A TOWARD INCLUSIVE AGRICULTURAL COMMERCE: AGROWEB, A LOCATION-BASED SERVICES (LBS) PLATFORM FOR BUYING AND SELLING AGRICULTURAL PRODUCTS.

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Abstract— In this project, AgroWeb is introduced as an innovative platform based on Location-Based Services (LBS) aimed at transforming and modernizing agricultural commerce. The initiative seeks to establish a direct connection between producers and consumers, initially focusing on the Choachí road near Bogotá. Leveraging geolocation, buyers can easily discover local products, while sellers, including farmers, can offer their goods without relying on intermediaries. This approach not only streamlines the user experience but also reduces costs in the supply chain, benefiting both parties. AgroWeb addresses the lack of visibility for local agricultural products and emerges as an effective and sustainable solution to promote the inclusion of Colombian farmers in the market.

Keywords: **LBS, agricultural commerce, geolocation, local products.**

I. INTRODUCTION

In the Colombian context, the agricultural sector is grappling with critical challenges tied to economic instability and the supply chain. The surge in prices, particularly in food and beverages, adversely impacts farmers, creating an unfavorable dynamic where dependence on intermediaries leads to disproportionate prices and limited profits.

Addressing this issue is the platform, conceived to tackle the obstacles present in the marketing of agricultural products. This project stands as a technological solution, harnessing the accessibility and versatility of web platforms and focusing efforts on geolocation to facilitate direct connections between producers and consumers.

The justification for the platform lies in its ability to significantly improve the Colombian agricultural supply chain. By initially focusing on the Choachí route and its surroundings, the platform aims to offer an efficient experience for buyers while enhancing visibility and profitability for sellers, including local farmers.

The implementation of geolocation as the central axis of the project represents a key differentiator, allowing users to establish direct links with the nearest suppliers and eliminating the need for unnecessary intermediaries. Moreover, AgroWeb addresses the lack of effective means for farmers to promote their products, filling this gap through an accessible and effective technological platform.

Through a sustainable and inclusive approach, AgroWeb positions itself as a comprehensive solution to strengthen agricultural trade in Colombia, offering an alternative that seeks equity and efficiency in the supply chain.

II. RELATED WORK

To spot platforms sharing similarities in structure and business models, we scrutinized seven applications: Fruvi, BeCampo, ComproAgro, Waruwa, The Food Assembly, LocalHarvest, and Barn2Door.

Fruvi
Links Colombians to local farmers, delivering fruits and veggies directly. Orders of 30,000 pesos or more are home-delivered in 24-48 hours in Bogotá and Medellín.

BeCampo
A web and app combo, connects farmers selling organic produce directly to homes, ensuring fresh and high-quality products reach doorsteps.

ComproAgro
This social platform lets farmers create profiles, showcasing products for direct sales. Managing 12,000 users across 29 Colombian departments, it focuses on cutting out intermediaries.

Waruwa
Stands as a store supporting artisans from diverse indigenous communities, emphasizing handmade, culturally significant products.

Barn2Door
Provides a personalized online marketplace for agricultural producers, streamlining sales processes from inventory management to direct communication with customers.

The Food Assembly
Operating across Europe, this platform connects consumers with local producers for fresh, organic foods, functioning as an online market with nearby pickup points.

LocalHarvest
Primarily in the U.S., connects consumers with local producers of organic foods through a virtual directory of local producers and farmers' markets.

Comparative Analysis and Advantages

In a detailed examination of various agricultural platforms, AgroWeb emerges as a compelling and distinct option in the marketplace. Unlike many others, AgroWeb employs a multiplatform strategy, ensuring accessibility for both Android and iOS users, along with a web interface. This approach significantly broadens its user base, eliminating economic barriers as it provides free access.

One distinctive feature setting AgroWeb apart is its focus on Location-Based Services (LBS). This allows users to pinpoint and directly contact local producers along the Choachí route. This strategic use of geolocation technology provides a substantial advantage over competitors, fostering a direct connection between consumers and farmers. This direct link not only streamlines the buying process but also contributes to the economic empowerment of local farmers, as it eliminates unnecessary intermediaries.

Geographical specificity is another strength of AgroWeb. While other applications span entire countries or regions, AgroWeb concentrated primarily in Bogotá and the Choachí route. This focused geographic approach suggests a tailored and targeted service, ensuring a more concentrated and effective impact on the local agricultural ecosystem.

Moreover, AgroWeb offers a diverse array of products, including fruits, vegetables, dairy, and information about local attractions. This diversity not only broadens its user appeal but also positions the platform as a comprehensive solution for those interested in acquiring fresh, local agricultural products and exploring the cultural and tourist aspects of the region.

The flexibility in AgroWeb's business model is noteworthy. Allowing transactions both at wholesale and retail levels provides users with a versatile platform. This adaptability caters to the diverse needs of users, fostering participation from various actors in the agricultural supply chain. In contrast, some platforms may limit themselves to specific transaction types, potentially excluding significant segments of users.

III. PROPOSAL

Our objective is to design and implement a platform for the purchase and sale of agricultural foods that operates in a locality within the city of Bogotá and leverages location-based services (LBS). The economic instability has negatively affected farmers, who face difficulties in obtaining fair prices for their products and establishing mutually beneficial trade agreements, given the challenging nature of being a farmer in our country. Often, they are forced to sell their products in the city, incurring additional costs and greater dependence on intermediaries. Consequently, an additional issue has arisen in the production chain, where intermediaries wield significant power and increase prices disproportionately. This issue highlights the need to address deficiencies in the agricultural supply chain in Colombia. It is essential to analyze and understand the factors contributing to this problem to seek solutions that promote equity, sustainability, and efficiency in the trade of agricultural products.

Therefore, the following guiding question arises: How can a web platform be developed to integrate and strengthen different communities to facilitate the buying and selling of food?

In what follows, we are going to present the five subsystems of the platform

Design Subsystems Description

In the first subsystem, we developed a registration system that offers users a straightforward and efficient method to create an account and access all available services. Through a secure and streamlined process, users input their personal information, create a username, and establish a unique identity by setting up a password. It's essential to note that registration undergoes a validation process to ensure the authenticity and legality of sellers. During this process, a registration request is submitted and must be verified by a designated validator. The validator reviews the seller's information, and if deemed appropriate, access to the platform is granted. Additionally, inclusion of the seller's business registration is mandatory to ensure compliance with relevant regulations.

In the second subsystem, we designed a security system implementing robust measures to protect user data and privacy. Utilizing encryption technologies, the platform secures the integrity of confidential information, preventing unauthorized access. This reliable and confidential security system fosters user trust by providing a secure virtual environment for transactions and sharing sensitive agricultural information. AgroWeb's security pillars include controlling sensitive information, safeguarding personal data and passwords, and implementing a security filter restricting the view of other users' data until successful registration is completed. Measures are in place to protect information received through forms, preventing attacks such as Cross-Site Request Forgery (CSRF). Furthermore, a focus on establishing a secure connection via HTTPS for encrypted client-server communication is paramount. In summary, a security design has been implemented to maintain user data confidentiality and prevent attacks on platform input fields.

Another implemented subsystem is the Geolocation system, enabling users to locate and access relevant information based on their geographic location. This subsystem allows users to obtain accurate data about product availability in their area, offering a personalized and optimized experience. It enhances sellers' ability to display agricultural products and provides buyers with detailed information about producers along their route.

The fourth subsystem, Purchase and Sale, provides users with an efficient and secure platform for commercial transactions

related to agricultural products. Through an intuitive design and user-friendly interface, sellers can post product ads, negotiate, and finalize agreements conveniently. This subsystem facilitates direct communication between buyers and sellers, promoting transparency and trust in agricultural transactions. AgroWeb makes buying and selling agricultural products more accessible and effective, connecting stakeholders efficiently and beneficially.

The final subsystem is the Approval system, managing platform users in a controlled and structured manner. It introduces the crucial role of a validator to verify the authenticity of supplied information, especially concerning key figures such as sellers. Data verification begins with the platform form, initially trusting user-provided data. This information is sent to the validator through a local information control system, using Redis. The validator reviews and verifies the data, with the ability to delete accounts if the information is invalid. The validator's profile includes specific pages for tasks like validating order status, verifying seller authenticity, and reviewing existing orders. This detailed approach equips the validator with the necessary tools to efficiently fulfill responsibilities within the AgroWeb system.

IV. IMPLEMENTATION

A. Platform general Design

Everything starts with the users, who can access the platform from any device available in the market. To develop all the elements of the platform, the Django framework is used, working with the programming languages Python and JavaScript. These tools act as interpreters to code and manage all the functionalities of the platform.

With this configuration, the ultimate goal is achieved: providing users with the ability to buy and sell agricultural products along the Choachí route through a platform that facilitates the achievement of mutually beneficial agreements for both parties.

B. Components

The AgroWeb project has been designed following a three-layered software architecture model: presentation, business logic, and data access. The presentation layer is responsible for generating the user interface adapted to different devices using technologies such as HTML, CSS, and JavaScript. This layer focuses on providing a pleasant and user-friendly experience, allowing users to interact intuitively with the platform.

On the other hand, the business logic and data access layer play a crucial role in the project. Here, user requests are processed, specific business rules are applied, and aspects such as geolocation and the storage and retrieval of data related to agricultural products are managed. To achieve this efficiently, the Django framework has been chosen, known for its high level of abstraction and adherence to the Model-Template-View (MTV) pattern. This approach ensures a clear separation of responsibilities between components, facilitating rapid and structured software development

C. Solution approach

The solution proposed in the AgroWeb project is based on the previously mentioned architecture with the aim of providing a robust and efficient platform. By implementing key features such as user registration, product listing and searching, shopping cart, and online payments, AgroWeb meets user demands, offering a comprehensive experience in the buying and selling of agricultural products.

In the AgroWeb project, while emphasis has been placed on implementing key functionalities and ensuring user satisfaction, a formal usability study has not been conducted so far. However, a careful internal evaluation of the user interface, navigation, and information presentation has been carried out.

Throughout the development process, attention has been given to the user experience, aiming to ensure an intuitive and user-friendly interface. Continuous testing and adjustments have been made to enhance accessibility, clarity, and functionality. While a formal usability study with an external user group has not been conducted, feedback and opinions from internal users have been considered during testing and validation stages.

It is important to note that, in future phases of the project, a more comprehensive usability study is planned to assess efficiency, effectiveness, and user satisfaction concerning the AgroWeb platform. This study will help identify potential improvements and optimizations to provide an even more satisfactory experience for users

D. Views

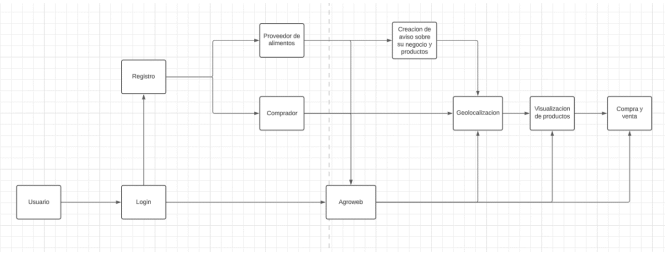

Figure 1. Context View

V. DEVELOPMENT OF THE AGROWEB PLATFORM

As we have previously established in the architecture phase based on a three-layer model, it has provided us with a robust structure encompassing presentation, business logic, and data access. Thanks to this solid foundation, we are ready to delve into the next stage of the project, where we will address in detail the development of the platform itself. During this chapter, we will explore the methods used, and the functionalities implemented for each case, dividing it into the Frontend development part, which focuses on design and user interfaces, and Backend development, which focuses on the logic within the platform that is not visible at first glance.

I. Frontend

a. *Responsive Design*

For the development of the platform in a responsive manner, it is necessary to modify the structure of the CSS already implemented in the desktop version to adapt it to different types of screens, ensuring that the quality of the elements displayed within the platform is not compromised.

b. *Platform Interfaces*

Figure 2. Overview of the Main Page of the Platform

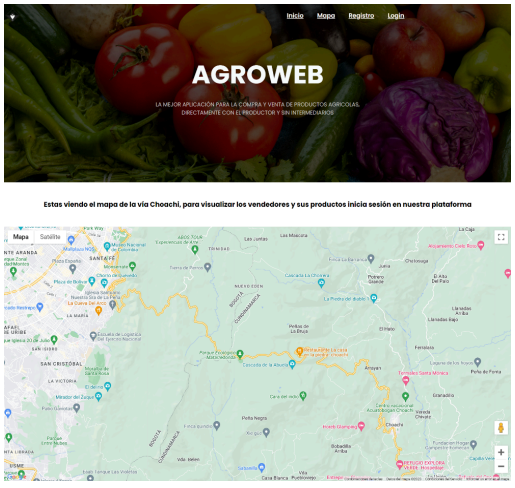

Figure 3. Map Page of the Platform Without Login

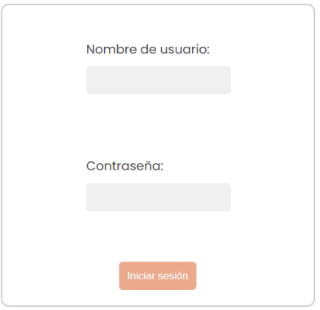

Figure3. Login Page on the Platform

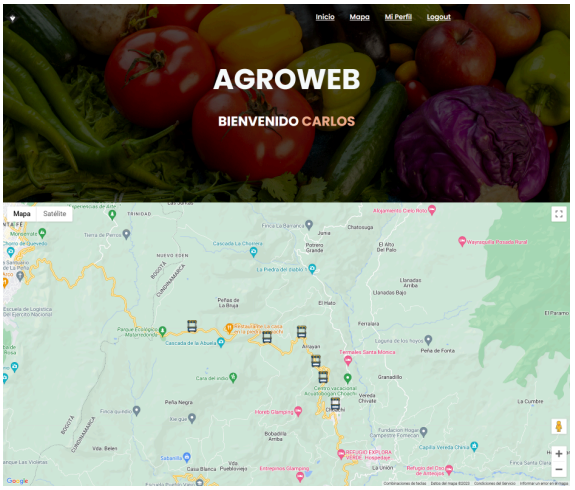

Figure4. Map Page of the Platform While Logged In

Figure5. Order Validation Page for Validator Role

II. Backend

We developed a responsive web platform using the Django framework, designed to adapt to various devices and resolutions. The application aims to facilitate access to local and organic products from small rural producers, utilizing Google Maps for key functions such as geolocation and point-of-sale queries. For the infrastructure, we implemented Amazon Web Services for the PostgreSQL database and Redis for validations, and finally, deployed the application.

We got three fundamental roles in the platform:

1. CLIENT

a. Customer Registration:

This function is responsible for registering a new customer, where you can find the following fields: username, customer's name, email, password, and repeat password. For the latitude and longitude fields, a script has been added to assist the user with their current location, but it can also be manually changed if desired.

b. Login:

This function is responsible for validating data against the Users table in the database and, based on that, granting or denying access.

c. My Profile:

This function is responsible for loading a screen with the customer's data.

d. Edit Profile:

This function is responsible for editing the customer's data by updating their information in the vendor table in the database.

2. SELLER

For the Seller user, different functions were implemented, which we will see below:

a. registerSeller:

This function is responsible for registering a new Seller. In it, you can find the following fields: username, seller's name, ID number, password, repeat password, store name, phone number, stall location (latitude and longitude), schedule, and products. For the latitude and longitude fields, a script has been added to assist the user with their current location, but it can also be manually changed if desired.

b. Login:

This function is responsible for validating the data obtained from the Users table in the database and, based on that, granting or denying access.

c. My Profile:

This function is responsible for loading a screen with the seller's data.

d. Edit Profile:

This function is responsible for editing the seller's data by updating their information in the vendor table in the database.

3. VALIDATOR

This validator role is established with the purpose of verifying the data of sellers and creating a regulatory profile on the platform. Not just anyone who enters the platform can create this role; it must be an email from an institution or person with the authority to determine the accuracy of buyer records. The validator will have their own viewing window with all records of sellers and order statuses. It is important to note that Redis has been implemented to access the data, which will then be sent to the PostgreSQL database once verified.

Moreover, it is envisaged that this validator role will be assumed by a governmental entity. This is strategically designed to allow an authoritative body, through mercantile documents, to validate the information provided by sellers, ensuring compliance with all national regulations and legal requirements that vendors must adhere to in order to engage in the trade of products. This process facilitates the platform's commitment to upholding legal standards and ensures that sellers operate in accordance with the necessary legal and regulatory frameworks.

VI. CONCLUSIONS

The development of AgroWeb marks a significant milestone in the quest for innovative solutions to the challenges facing local agricultural commerce. The implementation of diverse services and subsystems, catering to the needs of both sellers and customers, showcases a comprehensive approach to addressing the intricacies of the agricultural supply chain.

This project aspires not only to modernize the way agricultural products are exchanged but also to foster the inclusion of Colombian farmers in the digital age. The ongoing review by the municipality, particularly in Choachí, reflects the interest and significance that the AgroWeb platform could have in revitalizing and strengthening the local economy.

The special attention given to data validation, with a designated validator role and a meticulous review process, underscores a commitment to the integrity and authenticity of user-provided information. This robust approach not only ensures consumer trust but also addresses concerns regarding legality and transparency in agricultural trade.

Collaboration with the municipality signifies a significant step toward the integration and acceptance of AgroWeb as a viable and beneficial solution for the Choachí community. The potential for inclusion in this municipality not only marks an initial success but also opens the door to possible expansions and scalability of the project into other geographical areas.

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VII. ACKNOWLEDGMENTS

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