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Implementation of a Mobile Application to Help the Client Locate Formal Stores in the Gamarra Commercial Emporium According to the Clothing

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ABSTRACT

The clients of the Gamarra emporium spend too much time finding the store that sells their desired garment, as well as the address, this situation makes the purchase made by the clients tedious, but above all they do not feel satisfied and no longer want return to make purchases, since there are too many buildings that are not grouped by category and that causes them to waste too much time searching. The proposal of this research work is to implement a mobile application whose storage allows, mainly, the search for garments according to the needs of each client, in addition to this they will have the option of seeing the path to reach the store in which they wish to buy, this will have a very positive effect on customer purchases, reducing search time. The results of this research work yielded very interesting results, in the analysis that was carried out it was obtained that the vast majority of the surveyed population considers that the implementation of this mobile application is totally necessary. Below, you will be able to observe in detail the research work carried out.

1. Introduction

The Gamarra Commercial Emporium, also called just "Gamarra", is the empire par excellence of Peru with respect to the national textile industry. It is the traditional market where you can find everything from manufacturers to large corporations with great activity and considerable economic transactions, with influence in commerce, the fashion industry and the manufacture of clothing.

Gamarra has main areas where many small stores operate, despite having a significant production and sale of clothing, these business activities have been developing in a disorderly manner, causing serious problems such as public and territorial disorder. Most of the stores are invaded all around by street vendors, which makes it difficult to locate formal stores. Most of Gamarra's stalls are not located in front of the sidewalks, but on different floors of more than 150 galleries, and of course having a store with an "entrance door" is a thousand times more valuable than being located indoors,

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so logically the street vendors would prefer to walk with their products and sell them on the street, thus obstructing the formal sale and economic development of legal entrepreneurs [1]. However, because the street vendors are obstructing the free movement of people, the roads become confined, representing a danger to everyone because they are exposed to unexpected circumstances, such as tripping, theft and difficult exit in the event of a fire [2].

Given that the amount of a population is related to the activity of the inhabitants, the district of La Victoria covers 8.74 km2, representing 0.33% of the total of the province of Lima. According to the Instituto Nacional de Estadística e Informática - INEI, the population density reaches 175,372 inhabitants, being a district of migration from the countryside to the city, which converts it from being a residential area to a commercial one [3]. This represents a conglomeration situation, where everyone wants to sell no matter where they are located. In a document prepared by INEI, whose records came from SUNAT and surveys by the Sistema Estadístico Nacional - SEN, it details that, until December 2017, there were 39,630 establishments with economic activities in the commercial emporium, it increased by 24, 9% compared to what was registered in 2016 [4]. Since there are more points of sale, many times the client cannot locate the store where they can buy what they are looking for, or sometimes, they can locate said store, but they cannot complete the purchase of what they need.

However, after the hard blow of the pandemic, Gamarra had to close its doors for a while, taking advantage of this, the Municipality of the La Victoria district was able to clean the streets and buildings of this emporium, but on their return, it was overshadowed by the wave of informality. Before, 150,000 people went to Gamarra daily, in 2019, only 30% of the activity has been reactivated, consequently, not even 40,000 people go for fear of the chaos caused by informality and they do not want to get infected by the congestion of people [5]. Since the client does not clearly know the location of the formal stores, with more emphasis when they are looking for a certain type of garment, they are forced to continue exploring more places, going through many and unnecessary parts of the commercial emporium, risking being able to catch COVID-19, occurring much more frequently in those people who rarely visit the establishment.

This research work will present the following background information as a basis for the acquisition of knowledge in the technologies that have been implemented in other projects, which occurred in a previous time and a different geography, maintaining the relationship of this topic with what has been elaborated.

In the first instance, there is the thesis article, where the problem they supported was based on the different lifestyles that people lead today, so many times they tend to forget to buy those basic necessities, such as clothing, food, etc [6]. Due to this, they decided to create a mobile application, called GeoMemo, focused on Android, exploring the capabilities of this operating system, the main thing was to obtain the location through the GPS of the mobile phone, this was possible through the SDK, thus having the geographic location of the user, another alternative to locate in the WiFi was considered, for the MAC addresses, they also used the NDK, this tool together with the C and C++ languages, they managed that the cell phone system can have communication through the sensors of the mobile with the wireless networks of commercial premises. So, for this application to work, previously the geographic data and the sales category provided by said store had to be entered, so in the GeoMemo an item that was wanted to be purchased was registered, then it was verified that once the customer was located near a store where the previously saved item was sold, the application made a comparison between the records and if they coincided, it launched a notification to the mobile device, in this way, the situation of the detection by GPS and the WiFi data is used in the detection of stores of a shopping center where you can buy a certain product.

On the other hand, in this article Sarapura *et al.,* [7] stated that the problem encountered is that blind people and people with low vision cannot move safely as they are usually clinging to a person who accompanies them, the accessibility of buildings does not favor communication with their environment, therefore they cannot have an adequate social life. To deal with this situation, a software application was created to detect the position of the individual through Reference Points, which in turn will make the necessary indications to guide the person to the desired place. This along with the paths and directions based on the structure of the building, all the data will be stored in JSon format so that all the information is loaded and processed by the server. In addition, the interactive graph tool is used to understand the route map better and faster and allows the creation of nodes to define the intersection points of the routes, which can be modified to determine a shortest path to the destination. For this to be possible, the Raspberry Pi device is necessary, mounted on the LAMP Server, which will serve as a web server to process all the information to the users and as a router with wireless access, and also GIT to download the system files on the server. Web. Then, when the blind person enters the establishment, through his mobile device (Nokia E5), he connects to the web browser and will use an application to read text on the screen, obtaining a virtual representation of the physical distribution of the paths. after loading the information of the route map, granting necessary instructions for the user to reach the required place.

As for the following thesis article by Albarracin Mendez *et al.,* [8], it shows the problem it is in is being able to identify store locations, since most people cannot locate themselves with precision and agility, which makes people lose interest. in making stores visible and settling for what they find. That is why in the development of this present project it is important to make use of geographic location services for mobile devices, Android operating system, applying the APIs of Google Maps, Geolocation, and even HTML, CSS, AJAX. This undertakes to adjust an interface to retrieve the sources of territorial location for client devices and provide location information through queries to the server, WISE is also applied since it also combines geolocation technology and optimization algorithms of routes to calculate the shortest route between a set of points or locations on the web. The WISE Mobile system, is built on Android for version 4.x, consists of two measures, first for the web server, in which the information is processed, treated and considered, it is also in charge of disclosing information to the user and establishing the territorial location of the place, whose information is sent to the server for its corresponding observation use. In the same way when navigating in the program, the API sends a report of the axes. The realization of this functional prototype serves as virtual guide intermediate assistance and has positive results for people, such as the location of the store that you want to locate, and decrease the arrival time.

Similarly, in this thesis by Barrionuevo and Gomez [9] explains the problems that exist in supermarkets, he refers to locating a product that the customer wants, since certain problems are evident, such as, for example, not having knowledge of the location of the product that is inside the supermarket, in addition to not being aware of the promotions and the most outstanding problem is the loss of time. Given this situation, the development of a mobile application was suggested that can allow the client to locate the desired products and thus keep track of their sales. The Canvas business model was used, this made it possible to carry out an adequate study of the market, as well as to detect the client's requirements, in addition the SAAS software distribution model was used, this allowed creating a cloud hosting for said application and only require internet access, on the other hand, the Apache Cordova and Ionic frameworks were used, both can be combined for the development of a mobile application. Then the mobile application allows the customer to create their shopping lists quickly, they can check the location of existing products in supermarkets; It also allows you to view existing promotions and finally add them, offering the customer a faster way to purchase your products.

As has been observed in the detailed background, it can be specified that a very large technological change is currently taking place in our environment that impresses society, which causes an impact on applications oriented to mobile devices, which makes them essential tools of daily life.

The technologies that will be present for the development of the software in this work are the following: The IDE (integrated development environment) that will be used is Android Studio, this system will allow us to unify the code and the resources necessary for the execution of the application. , in addition to allowing the implementation of the Google Maps API (Application Programming Interface) through the Maps for Android SDK (Software Development Kit) for map playback and locations, as well as user interaction through of markers on the map. Within this development environment, Android Location Services will be integrated, an API created by Google, which allows knowing and updating all the parameters, be it latitude, longitude, altitude, speed and direction, and even resetting the location in real time; In the same way, it uses geopositioning methodologies through local Wi-Fi networks, GPS and mobile phone networks. In the same way, the development of the mobile application will be under the Java programming language, the default language for the mentioned IDE, being easy to integrate, with readable syntax and works with object-oriented programming; Finally, a database management system to store the required information, for which SQLite will be used, which contains full support by Android, allowing the need for a file to store all the data.

The proposal of this work is to make a mobile application that allows people to access the location services of the commercial premises of the Gamarra emporium, where customers can find the stores according to the category of garments they are looking for, they can also view the trajectory to reach the store in which you are interested. This is necessary since it has been observed that most people do not usually have an orientation of the location of the stores in the large territory of the Gamarra emporium, on the other hand, it is desired to improve the flow of sales of the formal stores that They are located in the Gamarra buildings, these are the reasons why you want to make the mobile application, to satisfy the needs such as facilitating the customer shopping experience and increasing the traffic of buyers from the stores of formal entrepreneurs.

2. Methodology

The content of this section will be focused on the description of the problem-solving process that has been planted since the beginning of this research work, which will go into detail about the procedures and tools used in the development of our previously proposed solution, being explained in a theoretical and systematic way for a better understanding of the subject.

2.1 Flowchart Approach

This diagram provides a quick and simple view for easy understanding of what you want to detail. This graph represents the step by step of a procedure, process or system, so it is possible to have a clear concept of what is carried out in this mobile application [10].

Next, in Figure 1 the operating sequence of the mobile application is presented, as a starting point, the user enters the application allowing him to see on the screen if he wants to search for a store, then the user will have the option of entering a text to filter the store search, after that you will be able to view all the available stores and finally see the trajectory of the store you previously selected. Otherwise, the user will be able to add a new store, entering all the necessary information and finally return to the beginning.

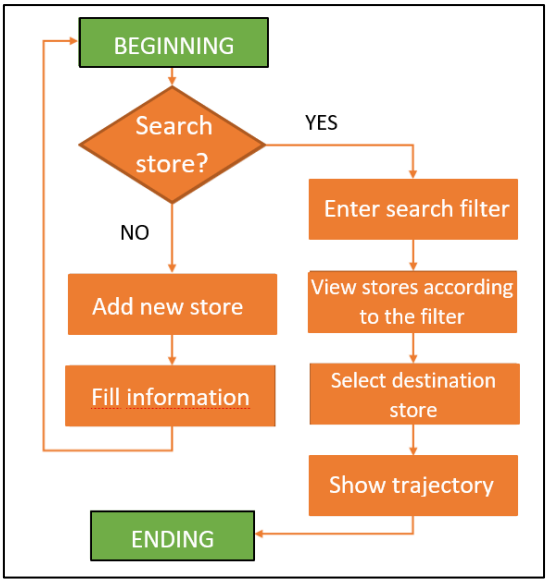

Fig. 1. Operational flowchart of the mobile application

As shown in the figure, there are two path options for those processes that are going to be contemplated in the main menu of the software, likewise these include steps to follow that will be better detailed below.

2.1.1 Find store

First of all, when entering this option, the user will be presented with a text box so that he can enter the characters corresponding to the data of a previously registered store, so that a request will be generated to the server.

Then, the server will perform a search in the database on the table that represents the store, then this database will respond to the server returning the data of all the stores that have matched the filter entered by the user.

Thus, in the interface shown in the first step, it is where all the corresponding data of each of the stores will be returned, separated to clearly differentiate them, also when the user selects one of the sections, it will mean that he wants to reach that store, thus generating another request to the server.

Lastly, the query will be answered by geolocation technology, returning an image of a map with the user's current location and the route that must be taken to reach the store that has been selected as the destination.

2.1.2 Add store

On the other hand, there is the second option whose path represents the sequence to be carried out to create a store record in the database, for which it will be necessary to use an insertion SQL statement called "Insert".

For this to be effective, the user will be presented with several text boxes where he must fill them in with the information corresponding to a store, which to ensure that it is a formal owner, will go through a RUC validation, as well when finish the registration process the new store will redirect to the main menu for the user to choose their next activity.

2.2 Connecting Android Studio to SQLite

Through the multiple classes offered by the SDK tool provided by Android Studio itself, the administration of the database in SQLite is simple.

The vitality in the connection lies in the class called "SQLiteOpenHelper", this must be imported for the correct communication between our application with the database, in addition to granting several classes to be extended, consequently having the ability to use the essential methods such as “onCreate()” and “onUpdate()”, which are necessary tools for the connection between Android and data. Likewise, in Figure 2, a graphic representation of the statement is presented.

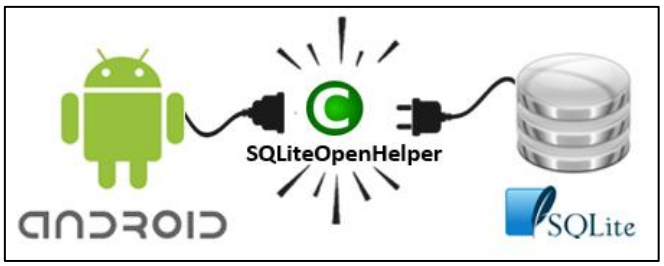

Fig. 2. Database connection

2.3 Software Architecture

The design of this architecture is considered a fundamental point due to its impact on software systems, in this it is defined which components will be responsible for guiding the programming and will interact with each other, therefore, the pattern made will influence the design of the technological solution that is proposed to be developed [11].

In Figure 3 the software architecture can be shown. First, we have a presentation sample that contains the mobile device with which the user will send a location request, said request will be issued with a WiFi connection, then the location will be searched through the Google Maps API and included with the SDK, this will work correctly in your terminals, after that it will be stored in the SQLite database that is incorporated in the mobile device.

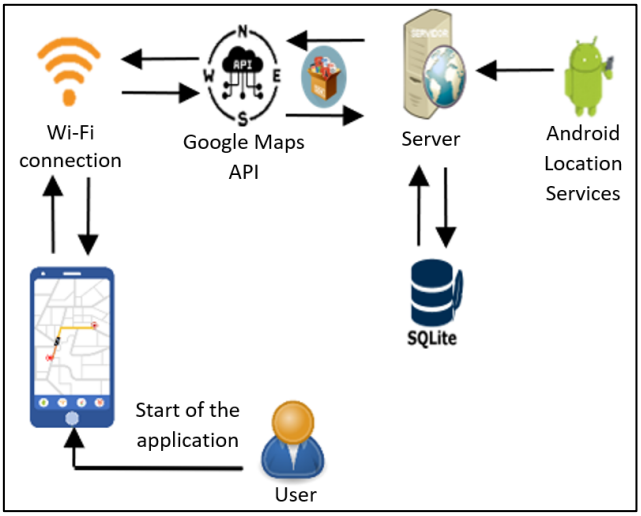

Fig. 3. Software architecture

From the figure shown, it has been seen convenient to make a much more detailed and better classified graph, where all the technologies that had been previously mentioned in another paragraph will be considered and the visualization will be more comfortable. Next, in Figure 4, the Layer Model Software Architecture is presented.

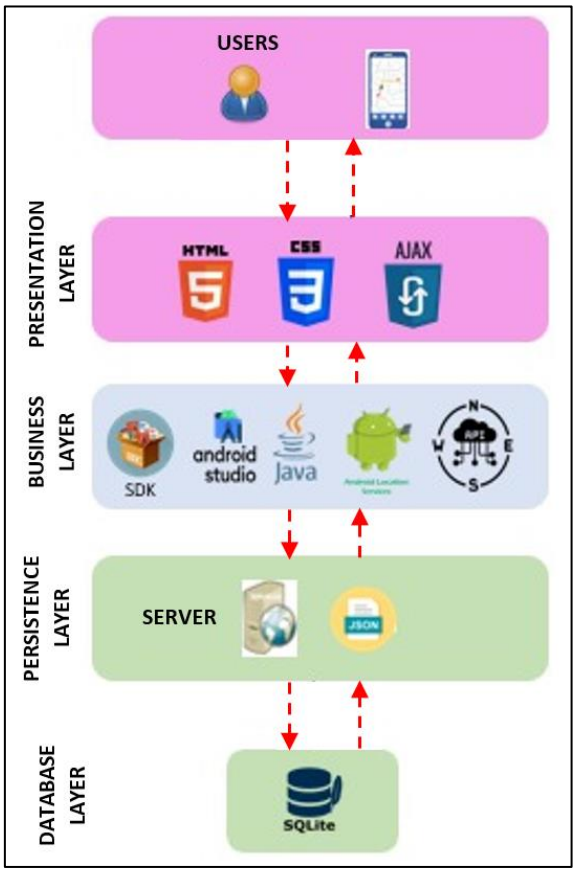

Fig. 4. Software architecture layers model

As could be seen, the model selected for the context of this research work consists of 4 essential layers in which the technological tools to be used inhabit. Through the layers, the programs are executed simultaneously, allowing the information to flow more efficiently due to the good communication between blocks [12]. That said, now a concise detail about each of them is necessary, in the same way it will be mentioned which of the technologies will be used in each layer.

2.3.1 Software architecture

In this first layer, those technologies that are responsible for presenting a pleasant view to the user are located. Through this section, the use of HTML, CSS and AJAX will be implemented, chosen for their simple understanding and easy implementation.

2.3.2 Business layer

On the other hand, in this layer are present the software whose focus is to make possible the validation of the data, as well as to receive requests and present results. This will be the intermediary of the interaction between the user and the mobile application, among which are: SDK and Android Studio as tools for application development, Java as the base programming language for the

software, and Android Location Service and the API Google Maps to manage the geolocation of the user.

2.3.3 Persistence layer

In the current layer, there is a computer in charge of communicating with the database, in this case, the server, which allows sending the programmed SQL instructions to the database, using the JSON format, so that the latter then returns the information corresponding to what was requested, safely avoiding errors in the code.

2.3.4 Database layer

In this last layer there is only the database management system, for the purposes of this work, SQLite was chosen to store the data and receive the "queries" for its effectiveness with the surrounding layer.

2.4 Using the SDK for Mobile Development

2.4.1 In the scope of work for Android

Software development (SDK) is usually facilitated by the builder of a hardware, operating system and programming language. The basics of an SDK is that it typically contains a compiler, a debugger, and various application programming interfaces (APIs). The Android SDK is a group of software progress libraries and tools needed to develop Android applications. Every time Google releases a new Android update which provides us with a new SDK. It should be said that you mostly need to use Android Studio for any Android development, but by using the SDK it is no longer necessary to use it. Equally important to all its Android SDK tools, it codes programs from the beginning, this allows a development process to flow without any problem (from the development and debugging of the program and even in the packaging) [13].

2.4.2 Execution on API order

Most SDKs contain an API for binding new projects in mobile apps at the source text level on the command line. They often also contain code samples so that developers have sample programs and libraries when creating basic programs. Armed with these resources, they can more easily begin to optimize and progress complex applications, as well as debug them and even add new features as needed. Otherwise, it may include other elements, such as documentation, browsers, network protocols, experiment or study tools, and more. It even has the necessary elements that a developer might require to be able to set the latest app for their app project [14].

2.5 Target Population

In the present research work, the target population has been determined as follows: all the people whose interest in acquiring clothing is located in the Gamarra Commercial Emporium, the latter being located in the Victoria district, city of Lima, Peru; as well as the people who carry out their work activities in said commercial establishment, as for them, criteria have been established to be considered as those who are going to make use of the proposed solution.

2.5.1 Inclusion criteria

The checklist includes five inclusion criteria, as listed below

i. People who have one or more formal stores in Gamarra.
ii. People who sell only clothing
iii. People who want to participate voluntarily with the implementation of the mobile application.
iv. People who want to improve customer proximity and sales flow.
v. People who want to acquire a product more quickly.

2.5.2 Exclusion criteria

The checklist includes three exclusion criteria, as listed below

i. Informal workers.
ii. People who have their own app from their store.
iii. Persons under 18 years of age.

2.6 Prototypes of the Proposed Solution

In this section, the prototypes of our mobile application will be shown. Figure 5 shows the store registration that the owner can carry out, who will have to enter the following data: RUC, name, surname, address, reference and finally select the categories of your business; when all the fields are completed you will have to select the option to add a store, when all the data is validated, your store will have been registered in our database.

Fig. 5. Store registration prototype

Figure 6 shows the interface of the store search engine, in which the user can enter and view the list of categories according to the existing items in our database, when selecting one or more categories and performing the search using the Selecting the "Search" button will display all store records for that category.

Fig. 6. Prototype store search process

After choosing a store of interest, the user will be able to see the route to get to the establishment, Figure 7 shows the path that the user has to follow.

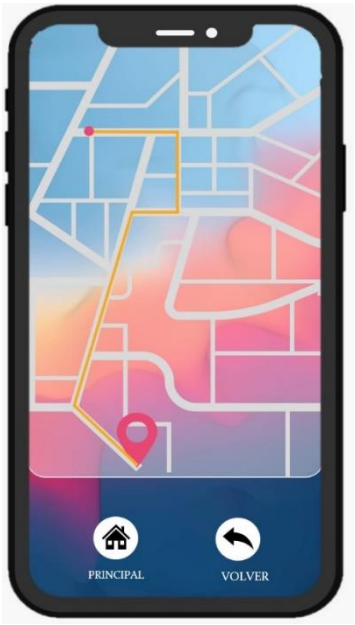

Fig. 7. Prototype store search outcome

3. Results

3.1 Final Software Presentation

Because the development of mobile applications under the framework of Android Studio allows the implementation of external packages, it was necessary to use some visual components to easily generate interaction with the application by the user in the different modules that have been coded, such as, fragments, recycleview and cardview.

For this reason, in Figure 8, the first module of the application developed in this research project is shown, here is the fragment of the registry to carry out the respective entry of information from the store to the database.

Fig. 8. Registration fragment outcome

In addition, as shown, it has text fields and drop-down lists that will be completed and selected, respectively, by the user, with the particularity that a RUC verification API has also been implemented, this to be certain that the registered store is owned by a formal person, where as soon as you enter your RUC number, through the button next to it, the application will be able to identify it and it will continue until you complete the rest of the form, culminating in the saving of said store.

On the other hand, in Figure 9, the second module is presented, which contains the query fragment so that the user can execute the filter required according to their needs.

Fig. 9. Registration fragment outcome

It is true that there is a default load of all registered stores as soon as this module is entered, however, the queries are carried out by selecting options from the drop-down lists, being effective in all possible combinations for a more precise filter.

3.2 Presentation of Surveys

To know the degree of importance of our app, we conducted a survey of 35 users, the results indicate that, through the implementation proposal of the mobile app for customers and owners of Gamarra, the following can be determined. The analysis carried out shows that 82.9% of the surveyed population fully agrees with the implementation of the mobile app that helps them find the location of a store in Gamarra according to their preferences, while 17.1% agree. Taking this into account, 100% of the population considers this proposal necessary, presenting the results in Figure 10.

Fig. 10. Results of question: Do you need a mobile app to help you find the location of a store in Gamarra according to your preferences?

Regarding the relevant characteristics of the mobile application, the search for stores in Gamarra according to their needs shows that 85.7% of the surveyed population considers that it is totally necessary while 14.3% considers that the need is partial. Accordingly, it can be determined that this search functionality is essential for the mobile application, this can be seen in Figure 11.

Fig. 11. Results of question: Do you think it is important that the mobile app allows you to search for stores according to the category you select?

Another feature that is the basis of our application is to show the path to get to the store that you previously selected. The results show that 67.9% of the population fully agree with this feature, while 32.1% agree. In agreement, it can be determined that for users it is important to have not only the address of a store of interest but also the trajectory, in order to arrive in less time, thereby improving the quality of the customer's purchase, the results are shown in Figure 12.

Fig. 12. Results of question: Do you consider it important that the mobile app allows you to show the path to get to the store you previously selected?

Now we will show the main characteristics for the user who owns a store in Gamarra, to guarantee a safe experience for users in general, we have implemented a functionality that validates the owner's RUC when wanting to register their store, which is why was part of the questions in the questionnaire. The analysis shows that 71.4% agree with this functionality while 28.6% fully agree.

With this, it can be determined that the owners consider this data validation to be of the utmost importance, the results can be reflected in Figure 13.

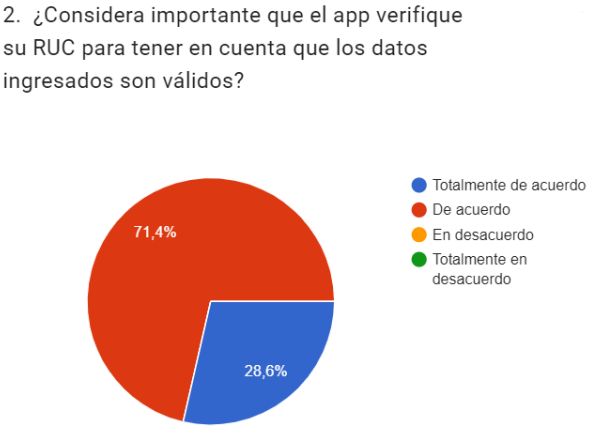

Fig. 13. Results of question: Do you consider it important that the mobile app verify your RUC to take into account that the data entered is valid?

4. Discussions

The mobile application developed in this research work contains the two modules that have been mentioned since the methodology stage, allowing control over the formal stores that exist and may be in the Gamarra commercial emporium.

These modules meet their respective objectives, keeping part of the required information private and at the same time another public segment. That is, the registration module is in charge of storing all the data that the user enters in the entire submitted form, despite the existence of a person's formalization verifier, this will not be shown; On the other hand, the query module displays all the stores that have been entered, helping the user to find a place of interest.

Through a comparison with what was developed, on this occasion it is not necessary for the common user to register certain objects, since this is done by the person interested in sharing the location of their store, so the customer can know for which direction to head to reach your selected destination [6].

However, regarding the limitations of the work, it was not possible to comply 100% with the proposed functionality of the application, this is due to the lack of deepening the topic related to geolocation, map generation and road traceability, as well as the relevant libraries. such as Google Maps and Android Location Services.

In addition, it can be taken into account that given the growth capacity of a commercial emporium, more buildings will be needed or at least vertically expand the existing ones, for this the idea of radio frequency identification to automate the management of facilities is interesting, which leads to more formal stores to be processed by the mobile application proposed in this paper [15].

Finally, it can be said that the work fulfills its main foreground functions, explained in simple terms, the registration and consultation of formal stores, although the point of "showing the tour" is pending, this returns to what is present in a work with potential to continue being developed, since it will help in a much more significant way the clients who come to this immense commercial emporium to have a location where to make their purchases.

5. Conclusions

The implementation of the mobile application carried out meets the objectives of the research, in developing a sustainable solution, and with almost all the defined functionalities, in order to help users finding the location of formal stores, which will improve the experience of customer purchase, in addition to helping to increase the profits of formal entrepreneurs in the Gamarra Commercial Emporium.

This work was carried out with the problem of implementing a mobile application for locating formal stores in the Gamarra Commercial Emporium, this meets the demands of the user and/or client, allowing the reduction of search time for formal stores in Gamarra. First of all, the application had an approval level of 82.9%, this means that users agree with the development of the mobile application. This responds to the problem that it is possible to develop an application that locates and divides the stores by category that the customer wants, in addition to reducing their search time for a formal store or the category that they like to find.

On the other hand, it was possible to observe that, due to the lack of depth in the subject of geolocation in mobile applications, at present there would be an incomplete step during the customer service process, referring to the news of the generation of maps. that is capable of guiding the path of a person, since such a tool is not implemented, this reflects that it is useful for the client, so it would be a key point in the popularity of the application.

Currently the mobile application is managed with the main functions, which is the registration and consultation of formal stores, with the exception of what has been mentioned (show the trajectory), since it is still under development. In other words, it is not fully developed yet, and therefore points were obtained for improvement within the application process.

The implementation of the tool will have a greater follow-up, and a better trajectory to the location of the store in which the user is interested, it will also sustain a good amount of interest in the application, and even optimization progress in the development of the application.

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