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A unified intelligent AI platform for resolving citizens' queries related to beneficiary service using AI -Powered chatbots a practical apparoach

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ABSTRACT

The daily many rural citizens visit government offices to inquire about beneficiary services that support poor and illiterate citizens. However, without proper knowledge, many eligible citizens fail to benefit from these services. In the artificial intelligence (AI) era, AI-powered chatbots, such as AI agents, can provide valuable support to the villagers and provide them with complete information at their door step. In this paper, a proposed framework, using a chatbot, to reduce the communication gap between citizens and government officials to improve service delivery performance. This chatbot is developed by using a built large language model, python libraries, fast API, and mongodb data base. Our findings demonstrate the challenges of imbalanced data and suggest improvements for future implementations. The system enhances service delivery by automating eligibility checks and reducing office visit frequency by up to 60%.

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1. INTRODUCTION

Gram Panchayats serve as the lowest administrative unit in India's governance structure, facilitating the implementation of central and state-level schemes. However, due to a lack of awareness and inadequate digital access, many eligible beneficiaries fail to avail of these schemes. This paper identifies the challenges in the current system and proposes a technology-driven solution for enhanced service delivery.

Chatbots can be categorized as rule based and neural network based. Rule based used predefined templates for simpler task oriented responses and neural network based chatbot used deep learning models called open domain modeling which is a more challenging area in neural network based. Agarwal and Wadhwa [1] artificial intelligence (AI) is known as the simulation of human intelligence [2]. By leveraging AI-powered solutions, we can bridge the digital divide and empower even the most remote and underserved communities to take advantage of the transformative potential of modern technology [2]. The concept of chatbot has come into the scene, which is a computer program that stimulates and processes human conversation, either written or spoken, allowing humans to interact with digital devices as if they were communicating with a real human [3] uses AI to interpret the text of the chat using natural language processing (NLP) in particular, instead of making direct contact with a live person, users can make conversation via text or voice [3]. To improve customer service many industries are attempting to include solutions based on AI like chatbots in order to deliver better service to their customers with faster and less expensive support [3] human-computer interaction (HCI) and AI paradigms are used to construct and design

intelligent conversational chatbots [4]. Earlier chatbots merely created an illusion of intelligence by employing much simpler string processing and pattern matching design techniques for their interaction with users using rule-based and generative-based models. However,with the emergence of new technologies more intelligent systems have emerged using complex knowledge-based models [5] chatbots are related to customer service, trying either to answer the frequently asked questions that do not need direct human interaction or to generate leads to the after-client follow-up and contact. Chatbots represent a potential change in the way that people interact with information and online services. Ferreira *et al.* [6] the large number of relevant services, the complexity of administrative services, the context-dependent relevance of user questions, the differences in expert-language and user-language as well as the necessity of providing highly reliable answers for all questions [7] the AI assisted chatbot system for providing customer services and providing better governance in public administration services [8] by handling routine queries and tasks, chatbots free up human agents to focus on complex and specialized issues, thus optimizing overall efficiency and customer satisfaction [9]. The referred chatbot, it is crucial to deal with multiple API's interconnected, external services, and numerous databases from the organizations, always focused on the improvement of the business process like the time optimization and the quality of the information retrieved, and the user experience related to them. Further system analysis shows a time saving of approximately 60% compared to the traditional way to access the information [10] public trust in chatbot responses depends on i) the area of enquiry, since expectations about a chatbot's performance vary with the topic, and ii) the purposes that governments communicate to the public for introducing the use of chatbots [10] public administration research in this area faces some limitations. First, much of the current search is the oretical and normative, lacking substantial empirical data to assess the results of chatbots. Second, the specific effects of chatbots on government organization operations and their interactions with the public are not well understood [11] citizens and public service providers chatbots used improvement in terms of access and improvement in terms of access and efficiency [12]-[15].

In the speedily evolving setting of technology, the advent of AI has opened up a world of possibilities for individuals and communities alike. One such promising application of AI is in the realm of assistive tools for villagers, who often face unique challenges in accessing information and services [16], [17]. The most common reasons for chatbot adoption among local governments are providing transactions information, consultation [18]-[20]. And the registered complaints with help of chatbot can enhance outreach with citizens chatbot adoption are accountability, accuracy, and exclusionary assumptions; acceptance of chatbot in local government and citizen [21]-[24]. Incorporating user suggestions and their institutional implications through the design thinking process could improve chatbot service quality. Chatbot adoption considering heightened interest in AI developments worldwide [25], [26].

– Methodology

"Figure 1 describes the process methodology adopted to create the chatbot for Gram Panchayat"

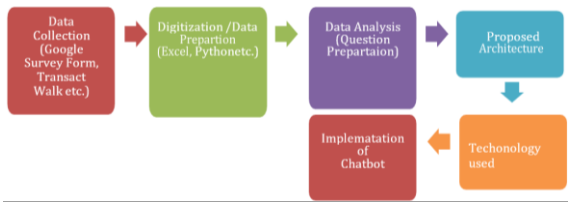

Figure 1. Process methodology for chatbot creation

– Data collection

Digital survey (google forms), interactions with citizens, government scheme from the data available on the portal. The data collection form or format can be seen in Figure 2.

– Data preparation and data analysis

After collection of citizen query missing values, question prepared on which citizen want to get assistance from the government "Table 1 is the summary of the queries or questions collect from the user through googleform or face to face interaction". Most commonly question identities are:

Q1: I am 60 + years, not government retired and zero income and need old age allowance assistant (Old age Pension).

Q2: I m female, widow not any source of income require government financial support to feed me and my children.

Q3: My income is less than 1lakh per year want to get house repairing help from the government.

Q4: Want to know for which scheme I am eligible.

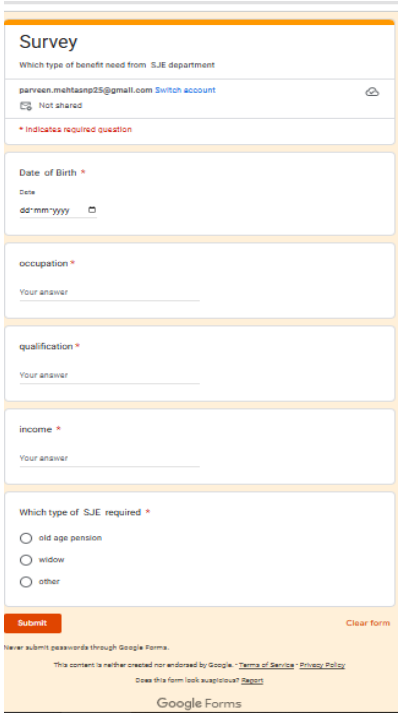

Figure 2. Google form for data collection

Table 1. Summary of the query received by the citizen

Sr.No.	Query by citizen	No. of query received
1	Allowance to dwarf	2
2	Allowance to eunuch	1
3	Disability pension	3584
4	Financial assistance for stage III and IV cancer patients	14
5	Financial assistance to destitute children	1795
6	Financial assistance to non school going disabled children	91
7	Financial assistance to widower and unmarried persons	468
8	Ladli social security allowance	407
9	Old age samman allowance	86513
10	Widow pension	14778
Grand total		107653

The proposed system architecture is depicted in Figure 3. The prepared data is used to answer specific questions or solve problems. This analysis can take various forms:

- Eligibility predictions: the chatbot uses the data to determine whether a citizen qualifies for a specific scheme based on the inputs they provide, such as age, income, or employment status.
- Query matching: using NLP, the AI agent analyzes the citizen's query to identify intent and relevant information, providing responses that are contextually relevant.

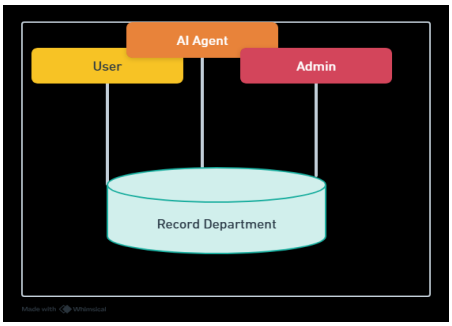

Figure 3. Interfaces used in chatbot

2. PROPOSED ARCHITECTURE

The architecture of the AI-powered chatbot is designed to handle the queries of citizens in a structured and systematic manner. "The flowchart in Figure 4 explains how the chatbot processes user queries."

1. User query input:
- The citizen enters their query through a chatbot platform which supports NLP. The query can relate to schemes such as pension eligibility, widow pensions, or disability benefits.
2. AI agent query processing:
- The AI agent receives the query and processes it. It checks the database for structured or unstructured information relevant to the query. For instance, it will check if the citizen's unique ID is linked to pension data.
3. Database information retrieval:
- The AI agent fetches the necessary data from the database. This could include the citizen's age, income, or employment status, or it could retrieve historical application data to assess eligibility.

Chatbot working initiate after citizen select Govt. Schemes assistant through his mobile or desktop. Chatbot conversation divides in intent, entities and context.as shown "Figure 5 presents the functional structure of the chatbot, including intent, entities, and context."

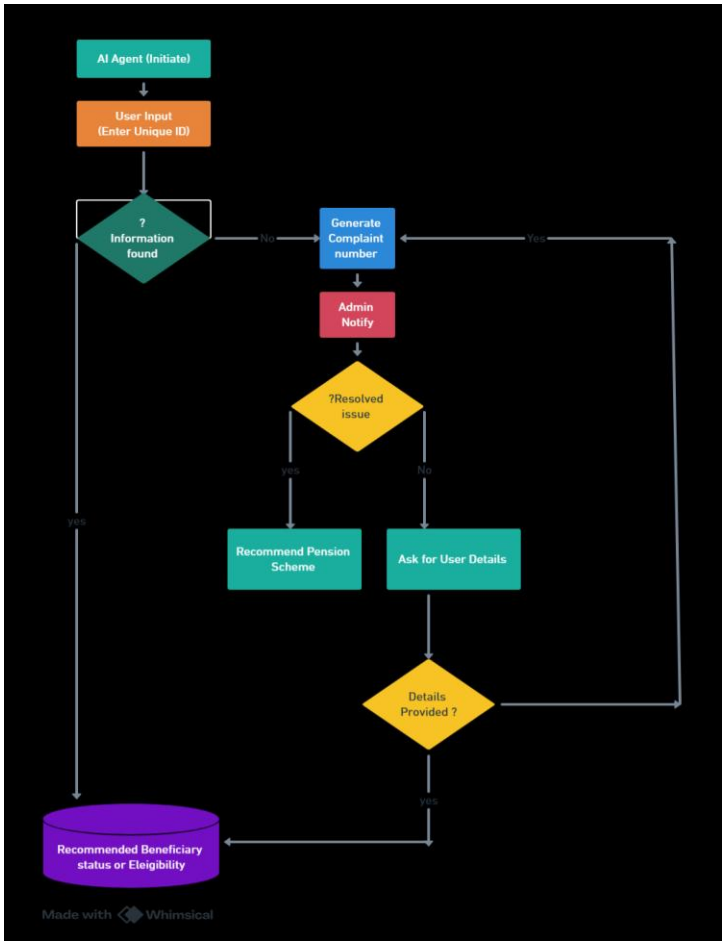

Figure 4. Flow chart of proposed architecture for query system for Gram Panchayat

- Intent

Intent represents a query/goals/information asked by citizen/user from the AI-assistant. what the user wants to achieve, such as asking about a government scheme, registering a complaint, or eligibility checking for a benefit.

Example:

User input: "How can i apply for a old age pension?"

Intent: “Application process inquiry”

– Entities

Entities represent the specific pieces of information extracted from the user query which details provide about the intent. These can include names of schemes, locations, eligibility criteria, or personal details.

Example:

User input: “How can i apply for an old age pension?”

Entity: “Old age pension” (Scheme Name).

Context

The context gives control over the bot’s event, It helps the chatbot maintain continuity in conversations by storing relevant details about a citizen’s previous queries or ongoing interactions. It allows follow-up questions tobe understood in relation to prior exchanges.

Example:

User: “How can i apply for a old age pension?”

Bot: “Do you mean old age allowance scheme or another scheme?”

The chatbot stores the context that the user is interested in Beneficiary scheme.

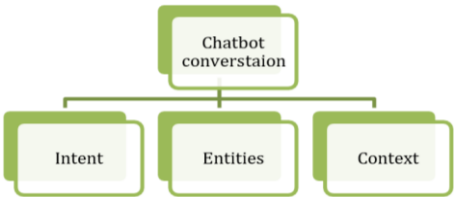

Figure 5. Functional structure of chatbot

Proposed conversation flow of the chatbot system

“As illustrated in Figure 6 the complete workflow of the query system involves six stages, from user identification to issue resolution.”

User identification phase:

– In the initial phase, the system prompts the user to enter or speak their unique identification number (UIN) assigned by the department. The chatbot collects the UIN through a multilingual interface (text/voice) and performs basic validation to ensure correct format and completeness. A valid UIN triggers database lookup; an invalid or missing UIN redirects the conversation toward complaint registration.

Database verification phase:

– The UIN is obtained, the chatbot’s verification module queries the MongoDB database or the departmental data repository through an API. The system performs exact and fuzzy matching to locate the user record. If multiple matches are found, a disambiguation query is presented to the user (e.g., confirmation of name, address, or date of birth). If the record is found, the chatbot retrieves relevant details for further processing; otherwise, the process moves automatically to the complaint registration step.

Data retrieval and recommendation phase:

– When a valid record is found, the system initiates the recommendation engine. It analyzes demographic and socioeconomic details to recommend applicable pension or welfare schemes. Rule-based eligibility filters (age, income, gender, disability status, caste category) are applied first, followed by an AI-based model (e.g., ANN) to refine predictions and handle incomplete data. The chatbot then communicates eligibility status and recommended services through the user interface.

Complaint registration phase:

– If the UIN is not found or data are incomplete, the chatbot automatically creates a complaint record. The user’s query, contact details, and system-generated timestamp are stored as a structured complaint entry in the database. Each complaint receives a unique complaint registration number (CRN) for tracking, and the chatbot immediately confirms registration to the user.

Administrative notification and action phase:

– After a complaint is logged, an automated notification is triggered for the administrative dashboard used by district or block-level officers. Notifications are sent via email, SMS, or internal dashboard alerts, assigning responsibility to the concerned officer or CPLO. This ensures timely support for UIN generation and correction of missing records.

Issue resolution and service recommendation phase:
- Once the issue is resolved and the citizen's record is validated, the chatbot re-engages the user. The system re-evaluates the updated record using the eligibility engine and confirms UIN activation. It then recommends eligible pension or welfare schemes, guiding the user through application submission.

Advantages of the proposed flow:
- Efficiency:automates record retrieval and complaint management.
- Transparency:provides tracking IDs for every interaction.
- Inclusivity:supports multilingual and rural-friendly access.
- Scalability: modular design enables integration with other welfare departments.
- Feedback loop:ensures continuous learning and adaptive improvement of the AI model.

3. ELIGIBILITY CHECK

The AI agent uses the retrieved data to check the eligibility of the citizen for the relevant scheme. For example, if the citizen inquires about the old-age pension, the chatbot will determine whether the citizen meets the age and income criteria.

4. USER FEEDBACK

Once the eligibility is determined, the AI agent returns the eligibility status to the user through the UI. If the citizen is eligible, the chatbot will inform them of the next steps. If they are ineligible, the chatbot will explain the reasons and offer other options.

5. COMPLAINT REGISTRATION

If the citizen's information is not found in the database or if they are ineligible, the AI agent registers a complaint and generates a unique complaint number. The government can then reach out to the citizen to resolve the issue.

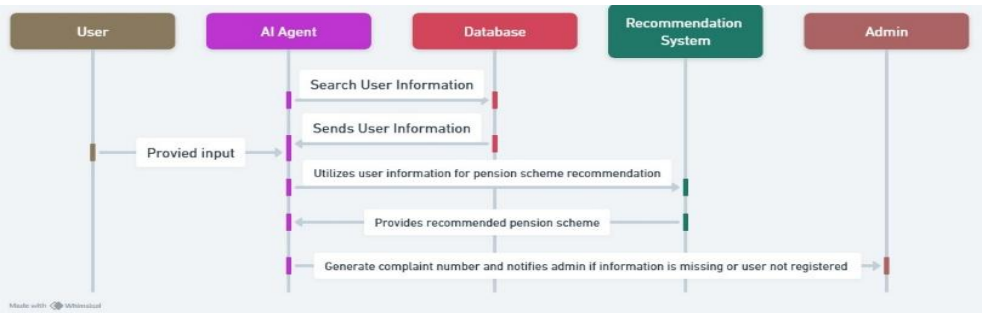

Figure 6. Work flow of query system for Gram Panchayat

6. TECHNOLOGY USED TO DEVELOPMENT CHATBOT

Fast API is used to handle HTTP requests in the system's micro services-based architecture. The following are the main elements of the architecture:

Frontend interface:
- A web-based platform for user interaction is hosted on vercel.

Backend server:
- Developed using fast API, to handling requests and managing data.
- Used for specifying REST ful endpoints and managing API requests.

Database:
- MongoDB is used for storing user queries, chat history, and complaint information.
- NoSQL database to efficiently store and access userdata.

AI service:
- Gemini AI API for intelligent response generation for user queries.
- Provides intelligent, situation-specific answers.

Security layer:
- To secure adminaccessused JWT-based safe secure access to administrative endpoints.

7. EXPERIMENTS AND RESULTS

In this paper, we developed a chatbot designed to help citizen to check eligibility of for the various beneficiary services. The chatbot was implemented using Rasa, and deployed on web interface as well mobile application platform. The chatbot was trained using a dataset comprising publicly available conversations, proprietary data, and user interactions.The below proposed architecture represents a step toward digital transformation in public administration to empowering citizens with timely information and streamlining government operations. “Figures 7, 8 and 9 demonstrate chatbot–user interactions for cases with and without a unique ID.”

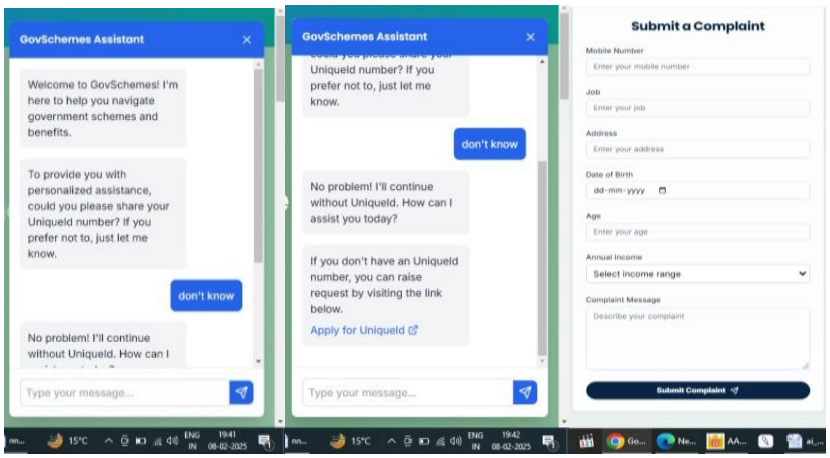

Figure 7. Chatbot and user conservation if citizen have not unique ID and complaint form

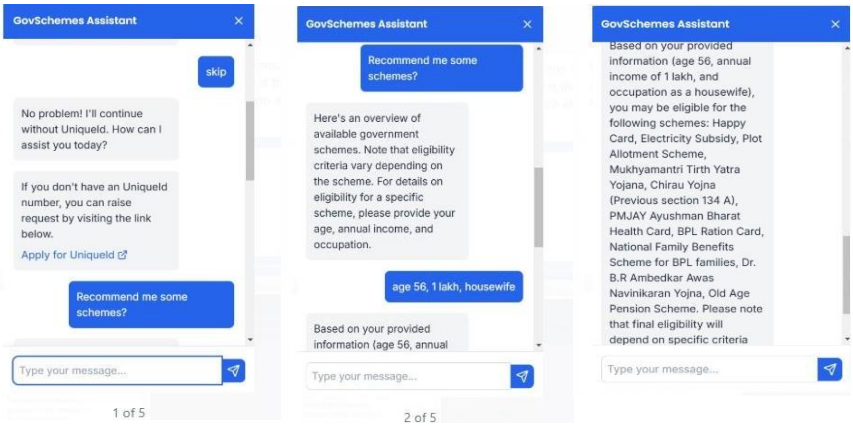

Figure 8. Chatbot and user conservation if citizen have unique ID chatbot recommend conversation to citizen

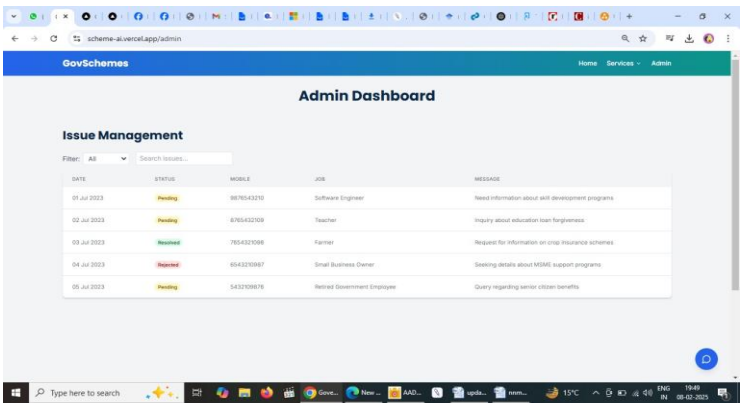

Figure 9. Admin panel conversation

8. CONCLUSION

The development of an AI-powered chatbot for resolving senior citizens' queries related to beneficiary services represents a significant advancement in bridging the gap between government schemes and citizens. By integrating AI, machine learning (ML), and NLP, this system enhances accessibility, accuracy, and efficiency in delivering critical public services.

The study highlights how AI-driven solutions can minimize human intervention, reduce bureaucratic inefficiencies, and provide real-time assistance to citizens, especially those in rural areas who often face challenges in accessing government benefits. The chatbot effectively automates eligibility verification, ensures transparency in scheme allocation, and simplifies the process for both users and government officials.

FINDING INFORMATION

- AI-powered chatbots significantly reduce response time and improve citizen engagement.
- ML models can predict eligibility with high accuracy, ensuring the right individuals benefit from government schemes.
- The proposed system overcomes key limitations of existing solutions, including lack of integration and accessibility issues.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Parveen Mehta	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	
Shweta Bansal						✓						✓		

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing -**O**riginal Draft
E : Writing - Review &**E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Ms. Parveen Mehta and Dr, Shweta Bansal have no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, Parveen Mehta, Due to personal information of Citizen for Security purpose not provided to any one third party.

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