Journal of Science, Computing and Engineering Research (JSCER)
Volume- 9, Issue- 4, April 2026.
DOI: https://do.org/10.46379/jscer.2024.0709

# CHATBOT FOR BUSINESS ENQUIRY

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**Article Information**

Received : 25 March 2026
Revised : 28 March 2026
Accepted : 29 March 2026
Published : 03 April 2026

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**Abstract—** In today's digital era, businesses receive a large number of customer enquiries through emails, chat systems, and online forms, making manual handling time-consuming and inefficient. This project, "Business Enquiries Using NLP and Deep Learning," aims to automate the understanding and classification of customer queries using advanced AI techniques. The system analyzes textual enquiries to identify intent, category, and priority level by applying NLP techniques such as text preprocessing, tokenization, stop-word removal, and vectorization to convert raw text into meaningful numerical data. Deep Learning models like LSTM, RNN, and Transformer-based architectures are used for accurate classification and intent detection. The proposed system improves response time, enhances customer satisfaction, and reduces manual workload by automatically routing enquiries to appropriate departments such as Sales, Support, or Billing. It also incorporates word embedding techniques like Word2Vec, GloVe, and BERT to capture semantic meaning and context, enabling better understanding of user intent. Additionally, the system handles multilingual and noisy data, ensuring robust, scalable, and efficient performance in real-world business environments.



**Citation: J.R.Arun Kumar, Sharafat Ali, Sahil Khan, Arman Khan,** "CHATBOT FOR BUSINESS ENQUIRY", Journal of Science, Computing and Engineering Research, 9(04), April 2026.

## I. INTRODUCTION

A Business Enquiry refers to a formal or informal communication initiated by customers, clients, partners, or stakeholders seeking information, assistance, or clarification regarding an organization's products, services, policies, pricing, support mechanisms, or collaboration opportunities. In contemporary digital ecosystems, such enquiries are predominantly received through web-based platforms, mobile applications, email systems, social media channels, and intelligent chatbot interfaces.

With the rapid digital transformation of enterprises, organizations are required to handle a high volume of customer interactions in real time. Traditional manual enquiry management processes are labor-intensive, time-consuming, and often incapable of scaling with increasing demand. Consequently, automated systems based on Natural Language Processing (NLP) and Deep Learning have emerged as an effective solution for intelligent enquiry handling.

In this project, a Business Enquiry is treated as unstructured natural language input submitted by users through a chatbot system, which must be computationally processed, interpreted, classified, and responded to automatically. Within the framework of an NLP and Deep Learning chatbot, such enquiries represent textual data conveying specific user intent. These messages may include grammatical errors, informal tone, abbreviations, multilingual expressions, and contextual ambiguity.

Common types of business enquiries include requests for product information or pricing, technical support issues, payment or billing concerns, account management queries, partnership or collaboration proposals, and general information requests. From a computational perspective, each enquiry constitutes a text understanding and classification task, where the chatbot system must extract semantic meaning, identify intent, and determine the appropriate category or response efficiently.

## II. PROBLEM STATEMENT

In the modern digital business environment, organizations receive a large volume of customer enquiries through various channels such as websites, emails, social media, and live chat systems. These enquiries may relate to product information, pricing, billing, technical support, account management, or partnerships. Handling them manually is inefficient, time-consuming, and resource-intensive.

Traditional customer support relies on human agents to interpret, categorize, and respond to each enquiry individually. This leads to delayed responses, inconsistent service quality, higher operational costs, and reduced customer satisfaction. As businesses grow, the volume and diversity of enquiries increase, making it difficult to maintain accuracy and speed.

Another challenge is that enquiries are unstructured and written in natural language, often including informal expressions, grammatical errors, abbreviations, or multilingual content. Rule-based systems fail to understand context and intent effectively, resulting in poor classification and incorrect responses.

Additionally, businesses require real-time processing and 24/7 availability, which is difficult to achieve with human-dependent systems alone.

## III. PROPOSED METHOD

The proposed system implements a Deep Learning-based intent classification model integrated with Natural Language Processing (NLP) techniques to automatically analyze and classify business enquiries received through a chatbot interface. The model is designed to convert unstructured textual input into structured and actionable information by identifying user intent and mapping each enquiry to predefined business categories.

### A. Input Layer (User Enquiry)

The system receives user enquiries as unstructured textual input through a chatbot interface. These enquiries may relate to product details, technical support, billing, or other business-related queries. The input is considered raw natural language data that requires processing.

### B. NLP Preprocessing

The input text is preprocessed to remove noise and standardize the data. This includes operations such as lowercasing, removal of punctuation and special characters, tokenization, stop-word removal, and lemmatization or stemming. Optional spelling normalization may also be applied to improve text quality.

### C. Feature Extraction and Vectorization

After preprocessing, the cleaned text is transformed into numerical representations using techniques such as TF-IDF, Word2Vec, GloVe, or contextual embeddings like BERT. These representations capture semantic meaning and enable the system to process text efficiently.

### D. Deep Learning Classification

The vectorized input is passed to a deep learning model for intent classification. The system may use an LSTM-based architecture consisting of embedding, LSTM, dropout, dense, and softmax layers, or a transformer-based model like BERT for better contextual understanding and higher accuracy..

### E. Intent and Category Prediction

The trained model analyzes the input and predicts the user's intent along with the corresponding business category, such as Sales, Support, Billing, or Technical queries. This structured output is essential for further processing.

### F. Response Generation and Routing

Based on the predicted intent, the system either generates an automated response or routes the enquiry to the appropriate department. This ensures quick resolution and reduces manual intervention.

### G. Training Procedure

The model is trained using labeled datasets of business enquiries. The process includes dataset splitting, forward propagation, loss calculation using categorical cross-entropy, backpropagation, and optimization using techniques such as the Adam optimizer and dropout regularization.

### H. Model Evaluation

The performance of the system is evaluated using metrics such as accuracy, precision, recall, F1-score, and confusion matrix. These metrics ensure the reliability, robustness, and effectiveness of the classification model.

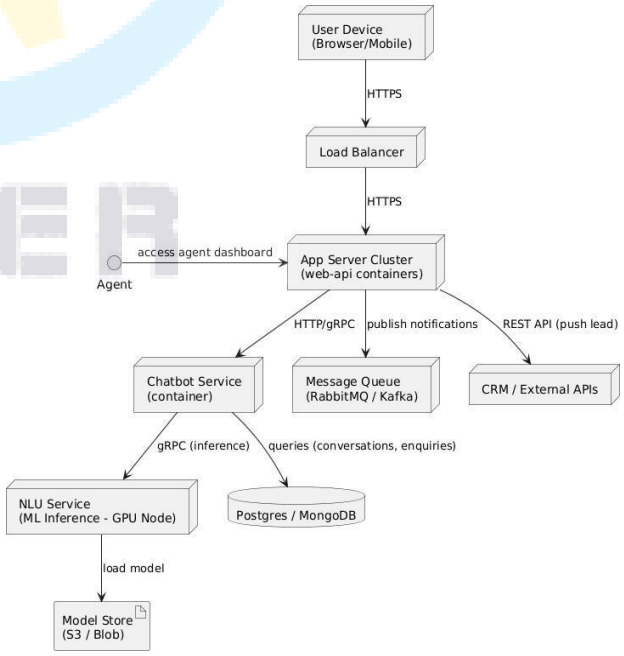


Fig. 1. Deployment Diagram

## IV. TECH STACK

### A. Frontend Technologies

The frontend of the proposed Business Enquiry Chatbot system is developed using HTML, CSS, and JavaScript to create a responsive and user-friendly interface. Bootstrap is used to enhance UI design and ensure mobile responsiveness across different devices and screen sizes. The frontend provides a chatbot interface through which users can submit enquiries and receive real-time responses. Additionally, it handles user interaction, input validation, and dynamic message rendering to improve the overall user experience. The interface is designed to be simple, intuitive, and efficient for seamless communication between users and the system.

### B. Backend Technologies

The backend is developed using Python-based frameworks such as Flask or FastAPI, which support lightweight and high-performance API development. It handles core functionalities including user request processing, API management, communication with the NLP module, and response delivery. The backend acts as a bridge between the user interface and the deep learning model, ensuring smooth data flow across components. It also manages error handling, request validation, and logging mechanisms. This layer is crucial for maintaining system performance, scalability, and reliability during real-time operations.

### C. Artificial Intelligence and Natural Language Processing

The system uses Natural Language Processing (NLP) techniques implemented through libraries such as NLTK and SpaCy for text preprocessing, including tokenization, stop-word removal, and lemmatization. These techniques help convert unstructured text into a structured format suitable for machine processing. For intelligent classification, deep learning models such as LSTM, RNN, or Transformer-based models (BERT) are used to identify user intent and categorize enquiries accurately. These models are capable of understanding contextual meaning and semantic relationships in text.

### D. Feature Extraction and Embeddings

The system uses TF-IDF (via Scikit-learn) and word embedding techniques such as Word2Vec and GloVe to convert textual data into numerical form. For advanced contextual understanding, transformer-based embeddings like BERT are utilized to capture semantic relationships in user queries.

### E. Database Technologies

Relational databases such as MySQL or PostgreSQL are used to store user data, enquiry logs, conversation history, and classification results. In some cases, MongoDB can also be used for flexible document-based storage

### F. Model Training and Evaluation Tools

Deep learning frameworks such as TensorFlow or PyTorch are used to build and train the intent classification model. The model is evaluated using metrics like accuracy, precision, recall, and F1-score to ensure reliable performance.

### G. Authentication and Security

Basic authentication mechanisms are implemented to ensure secure access to the system. It helps in controlling user permissions and protecting sensitive data from unauthorized access. Data transmission between frontend and backend is handled securely using APIs. Sensitive information such as database credentials and API keys can be stored using environment variables. This enhances system security and reduces the risk of data breaches.

### H. Development Tools and Deployment

The system is developed using Visual Studio Code as the primary development environment due to its flexibility and support for multiple extensions. Git and GitHub are used for version control and collaborative development. The application can be deployed on cloud platforms such as AWS, Microsoft Azure, or Google Cloud for better scalability and availability. Docker can be used for containerization, ensuring consistent deployment across different environments. This makes the system more robust, portable, and production-ready.

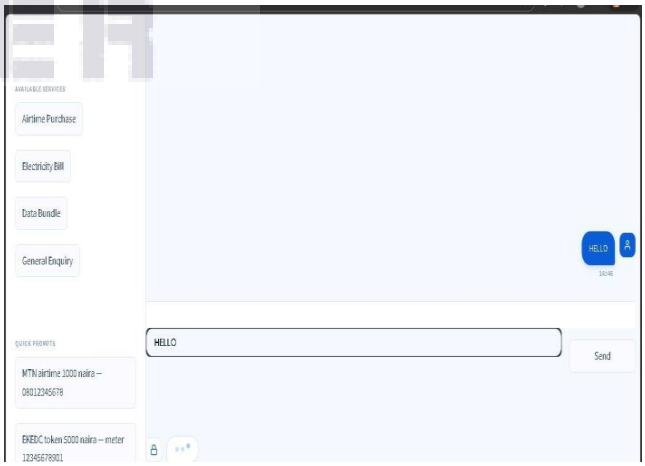


Fig. 2. Student Learning Dashboard

## V. RESULTS

The developed **Business Enquiry Chatbot using Natural Language Processing (NLP) and Deep Learning** successfully demonstrates the practical application of Artificial Intelligence in automating modern customer communication systems. The system is capable of accurately analyzing, interpreting, and classifying customer enquiries based on their intent and predefined categories using advanced NLP techniques and deep learning models such as LSTM and transformer-based architectures. It efficiently handles unstructured text input, including informal language, spelling variations, and diverse sentence structures, ensuring robust performance in real-world scenarios. **The chatbot provides relevant automated responses** or intelligently routes queries to the appropriate departments such as Sales, Support, or Billing. The results indicate a significant improvement in response time, a noticeable reduction in manual workload, and enhanced operational efficiency in enquiry management. Furthermore, the system maintains consistent and reliable performance, validated through evaluation metrics such as accuracy, precision, recall, and F1-score. Overall, the proposed solution is scalable, efficient, and capable of improving customer satisfaction by delivering fast, accurate, and context-aware responses in dynamic business environments.

## VI. CONCLUSION

This project successfully designed and implemented an intelligent Business Enquiry Chatbot system using Natural Language Processing (NLP) and Deep Learning techniques to automate the understanding, classification, and response of customer enquiries in a business environment. The proposed system overcomes the limitations of traditional rule-based approaches by utilizing advanced text preprocessing and neural network-based classification methods. It demonstrates strong capability in processing unstructured natural language input and accurately identifying user intent across categories such as sales, billing, customer support, and technical assistance. NLP preprocessing techniques help in text normalization and noise reduction, while deep learning models such as LSTM and transformer-based architectures improve contextual understanding and semantic interpretation. The system achieves reliable performance validated through evaluation metrics like accuracy, precision, recall, and F1-score. Its modular architecture ensures scalability, real-time processing, and seamless integration between frontend, backend, NLP module, and database. The chatbot efficiently generates automated responses and routes complex queries to relevant departments, reducing manual workload and improving response efficiency. Overall, the project delivers a scalable and intelligent solution that enhances customer interaction and supports digital transformation.

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