Development of a Web Application with Chatbot Integration for Cattle Care

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In this research, a web application called "Ganaderos Online" was created and integrated with an AI-based chatbot to improve decision-making dynamics and livestock sustainability by improving the quality of decisions among ranchers through an enhanced channel. The research was conducted in Guasaganda parish, Cotopaxi province, Ecuador, with 63 cattle farmers chosen according to statistical parameters. The methodological approach applied was mixed (quantitative and qualitative), using structured questionnaires with a Likert scale to measure user satisfaction, open interviews to capture qualitative perception, and Spearman's coefficient to test the hours of chatbot use with efficiency in decision-making. The findings showed that 70.31% of the sample rated the interface's ease of use as positive, while 59.37% highlighted the chatbot's usefulness in livestock care. A perfect correlation was tested using Spearman's coefficient. The development used technologies such as HTML, CSS, JavaScript, Botpress, and OpenAI, as well as a database developed in PHP. This research indicates that the application represents an innovative and effective solution

Keywords: Artificial intelligence, animal husbandry, and decision-making.

1. Introduction

"The use of advanced technologies, such as artificial intelligence and chatbots, has become increasingly important in different economic sectors." (Bermeo-Conforme, 2024) Its application in the livestock industry, which is also beginning to be noticed, especially in rural contexts, arises from the difficulty of achieving efficient management in this sector.

This research paper presents the development of a web application called Ganaderos Online, which integrates a chatbot that responds with information related to cattle care, feeding and health practices in the Subtropical Cotopaxi-Ecuador. The main objective is to improve efficiency in decision-making by providing quick access to specialised information about cattle.

However, the problem to be solved arises from the need to digitalise and automate processes in the livestock sector, where accessible technological tools for efficient animal management are scarce. Livestock farmers rely heavily on face-to-face consultations, which were previously unavailable, limiting the possible answers to livestock health and management problems impacting the sector's productivity. Therefore, developing a dynamic web page with chatbot implementation and ChatGPT oriented to meet the needs and questions about cattle is

a relevant innovation that could optimise farmers' resources and reduce operating costs.

The present study is supported by theories of artificial intelligence and natural language processing, through which it is possible to ensure that the automated systems created can provide contextual and valuable responses to the user. According to (Sadiku et al., 2021), the Term "artificial intelligence" (AI) refers to the ability of computer systems to perform human tasks, such as learning and thinking, which can often only be achieved through human intelligence.

Today, "AI advances are revolutionising the agricultural and livestock sector" (Tramallino, 2024), facilitating decision-making.

(Ortiz Baptista, 2023) Demonstrates that the operation of ChatGPT is based on machine learning; it uses knowledge and information previously trained in its model, using text data from a wide variety of sources, such as web pages, books and scientific articles.

In this context, "the GPT-4o model is used by the Ganaderos Online chatbot, which has been trained with appropriate information from studies and articles related to livestock farming so that the answers are accurate and relevant to user queries." (Diego Olite, 2023)
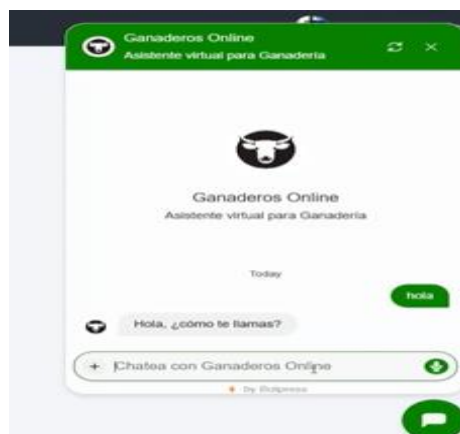

Fig 1. Cattlemen Online Chatbot.

As stated by (Alarcón et al., 2023), using digital tools allows producers to obtain this crucial information when it happens, thus reducing their reaction time to problems on the farm. However, very few studies have been applied to the Ecuadorian livestock context, adding value and novelty to the research. Therefore, this study adds value to the existing few studies that have been applied to the Ecuadorian livestock context. It adds literature by applying AI models in the Ecuadorian rural context and accessing their impact in an environment with little access to digital technologies.

The research was conducted in the Guasaganda parish, a rural area in Cotopaxi, Ecuador. In this area, livestock farming plays a key role as an economic source. The digitisation of livestock farming in this region would improve the welfare and production of the local population.

Therefore, the purpose of this research is to evaluate through Spearman's correlation if there

is a relationship between the number of hours of use of the chatbot integrated into the web application "Ganaderos Online" and the decision-making of the farmers, the efficiency in livestock management and, in turn, contributes to the sustainability of the sector. It is complemented by measuring user satisfaction using the Likert Scale and validating the use of advanced technologies as support tools in rural management in the canton of La Maná, province of Cotopaxi.

2.   Method

The following study is presented in the form of a research article: the target population of the analysis was the Guasaganda parish of La Maná canton in the province of Cotopaxi; the variables in question are the use of the web application and the satisfaction of the farmers with the improved decision-making, efficiency in livestock management and, in turn, contributes to the sustainability of the sector. The study population consisted of eighty cattle ranchers in the area; however, sixty-three individuals were selected when applying the sample and readjustment formula.

The research used a quantitative and qualitative approach, with bibliographic, correlational, and field modality, to understand the impact of the web application with chatbot integration in cattle management. Consequently, a "correlation through Spearman's coefficient" (Apaza et al., 2022) was carried out, whose approach is a statistical analysis to determine causal relationships between variables with the sample of eight veterinarians in the area. The methods used were applicative and descriptive, given that they took into account the evaluation of the implementation of a particular technology, as well as the users' perception of it.

The research design was observational since the data were collected only once, without intervening in the participants' behaviour. The study population comprised farmers and veterinarians of the Guasaganda parish since they are the primary users of the application.

The sample was selected by formula and applied to farmers interested in participating in the study, those with previous experience using the technology, and those who were less familiar with the technology. Therefore, a balanced perspective of the user's application experience was obtained. One of the main techniques used for quantitative data collection was the "survey". An experimental survey was implemented to measure perceived satisfaction, usability and perception of the application after having access to the application for two weeks.

Qualitative interviews were conducted to deepen the users' experiences and understand how the application could influence their daily work. A flexible questionnaire guided the interviews, including open-ended questions about the chatbot's usefulness and perceived improvement areas.

The data collection instruments included a structured survey using "the Five-point Likert scale to evaluate various aspects of user satisfaction" (Landaluce Calvo, 2024). An interview guide with open-ended questions was used for the interviews, allowing participants to share their experiences and suggestions freely. Regarding ethical considerations, confidentiality and informed consent were ensured for all participants. Before starting the study, the purpose of the research was explained to each participant and the voluntariness of their participation was confirmed. The data obtained were anonymised to protect the identity of the users and

guarantee their privacy.

It is essential to add that "the Scrum methodology played a fundamental role in the development of the web application, allowing research and development to be managed in an agile manner through short sprints, facilitating key functionalities" (Ballesteros-Quintero, 2021).

3.   Results

The dynamic web application with integration of the chatbot 4.o specialised in cattle care and advanced functionalities for user management. It comprises five main sections: home, about, information, news, linked to the official Facebook page of "ganaderos online", and log in. To access the platform, users must register through a process that requires a unique code generated by the administrator, who plays a key role in managing registrations, updating passwords and managing user permissions.
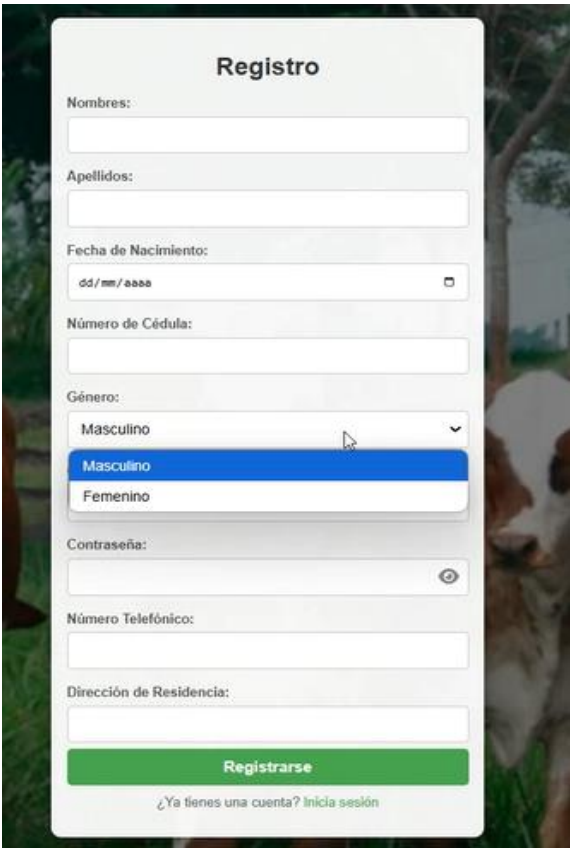

Fig 2. Option to register to enter the application.

On the other hand, the client user can interact with all the sections and use the chatbot, which provides personalised assistance with the required information. The application was developed using technologies such as HTML, CSS, JavaScript, Bootstrap and jQuery, integrating tools

such as Visual Studio Code, Botpress and OpenAI for the design and functionality of the chatbot; in addition, all records, both users and interactions, are stored in a database developed by PHP.
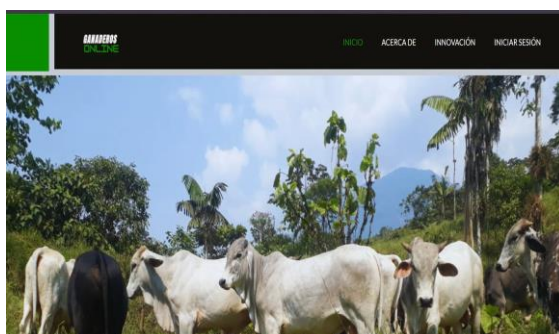

Fig 3: Image of the Cattlemen Online Application.

On the other hand, the selection of the Framework is detailed below in the form of a comparative table.

Table 1: Framework comparison.

Feature	Bootstrap	Foundation	Bulma
Basic language	CSS, HTML, JavaScript	CSS, HTML, JavaScript	CSS, HTML, JavaScript
Reusability	High	High	Media
Bookstores	Very high	High	Media
Popularity	Very high	High	Media
Performance	Excellent	Good	Good
Cost	Free of charge	Free of charge	Free of charge
Development time	Low (fast)	Medium	Medium

Consequently, Bootstrap is the most popular CSS framework due to its ease of use. It offers a wide variety of reusable components, allowing for rapid development. Compared to Bulma and Foundation, it provides more extensions and libraries, making it suitable for large-scale projects. Although all three frameworks are free, Bootstrap excels in performance. (Bastidas-Logroño, 2020)

The sample was selected as follows:

3.1.   Study Participants

To define the object of study and the field of action, it is necessary to establish the population and the sample to make known the different statistical techniques to calculate a sample in a population of professionals in the agricultural and livestock field (Cortés-Cortés M, 2020).

Thus, this sample calculation formula is used to determine the appropriate sample size for surveys or studies, ensuring that the results are representative of the population with a specific confidence level and margin of error, where

N = Population size N= 80

Z = Confidence level

Z= 95% = 1.96

E = Maximum allowable error E= 5% = 0.05

P = Probability in favour P= 90% = 0.9

Q = Probability against Q= 10% = 0.1

3.2.   n°Calculation of the initial sample size ( )

The general formula used to calculate the initial sample size is:

$$n° = \frac{z^2\,(p)(q)}{e2}$$

By substituting the values:

$$n° = \frac{1.96^2\,(0.9)(0.1)}{0,052}$$

$$n° = \frac{0.3456}{0.0025}$$

$$n° = 138,24$$

$$\underline{n° = 138}$$

This initial calculation suggests that a sample of 80 individuals would be needed to obtain results with the specified confidence level and margin of error in a very large or infinite population.

3.3. n^1)Sample size readjustment (for a finite population:

Since the population is finite (80), an adjustment is applied to ensure the sample size is representative. The readjustment formula is:

$$n^1 = \frac{n°}{1 + \frac{(n° - 1)}{N}}$$

By substituting values:

$$n^1 = \frac{138}{1 + \frac{(138 - 1)}{80}}$$

$$n^1 = \frac{138}{1 + \frac{(137)}{80}}$$

$$n^1 = \frac{138}{1 + 1.1725}$$

$$n^1 = \frac{138}{2.1725}$$

$$n^1 = 63.5$$

$$\underline{n^1 = 64}$$

To know the Spearman correlation coefficient and the relationship between the variables, time of use of the application and efficiency in decision making, the following was developed:

1.   Collect data.

2.   Assign ranks.

3.   Calculate the difference of ranks (di)

4.   Square the differences.

5.   Apply the formula.

The sample for the study sample consisted of eight veterinarians in the area.

Table 2: Spearman's correlation

Veter inaria n	Chatbot Hours of Use (X)	Efficiency in Decision Making (Y)	R (x)	R (y)	di	(di) 2
A	4	55	3	3	0	0
B	6	75	5	5	0	0
C	5	65	4	4	0	0
D	4	55	3	3	0	0
E	3	45	2	2	0	0
F	5	65	4	4	0	0
G	6	75	5	5	0	0
H	2	35	1	1	0	0
I	2	35	1	1	0	0
J	8	95	6	6	0	0

When applying the formula,

$$r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

$$r_s = 1 - \frac{6 \times 0}{8(8^2 - 1)}$$

$$r_s = 1 - \frac{0}{504}$$

$$r_s = 1$$

Spearman's correlation coefficient, r=1, indicates a perfect positive correlation between hours of app usage and veterinarians' decision-making efficiency when performing practices.
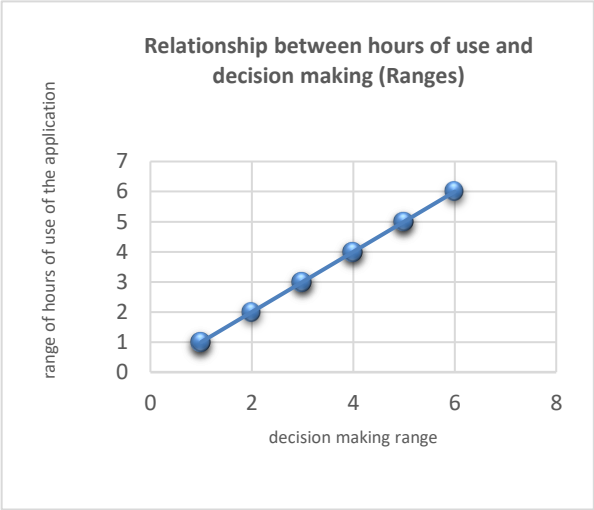

Figure 4: Representation of Spearman's linear correlation.

In the same way, a satisfaction survey was presented to sixty-four farmers with five questions based on the Likert scale, and the results were as follows:

Table 3: Likert Scale Table

Scale	Description
1	Strongly disagree
2	Disagree
3	Neutral
4	Agreed
5	Totally agree

Table 4: Q1. Is the application interface easy to use and navigate?

Scale	# surveys	Percentage
1	0	0%
2	0	0%
3	13	20.31%
4	45	70.31%

5	6	9.38%
TOTAL	64	100%

According to Table 3, most of respondents (70.31%) agree and consider that the application has an intuitive and easy-to-navigate interface.

Table 5: Q2. Does the chatbot provide valuable answers for cattle care?

Scale	# surveys	Percentage
1	0	0%
2	0	0%
3	12	18.75%
4	38	59.37%
5	14	21.88%
TOTAL	64	100%

The results in Table 4, corresponding to question 2, show that 59.37% agree that the chatbot provides useful answers for cattle care.

Table 6: Q3: Is the registration and login process efficient?

Scale	# surveys	Percentage
1	0	0%
2	0	0%
3	20	31.25%
4	40	62.5%
5	4	6.25%
TOTAL	64	100%

According to Table 5, the data from the third question of the survey shows that 62.5% of the sample agrees with the functionality of the registration and login process.

Table 7: Q4. Do the application sections meet my needs as a user?

Scale	# surveys	Percentage
1	0	0%
2	2	3.12%
3	60	93.75%
4	2	3.13%
5	0	0%
TOTAL	64	100%

As seen in Table 6 of question 4, the majority of the population is neutral regarding satisfaction with the application's sections, which indicates room for improvement.

Table 8: Q5. Am I satisfied with the security and handling of my personal data in the application?

Scale	# surveys	Percentage
1	0	0%
2	0	0%
3	44	68.75%
4	20	31.25%
5	0	0%
TOTAL	64	100%

With reConcerning7, which contains the data from question 5 of the satisfaction survey, it can be seen that 68.75% are neutral about security and data management.

4.   Discussion

In the present study (ROMERO-CANGAS, 2023) talks about the development of a web application for the Santa Isabel farm and demonstrates a significant advance in The digitisation of agricultural processes. Thus, it prioritises the automation of Administrative tasks by using technologies such as Django React for the backend and front end, respectively. It also highlights the implementation of the Scrumban methodology, which enabled efficient planning and compliance with structured objectives, highlighting a positive impact of the system in reducing manual processes with significant savings of 68.23%.

In comparison, "Ganaderos Online" also seeks to optimise agricultural methods, but through a different approach, integrating a chatbot based on artificial intelligence and trained to respond to cattle concerns. This innovative tool facilitates access to information, promoting a constant and personalised system interaction. With a remarkable value, new technologies such as HTML, CSS, JavaScript, Bootstrap and jQuery allow an efficient system in combination with the Scrum methodology.

One point of convergence between the two studies is the interest in sustainability and modernisation of the agricultural sector.

5.   Conclusions

In short, developing the "Ganaderos online" web application marks a breakthrough in the livestock sector, but more significantly in the Guasaganda parish of Cantón La Maná, Ecuador. The composition of the application with an artificial intelligence-based chatbot has provided cattle ranchers with a great tool that facilitates access to key information, improving decision-making on livestock management. The results of Spearman's coefficient (r=1) show a perfect correlation between the application's hours of use and the farmers' efficiency in decision-making.

At the same time, the satisfaction survey results were evaluated using the Likert scale, which

was applied to 64 users to confirm the general acceptance of the tool. Some 70.31% considered the application's interface easy to use, while 59.37% highlighted the chatbot's usefulness for livestock care.

Finally, implementing technologies such as HTML, CSS, JavaScript and artificial intelligence tools such as OpenAI and Botpress, along with implementing the Scrum methodology, allowed us to deliver fast and effective development with a product that met the sector's functional needs. Ultimately, "Ganaderos online" not only solves specific problems in the livestock sector but also sets a benchmark for how advanced technologies are leveraged to promote sustainability and productivity in that area of Ecuador. With due attention to continuous improvement in the identified areas, the application can serve as an essential tool for the digital transformation of the agricultural sector.

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