Analysis of the perception of security at the concepción campus of Universidad del Bío-Bío

Mónica Caniupán M.[1], Leticia Galleguillos P.[2], Tatiana Gutiérrez-Bunster.[1], Katherine Prats P.[2], Alejandra Segura N.[1] y Brunny Troncoso P.[1]

[1] *Depto. Sistemas de Información, Universidad del Bío-Bío, Chile.*
[2] *Depto. Ingeniería Industrial, Facultad de Ingeniería, Universidad del Bío-Bío, Chile.*

Abstract
In this article we present preliminary results of a project implemented at the Universidad del Bío-Bío (UBB), Concepción campus, that seeks to contribute to increasing the perception of security among users, by using Information and Communication Technologies (ICTs). Currently, community members of the Concepcion campus at UBB show different perceptions of insecurity. Initially, we perform a diagnosis to know what are the insecurity problems that affect the community, and the effects of insecurity on the well-being of the community of the Concepción campus. In this way, we establish the main problems around security and evaluate different ways in which the use of ICTs contributes to improve the insecurity perception. This article reports a mobile application prototype, that allows alerting of possible unsafe events, to be used within the Concepción campus. This application also permits to generate reports of security problems that are perceived at the campus, which allow both application users and university managers to acquire information on the university environment in terms of security.

Keywords
Security, Information Technologies, Mobile Applications.

1. Introduction

The project "Information Technologies and their use in Security Systems" [5], currently under development and whose partial results are presented in this article, was one of the winners in the "UBB Women Innovation" contest in 2022 carried out by the Universidad del Bío-Bío (UBB), Chile.

In the research work, we evaluate the current situation of the Concepción campus at the UBB, carrying out an initial diagnosis of the effects of insecurity on the well-being of the university community in terms of distrust and perceived insecurity among its users; establishing which are the main security problems, in order to evaluate the different ways in which the use of Information and Communication Technologies (ICTs) can help to improve this perception. We focus on solutions based in technology that, for example: facilitate the communication of states of security or insecurity in real time, use spatial databases to identify unsafe/safe places [17], carry out route searches from a point of origin to a point of destination [4], allow inter-user communication via chat, etc. We elaborate a set of possible ideas to be developed at the campus, select the most relevant and construct a prototype during the development of the project, leaving the rest for future work.

According to initial studies carried out regarding the effects of insecurity on the well-being of the university community of the Concepción campus, people acquire perceptions of insecurity due to factors such as poor lighting, the presence of people from outside the campus, the low attendance of people in the afternoon, and other reasons. Women are the ones who may feel most affected, since

according to the 18th National Urban Survey of Citizen Security (prepared by the National Institute of Statistics, in 2021), they are the main victims of crimes such as theft and robbery by surprise with a percentage of 64.2% and 71.4%, respectively [8].

In addition to insecurity, there is mistrust, which is defined as the correlate of the insecurity feeling and perception of uncertainty with which people live daily. The perception of insecurity occurs when it is not known what to expect from others or it is suspected that others are dishonest or opportunistic. This perception is defined as the fear that people suffer from being a victim of direct or indirect crime, physical or psychological damage that affects the individual well-being, mental health, happiness and quality of life, with respect to the feeling of individual well-being that leads to happiness [12, 10,15]. Women at UBB from all university levels, including students, academics, administrative staff, professionals, and support services, are the ones who feel the most insecurity at the Concepción campus. The feeling of insecurity increases in women who must work in the afternoon or night shifts, where the traffic of people is less, which causes criminals to take advantage of this.

2. Perception of security at the UBB Concepción campus

Security management in the urban environment can benefit from the ability to manage knowledge, convert it into information and use it for decision-making on security and prevention policies, intelligence and repression, and thus to achieve safer environments for its visitors [1].

The feeling of insecurity with which citizens live is no an exception within the Concepción campus of UBB [11, 19]. In this context, the UBB has communicated the generation of a security instance to propose a set of short and medium-term actions to reduce the concern generated by situations of vulnerability that occur at the UBB [6]. Our project seeks to carry out a diagnosis of the current situation among the community of the Universidad del Bío-Bío, in order to identify some effects of the perception of insecurity on the well-being of the community and generate solutions based on ICTs to improve the perception of the community´s members.

According to [18] insecurity has two well-defined dimensions. First, the objective one, associated with direct suffering from crime, the existence of tangible factors, such as crime or violence, and the effectiveness of security and justice administration systems. Second, the subjective one, which involves the perception and appreciation that people consciously or unconsciously make about the risks and actions carried out by institutions related to security and justice.

On the other hand, distrust is defined as an incompatibility between citizen interests with respect to other actor that does not comply with the expected actions [16]. These breaches lead to uncertainty and a perception of insecurity, which is defined as the fear that people suffer from being victims of crime, physical and psychological damage that affect the individual well-being, the mental health, the happiness and the quality of life with respect to the feeling of individual well-being that leads to happiness [3].

Given that those who have felt the most insecurity on campus are women, there is an opportunity to activate support networks, build trust, and others that contribute to solving the problem. This is supported by the work in progress performed by the UBB, to prepare the Comprehensive Gender Policy against Sexual Harassment, Violence and Arbitrary Discrimination for reasons of sex/gender. This project supports the achievement of this institutional initiative [7]. Specifically, line of action 5 "Early warning", where a co-construction of a risk alert map for the university campuses is proposed, with the aim of disseminating spaces of imminent risk of sexual harassment, violence and arbitrary discrimination for reasons of sex / gender.

In general, the use of mobile applications facilitates mass reporting and alerts (for example, the device designed by [14]). The intelligence that can be obtained from the data generated can be useful to generate projects based on ICTs for the units in charge of implementing prevention and security measures, where, security indicators are disseminated, the effectiveness of adopted prevention actions

is controlled, among other aspects. Thus, creating a specific digital tool for the university context is a valuable contribution for the development of a safer space. Also, it contributes to the construction of a community that can collaboratively assume the resolution of environmental problems [2, 9].

3. Campus Survey Results

3.1. The Survey

The objective of the survey is to obtain the perception of the university community on the existing level of security on the Concepción campus and its surroundings. The survey is restricted to emails with the university extension, in order to ensure the participation of the university community and avoid external opinions that could distort the requirements. This survey was applied between December 21, 2022, and February 16, 2023.

For the preparation of the survey, we preformed interviews with the head of the campus security, as well as with the staff of the support services (cleaning staff, external company). Also, we considered a request made by the UBB students, we attended to an internal seminar, and we had a meeting with representatives of the Security Department of the Municipality of Concepción.

The survey consists of 20 questions divided into 6 parts: i) demographic questions (questions 1 and 2). ii) Part that refers to criminal acts within or near the campus, with time range and place (questions 3-7). iii) Part that refers to the perception that the community has of both the campus and its surroundings (questions 8-10). iv) Part that makes it possible to identify the options that people seek to have a better sense of security (questions 11-13). v) Section that seeks problems and possible solutions that are being addressed by the university (questions 14-15). vi) Part that allows to identify other areas of security, in this case the health and prevention areas (questions 16-20).

3.2. Results

The survey was answered by 215 people. Regarding the demographics of the population, 53.95% identified as male, 45.12% as female, and 0.93% as non-binary or other. The fact that 45.12% of those surveyed identify themselves as women, shows that there is a significant representation of women in the surveyed population. It is also important to note that there is a percentage of non-binary people and others, indicating a diversity in gender identity in the survey population. It is important to understand the perspective and experiences of different groups in the survey population, especially in areas where gender identity is an important factor.

Of the total surveyed, 27% identified themselves as belonging to the Academy, 34% as Students, 35.3% as Administrative, 2.3% as Support Services and 1.4% as Professionals. Most people identify as Student or Administrative, indicating that these groups are well represented in the survey population.

Regarding criminal acts, only 8.4% of the surveyed reported having suffered some criminal event on campus during their university life. It should be noted that the majority of those surveyed have not suffered criminal events on campus, therefore, the Concepción campus maintains good security standards. Of the criminal events, 36% of them occurred in the classroom sector, which is important since students mainly circulate in these units, the rest of the responses are divided among various identified sectors of the campus (see Figure 1). This information is useful to understand the geographic distribution of criminal events within the university and to identify possible patterns or trends in the occurrence of these events.

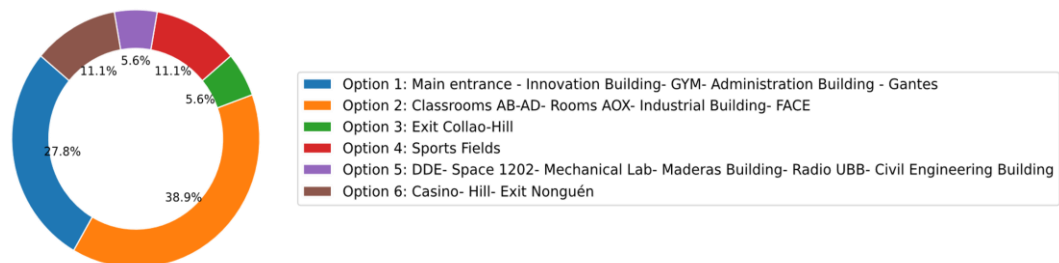5: If it is within the University, specify the quadrant:

Figure 1: Geographical distribution of events.

Of the 18 received answers from crime victims, 6 indicated having suffered a robbery, either with or without force, 4 indicated had suffered theft, and 4 indicated had suffered street harassment. The remaining responses indicated a variety of crimes, such as intimidation, or some damage to the vehicle. This information is useful to identify potential areas of security events and to improve security at the university.

Question 8 seeks to know the perception of security that users feel. 56% of those surveyed state that the problem is the campus environment, not the campus itself. 31% state that the campus is calm and safe. 11% think that the university is dangerous and only 2% think that the environment is safe (see Figure 2).

8: What is your security percpetion when attending to the University?

Figure 2: Perception of security on campus.

Questions 9 and 10 are related to the perception of the riskiest place, considering only the feeling of insecurity and not necessarily related facts. The classroom sector and the casino location that are close to a hill towards a side exit from the campus, places that are separated from the rest of the campus facilities, are indicated as the most problematic. In addition, it is indicated that the problem of the place is the lack of luminaire (see Figure 3).

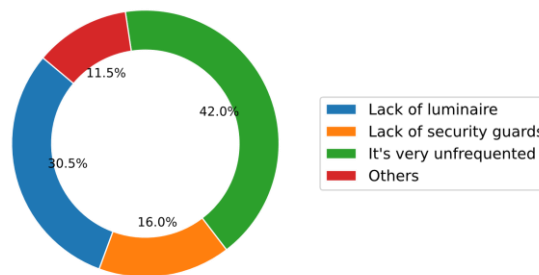10: Why do you consider the chosen quadrant to be dangerous?

- 11.5%
- 42.0%
- 30.5%
- 16.0%

Legend:
- Lack of luminaire
- Lack of security guards
- It's very unfrequented
- Others

Figure 3: Reasons for insecurity in sectors of the UBB Concepción campus.

Regarding the need to have self-defence courses, 68.8% answered affirmative, which shows a latent concern for the subject, and it is believed that a self-defence course can help in this regard. If the UBB considers that it is important to guarantee the safety of its members, it may be useful to offer training on this topic to provide tools and skills to prevent or manage risk situations.

Consulted about the use of a personal security application, it is found that only 4.2% of those surveyed use or have used a personal security application, while 95.8% do not.

On the other hand, the UBB has installed panic buttons on the university campus, of the total surveyed, 64.19% have not seen them, 25.58% believe that it is a good initiative, 9.30% consider it a good initiative, pointing out that it is better to use an application and only 0.93% think that they are not necessary. The responses suggest a lack of dissemination of basic security information, they consider it a good initiative, while almost 10% think that it would be better to have an application for eventual problems. In addition, 40.30% of those surveyed do not know the emergency numbers available on the university campus, which is worrying, since it is important for people to know how to act quickly in the event of an emergency.

Regarding of accidents on campus, 12.44% of those surveyed responded that they had suffered an accident, of which 20% indicated that they did not need attention, while 52% needed attention and obtained it. However, it is worrying that 28% who needed care did not receive attention, which suggests that there may be problems in the emergency care and response system at the UBB. This information is relevant to take actions in case of accidents. Within the same topic, 15.35% of those surveyed stated that they had to help someone at the university and knew what to do, which suggests that there are trained and prepared people to act in emergency situations. However, it is necessary to consider measures to train more members of the university in first aid and emergency care, given that 69.77% have not taken a first aid course, which means that a high percentage of people lack basic knowledge to act in an emergency.

Finally, it is important to highlight that 94.88% of those surveyed agree that it is important to develop skills to act in emergency situations. Therefore, it is important that the UBB takes this demand into account and offer training programs in first aid and other personal safety skills.

4. Security tools

The creation of a specific digital tool for the university is a valuable contribution for the development of a safer space [13]. This also contributes to the construction of a community that can collaboratively assume the resolution of environmental problems. That is why in 2018 the UBB offered the "My UBB" application to the community, with various purposes for the UBB staff. One of the objectives of this application is to inform to users when something unusual happens on campus. The alerts escalate in such a way that the respective manager resolves the problem. However, this application does not have

fundamental security features, such as users being able to comment on alerts, alert details, automatic disabling of alerts, etc. Another negative point is that the application can only be used by the UBB staff, which reduces the interaction and information that circulates through the application, since the number of staff members is lower compared to the number of students who circulate daily through the university.

In the current context, developing an application focused on giving a security alert would allow all those who participate in the university community to use the application. In addition, it results in a good opportunity to add the functionalities already mentioned.

There are applications in the Play Store that help report insecurity situations. Some of them are the following, of which we detail their main functionalities and negative aspects.

Table 1.
Applications to report insecurity situations.

Tool	Link	Description
SOSAFE	(https://es.sosafeapp.com/)	It allows reporting, communicating and informing about what happens within the city through notices and/or complaints. Also, it allows the use of multimedia material.
		A negative aspect of this application is that any user can use it, which leads to alerts from all over Chile, which is a problem, since an application is being sought that can be accessed by people in the university community.
Alerta Alcom	(https://play.google.com/store/apps/details?id=com.hagroy.alcomapp&hl=es_VE&pli=1)	It allows you to enter various types of alerts or complaints by attaching multimedia content. This application has been reported as not very intuitive, with few features, with problems when adding alerts, and does not allow communication between users.
SOSFem	(https://sosmex-niunamenos.com/)	It allows to send help messages to contacts, making emergency calls through an SOS button and by shaking the cell phone.
Haus	(www.haus-app.com)	It allows to access to an SOS button to add an alert. You have problems logging in, trying to register, etc.
UrSafe	(https://ursafe.com/)	It allows you to set personal safe words that trigger different responses, depending on the severity of the situation. It does not have many features.
Sister	(https://apps.apple.com/us/app/sister/id1481562340)	It allows to find safe routes, add alerts and show the location to the contacts added in the application. It has few functionalities and presents registration and login problems.
Personal Safety Emergency App	(https://play.google.com/store/apps/details?id=com.google.android.apps.safetyhub&hl=en&gl=US)	It allows you to request help from contacts who are in the same plan. It is a paid tool, with few features.

5. WSOSUBB Application

This section describes the first Android version of the WSOSUBB application developed in the context of the project "Information Technologies and their use in Security Systems" [5], which seeks to contribute to reduce the feeling of insecurity experienced by the community of the Concepción campus at Universidad del Bío-Bío. WSOSUBB provides a tool for students, teachers and

administrators to report and learn about emergency situations or security problems on campus. The application also aims to facilitate the identification and interaction between users and provides information about dangerous places and safe places on campus.

This application allows to generate reports depending on the security problems that arise within the Concepción campus at UBB. The application makes it easy for the community to inform and warn, through alerts, what is happening inside it. In addition, it has the following functionalities:

- Alerts: generation of different types of alerts depending on the display of active alerts from the university community (ordered from the most recent to the oldest).
- Notifications (activate or deactivate notifications, alerts near the user's location).
- Interactive map (with representation of the university buildings).
- Interaction (comment alerts, give likes).
- Visualization of places with the highest number of alerts of a type.
- Suggestions for the application, which allows to improve the application and add new functionalities necessary for the users.
- Identification (registration and login with institutional email).

5.1. Architecture Design

The architecture design is client/server. The mobile application acts as a client, sending requests over the internet to the server. The server, in turn, processes these requests, performs the queries to the database and sends the obtained data to the client. This architecture was selected since its good performance in the context of mobile applications that make many requests simultaneously. This design allows for efficient scalability and easy of maintenance compared to other options.

The application was developed in Javascript programming language, together with NodeJS. The Frontend was constructed with the React Native framework together with Expo CLI. These were chosen since both React Native and Expo CLI, together, help in the development of mobile applications and allow testing on non-emulated devices. On the other hand, in the Backend we worked with middlewares and the Prisma ORM, which were fundamental for the development of the Backend, since the middlewares allow working with images and Prisma allows grouped information obtained from the database to be sent to the Frontend. The structure for the development of both the Frontend and the Backend, consists of separating the files depending on their functionality within the project, this allows the developer better control of files and adds order to the project.

Figure 4 is a graphical representation (BPMN) of the alert's activation process in WSOSUBB application. The process begins with the alert activation in the application by a female user (alert creation), in which the application registers and posts it to the rest of the university's women's community. Then community users can respond to this alert in two ways: by making comments through the application, or by going to the physical place where the user who created the alert is located. Finally, the user in trouble also receives the reports of the event.
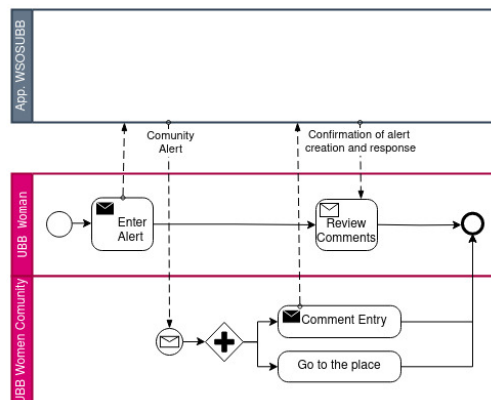
Figure 4: BPMN of the alert's activation process in WSOSUBB.

5.2. Interfaces Design

Figure 5 and Figure 6 show the application interfaces (which is constructed on Spanish). The user can position the pin in the location where they want to create an alert, which are typified into six types: suspicious activity, lighting failure, place with poor lighting, robbery incident and violent incident. Alerts are displayed on the map differentiated by color for a configurable period. Users can receive notifications of nearby alerts in addition to viewing them on the map to comment or like. In addition, the app has a navigation bar at the bottom which allows the user to navigate through it, to access other general options such as alert reports, notification settings, give suggestions to the team, etc.
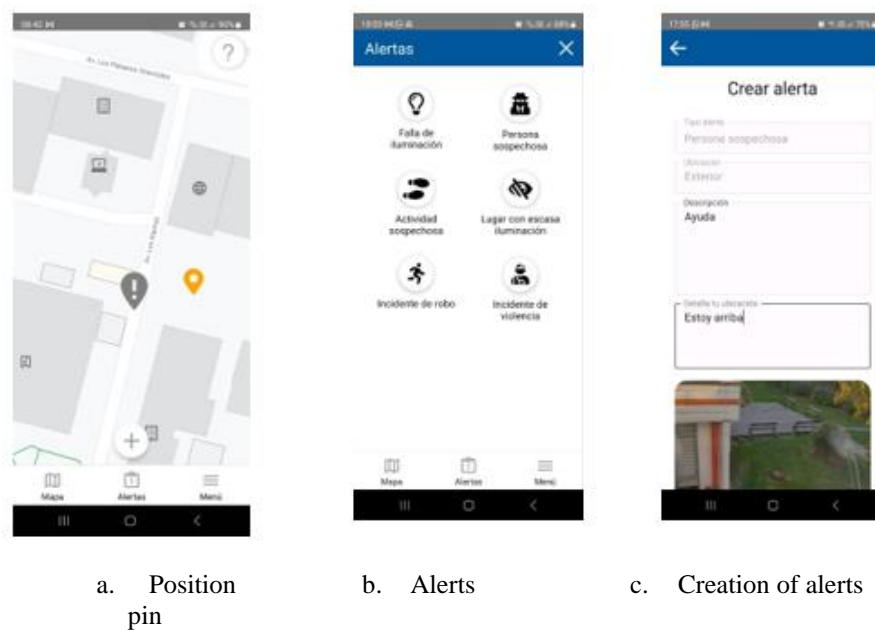
a. Position pin	b. Alerts	c. Creation of alerts

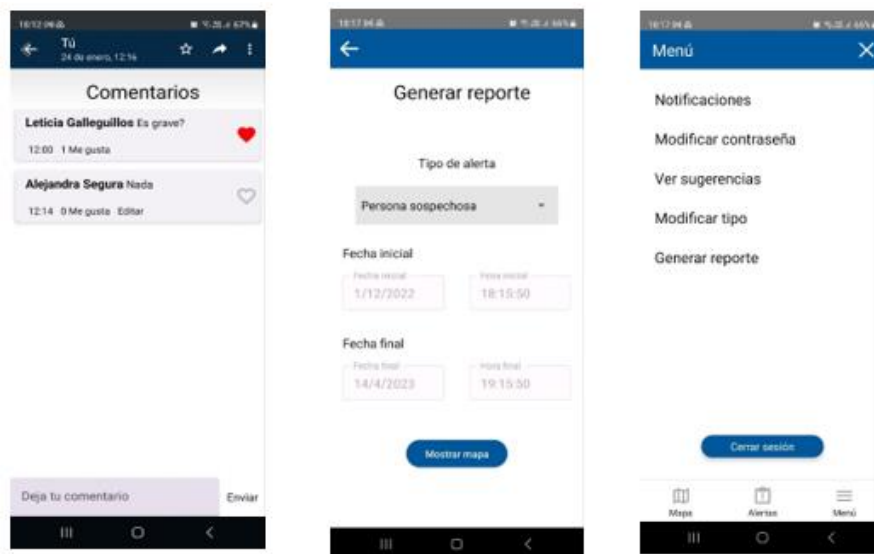**Figure 5**: Main screen, management and generation of alerts.

Figure 6. Comments screen, generation of reports and option menu.

6. Conclusions and Future Work

Through the analysis of the diagnostic results on the perception of security of the Concepción campus of the UBB, we can conclude that in general, people perceive that the campus is safe and calm. However, there is a perception that the environment around the university campus is somewhat dangerous.

Regarding the crimes suffered, robbery (with or without force) and theft are the most common, followed by street harassment. The quadrants that are considered the riskiest within the campus are those that are further away and with less lighting.

Related to the current security solutions implemented on campus, the panic button deserves to be rethought or improved, since 64.19% of those surveyed have not seen it, therefore, an improvement in its location and use is required.

With respect to self defense and first aid courses, the community wants to learn skills that allow them to protect themselves and provide basic care in case of emergencies. It would be positive for the university to consider increasing the offer of training on these topics for the entire universe of the community, since even though they have been carried out, they are generally aimed at small groups of the staff or students.

The WSOSUBB application prototype is in the testing period among users of the university community and requires going through an improvement process to be released on a massive scale.

We left as future work the application of the instrument in the Chillán campus of the UBB and the adaptation of the application for its community. In addition, it is future work and part of the project to identify and evaluate the cost of opportunities for improvement in knowledge of security within the campus.

7. Acknowledgments

8. References

[1] Arbaiza Fermini, L. A., Lindo. Á., Campins, R., & Valverde, M. (2017). La gestión del conocimiento aplicada a la seguridad ciudadana que brindan los gobiernos locales. https://international.vlex.com/vid/desconfianza-social-653770545. Desconfianza social

[2] Au-Yong-Oliveira, F. Moreira, J. Martins, F. Branco and R. Goncalves, "Technology usage as a way to increase safety and security in different geographies: Testimonials on the use of technology in Rio de Janeiro, Brazil," 2018 13th Iberian Conference on Information Systems and Technologies (CISTI), 2018, pp. 1-7, doi: 10.23919/CISTI.2018.8399266.

[3] Barsallo Alvarado, G. (2021). Urban mobility and personal safety as factors related to the decision of dropping out from university. Revista Universidad y Sociedad, 13(5), 242-247.

[4] Cabrera-Crot, L., Caniupán, M., Rodríguez, A., Seco, D. (2019).Trajectory Patterns Based on Segment-Cutting Clustering. In Proc. of the 13th IV Alberto Mendelzon International Workshop on Foundations of Data Management (AMW"19), ISNN 1613-0073, vol. 2369, Asunción, Paraguay, June 03-07.

[5] Caniupán Marileo, M. A., Troncoso Pantoja, B. A., Galleguillos Peralta, L. F., Reyes Pérez, L. S., Gutiérrez Bunster, T. A., & Segura Navarrete, A. A. (2022). Tecnologías de Información y su uso en Sistemas de Seguridad. Concepción, Chile. Proyecto: Tecnologías de información y su uso en Sistemas de Seguridad, código I+D INESGEN 22-88.

[6] Cuenta anual 2022 Universidad del Bío Bío https://ubiobio.cl/rectoria/docs/Cuenta_Publica_UBB_2022_extendida.pdf

[7] Dirgegen(2022). Política Integral de Genero UBB - Universidad del Bío-Bío. Disponible en: http://politicadegenero.ubiobio.cl/

[8] Instituto Nacional de Estadísticas. (2021). 18ª Encuesta Nacional Urbana de Seguridad Ciudadana (ENUSC) . Boletín de resultados con enfoque de género ENUSC 2021. Obtenido de https://www.ine.cl/docs/default-source/seguridad-ciudadana/publicaciones-y-anuarios/2021/bolet in-perspectiva-de-genero-18-enusc-2021.pdf?sfvrsn=928a60b0_2

[9] Ellis and L. Fiondella, (2018)."Technologies to Support Victims of Sexual Assault," IEEE International Symposium on Technologies for Homeland Security (HST), 2018, pp. 1-4, doi: 10.1109/THS.2018.8574194.

[10] Lechner, N. (2000). Nuevas Ciudadanias. Revista de estudios Sociales, Numero 005,Universidad de los Andes, Bogotá, Colombia. https://www.redalyc.org/pdf/815/81500504.pdf

[11] Leiva Tarazona, A., & Ramírez Ríos, A. (2021). Efectos de la inseguridad Ciudadana en el bienestar de la población. Ciencia Latina Revista Científica Multidisciplinar, 5(3), 3341-3352. https://doi.org/10.37811/cl_rcm.v5i3.535.

[12] Luhmann, N. (1996). Confianza. México, Editorial Anthropos

[13] Manako Yabe (2017) Cost-Benefit Evaluation: Students', Faculty's, and Staff's Willingness to Pay for a Campus Safety App, Journal of Criminal Justice Education, 28:2, 207-221, DOI: 10.1080/10511253.2016.1203009

[14] Mohammed, K. Elleithy and W. Elmannai, "KMSAFE APP: Campus Safety Mobile App," 2021 4th International Conference on Bio-Engineering for Smart Technologies (BioSMART), 2021, pp. 1-4, doi: 10.1109/BioSMART54244.2021.9677778.

[15] Ostrom, E y Ahn, T.K (2003). "Una perspectiva del capital social desde las ciencias sociales: capital social y acción colectiva". Instituto de Investigaciones Sociales. Revista Mexicana de Sociología, año 65, núm. 1, enero-marzo, 2003, México, D. F., pp. 155-233. ISSN: 0188-2503/03/06501-03. https://www.scielo.org.mx/pdf/rms/v65n1/v65n1a5.pdf

[16] Ramírez Ríos, A. (2021). Efectos de la inseguridad Ciudadana en el bienestar de la población. Ciencia Latina Revista Científica í4ultidisciplinar, 5(3), 3341-3352. https://doi.org/10.37811/cI_rcm.v5i3.535.

[17] Shekhar, Ch. (2003). Spatial Databases a Tour, Prentice Hall. Soto Latrille, P. (2018).Diagnóstico de la delincuencia y factores que influyen en la percepción de inseguridad en Chile. Disponible en https://repositorio.uchile.cl/handle/2250/152737

[18] Soto Latrille, P. (2018).Diagnóstico de la delincuencia y factores que influyen en la percepción de inseguridad en Chile. Disponible en https://repositorio.uchile.cl/handle/2250/152737.

[19] Vuanello (2009) Inseguridad urbana y sus efectos: percepción de los jóvenes http://www.scielo.org.co/pdf/crim/v51n2/v51n2a03.pdf.