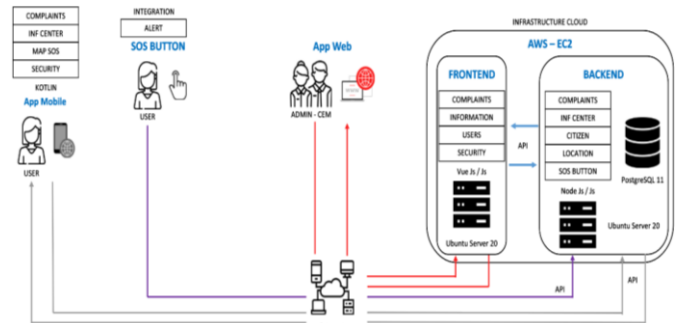


Fig. 2 Integration Architecture

It should be mentioned that the solution is capable of reducing the time for registering and handling complaints about violence against women through the use of a mobile and web application.

B. Solution components

The solution proposed in this study is made up of different technological components, which are detailed below:

1) Mobile application

Developed for the Android OS, it fulfills two main functions, managing complaints about gender violence and informing citizens about their rights and laws. The use of the application is free, that is, it is not required to be logged into the application to have access to the information modules. However, citizens must register to make a complaint and follow up. Then, in Fig. 3 some interfaces of the mobile application are presented.

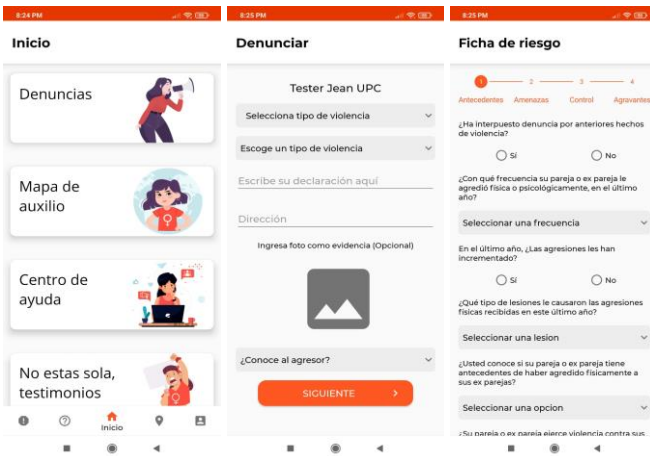


Fig. 3 Mobile application interfaces

2) Web application / Front-end

It is an application developed with VueJs that allows members of the police, family court and Women's Emergency Center to deal with complaints about gender violence according to the scope of their organization. In addition, a danger map is presented, which facilitates the visualization of the complaints reported through the mobile application and the femicide alerts generated with the device [8]. On the other hand, the information shown in the mobile application is managed from the web by the members of the Women's Emergency Center, guaranteeing that the information is accurate and updated. In Fig. 4 the hazard map implemented in the web application is displayed, which shows the location of the registered complaints.



Fig. 4 Hazard map of the web application

3) Back-end

It provides support at a logical level, it is developed with NodeJs and connected to a PostgreSQL 11 database manager. The Back-end presents and manages the services, both for the web application, mobile application and the alert device [8].

4) Integration with early warning devices

The early warning device for cases of femicide is integrated into our proposal through a service presented by the Back-end. In this way, it seeks to join forces with other studies to provide a more robust and complete solution.

C. Solution stages

1) Data collection

Obtaining data related to the victims, complaints and testimonies is done through the mobile application, the registration of complaints being the most important, since it is the one that initiates the process. Likewise, through the alert device [8], records of attempted femicide are obtained.

2) Data transmission

The data obtained through the mobile application or the alert device [8] are recorded in the database through the consumption of services, which are exposed by the Back-end. Also, images that are uploaded as evidence of the complaint are uploaded to Firebase through an API.

3) Data storage

The data obtained is stored in the database, built on PostgreSQL 11. Regarding the images that are uploaded as evidence, these are stored in Firebase Storage. Therefore, our database stores the URLs of the images.

4) Data collection and processing

This stage is composed of 3 sub-stages that are detailed below:

a) Receipt of complaints: Once the users register a complaint through the mobile application, the web application through the consumption of services on the Back-end will be able to show each one of the registered complaints with its respective detail. Once the complaint is identified, the police officer will contact the complainant to validate the data and assign a complaint number.

b) Validation and referral of complaints: The complaints previously registered will go through a police investigation, which will determine the validity of the complaint. Subsequently, the officer in charge of the case will prepare a police report, which will be attached to the complaint as support for its validity. Any valid complaint will proceed to be referred to the family court for its respective evaluation. This stage has a maximum duration of 24 hours.

c) Resolution of the case: The complaints that have been referred by the police go through an evaluation process in which each case is analyzed in order to determine the precautionary and protection measures that ensure the well-being of the victim and guarantee the fulfillment of your rights. This stage has a maximum duration of 72 hours.

IV. STUDY CASES

A. Organization

Homes, workplaces, streets, among others, are scenes of different types of violence against women. Therefore, the registration of 20 complaints about violence against women was simulated through the mobile application. Likewise, the

study was carried out with 15 Peruvian women between 19 and 43 years old who were victims of violence against women or who accompanied them. Finally, the validation of the web application was carried out with a colonel from the National Police of Peru and a collaborator from the Women's Emergency Center.

B. Implementation

1) Validation process

The Protection Stage on a case of violence against women has 3 actors, which are: the complainant, the police officer and the family judge. Regarding the worker of the Woman's Emergency Center, they intervene if the complainant requests their support.

The process begins when a victim registers a complaint of violence against women, for which the police officer validates the information in the complaint and initiates the investigation that must be resolved within a maximum period of 24 hours. If the investigation finds the aggressor guilty, it refers the case to the family court, where there is a maximum period of 72 hours to convene an oral hearing and present the precautionary and protection measures. Throughout the process, the complainant must report to the Women's Emergency Center if she is revictimized, the provisions of Law 30364 are not complied with or there are irregularities during the process.

The validation process was carried out in order to analyze the reduction in the registration time of a complaint of violence against women. Likewise, the interviews with the users were carried out in order to validate the acceptance and satisfaction of the mobile application. Finally, the interviews with the colonel and the collaborator were carried out in order to validate the process of handling complaints.

2) Metrics

The metrics defined for this study are displayed in Table IV an API.

TABLE IV
METRICS ASSOCIATED WITH THE PROPOSED SOLUTION

N°	Metrics	Formula
1	Reduction in the time to register a complaint percentage	$RT\% = 100 - \left(\frac{100 * TPR1}{TPR2} \right)$

Where:

- RT%: Percentage of reduction in the time to register complaints.
- TPR1: Average time for registering complaints in person.
- TPR2: Average time for registering complaints through the mobile application.

The data that fed the metric 1 were obtained through the research carried out and the data collected during the simulations carried out in a controlled environment.

C. Results

After the simulations run in a controlled environment (Test Environment), 20 results were obtained in relation to the time it takes to register a complaint using the mobile application. Then, the following table shows the data obtained from the simulations:

TABLE V
REPORT REGISTRATION TIME THROUGH THE MOBILE APPLICATION

N°	Time (min)
Simulation 1	6.47
Simulation 2	5.21
Simulation 3	5.44
Simulation 4	8.35
Simulation 5	5.10
Simulation 6	5.13
Simulation 7	5.18
Simulation 8	6.30
Simulation 9	5.35
Simulation 10	6.34
Simulation 11	5.15
Simulation 12	6.37
Simulation 13	7.30
Simulation 14	5.33
Simulation 15	5.23
Simulation 16	5.50
Simulation 17	5.54
Simulation 18	5.20
Simulation 19	5.30
Simulation 20	5.10

From Table V. it can be seen that the average time it takes to make a complaint through the developed mobile application is approximately 6 minutes. It should be noted that the atypical values obtained in the simulation are generated by uploading photos with a size greater than 6Mb. The results obtained were compared with the times in the police stations, which are 150 minutes or 2.5 hours. In this sense, there is evidence of a reduction in the time for registering complaints.

V. CONCLUSIONS

In this article, a technological solution is proposed in order to reduce the registration time of complaints about violence against women. According to the simulations carried out during the validation stage, a 95.9% reduction in the time it takes to make a report through the mobile application was evidenced. Likewise, based on the interviews carried out, it was identified that users feel more protected when making a report through the mobile application. The use of the application is directly related to the level of violence to which the user is exposed, that is, women who live in an environment of violence will make constant use of the solution to make complaints. Instead, users who are not exposed to an environment of constant violence will use the application for informational purposes.

Future work and research should focus on the use of new technologies to develop predictive models that identify possible aggressors, security models that can be applicable to existing solutions on the market, and methods that facilitate the emotional containment of victims of violence.

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