International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 12 Issue: 05 | May 2025 www.irjet.net p-ISSN: 2395-0072

AIClerk: A Multi-Agent Emotion-Aware and Personalized Smart Office Assistant with WhatsApp Integration and Automated Academic Workflow Handling

Sayed Mohd Zayeem Khateeb, Javeed Jatagar, Sudeep Kabadagi, Sachin Pattar, Prof. Shradha H

Sayed Mohd Zayeem Khateeb, Student, Dept. of AI & DS, Angadi Institute of Technology and Management, Belagavi, Karnataka, India
Javeed Jatagar, Student, Dept. of AI & DS, Angadi Institute of Technology and Management, Belagavi, Karnataka, India
Sudeep Kabadagi, Student, Dept. of AI & DS, Angadi Institute of Technology and Management, Belagavi, Karnataka, India
Sachin Pattar, Student, Dept. of AI & DS, Angadi Institute of Technology and Management, Belagavi, Karnataka, India
Prof. Shradha H, Assistant Professor, Dept. of AI & DS, Angadi Institute of Technology and Management, Belagavi, Karnataka, India

---

Abstract - *The increasing demand for automation and intelligent assistance in academic and professional environments calls for AI systems that are not only functional but also emotionally intelligent, personalized, and real-time accessible. This paper presents **AIClerk**, a smart office assistant designed using a multi-agent architecture that combines natural language understanding, emotion detection, task planning, memory-driven personalization, and WhatsApp integration. The proposed system accepts input via text, voice, or WhatsApp and processes it using advanced NLP techniques. It detects user emotions using a transformer-based model and adjusts task responses accordingly. A memory module personalizes task execution based on user history, while an auto-correction system ensures task reliability. Additionally, AIClerk introduces an innovative solution for academic institutions — a QR-based exam fee tracking and department notification system that automatically processes student fee submissions via screenshot uploads. With real-world usability and deep AI integration, AIClerk offers a unique, scalable, and human-like AI assistant for academic and administrative environments.*

Key Words: **Artificial Intelligence, Smart Office Assistant, Emotion Detection, Multi-Agent System, Natural Language Processing, Task Automation, WhatsApp Integration, Personalized AI, Academic Workflow, AIClerk**

1.INTRODUCTION

The increasing reliance on digital systems in academic and organizational environments has created a strong demand for intelligent, reliable, and user-friendly automation tools. Traditional office assistants and task managers often rely on rule-based logic with minimal adaptability or personalization. Moreover, most of these systems lack emotional sensitivity, contextual awareness, and real-time communication flexibility, which are essential for handling dynamic and human-centric workflows.

To address these limitations, we propose AIClerk — a smart office assistant built on a multi-agent architecture that leverages Natural Language Processing (NLP), emotion recognition, memory-driven personalization, and real-time messaging integration. AIClerk not only interprets natural language instructions but also adjusts task behavior based on user mood, past habits, and execution context. By integrating modern AI techniques with practical task automation, the system creates a responsive and human-like interaction experience.

A key innovation in this project is the inclusion of academic workflow automation, specifically a feature that allows students to upload proof of exam fee payment (with UTR and screenshot) via the interface. The system then automatically detects the student's identity and informs the respective department — reducing administrative overhead and manual verification tasks in colleges.

Furthermore, AIClerk incorporates a WhatsApp-based interaction layer that makes it accessible to users on mobile devices without needing a separate app. This increases usability and ensures that essential tasks and alerts are delivered in real time, where users are most active.

This paper outlines the design, implementation, and deployment of AIClerk, highlighting its modular architecture, technical components, and potential real-world applications in academic institutions and beyond.

1.1 Background and Motivation

In recent years, the integration of artificial intelligence into office and academic workflows has become increasingly vital for enhancing productivity, reducing repetitive tasks,

and improving human-computer interaction. Traditional task automation tools and chatbots are often limited to basic rule-based systems that lack personalization, adaptability, and contextual understanding.

Moreover, modern office and academic settings demand tools that are not only intelligent but also emotionally aware and responsive to user behavior. Students and staff frequently interact with digital systems for scheduling, communication, reminders, and administrative tasks. However, these interactions often occur through rigid platforms that do not offer natural, conversational, or emotion-sensitive experiences.

The motivation for developing AIClerk stems from real-world challenges observed in academic institutions, such as repetitive manual processing of exam fee submissions, delayed communications, lack of timely task updates, and difficulty accessing centralized systems. These problems inspired the need for a human-like, AI-powered assistant capable of understanding user emotions, remembering preferences, communicating over familiar platforms like WhatsApp, and automating workflows.

AIClerk aims to bridge this gap by offering an intelligent, adaptive, and personalized assistant that streamlines daily office and academic tasks, ultimately improving efficiency and user satisfaction.

1.2 Limitations of Existing Systems

Despite the increasing use of automation and AI-based assistants in office and academic settings, existing systems have several limitations that affect their practical effectiveness and user satisfaction:

- Lack of Emotion Awareness: Most virtual assistants and automation tools are not capable of detecting or adapting to the user's emotional state. As a result, they deliver generic responses that may not align with the user's mood or urgency.
- Absence of Personalization and Memory: Conventional systems do not retain any memory of previous interactions, user preferences, or frequently performed tasks. This leads to repetitive inputs and a lack of personalized user experience.
- Limited Adaptability in Task Execution: Current solutions operate based on predefined workflows or rule-based logic, which cannot adjust dynamically to changes in user context, sentiment, or task priority.
- Inadequate Real-Time Interaction: Many systems are restricted to web-based or desktop interfaces and do not support mobile-first platforms like WhatsApp, which limits accessibility and reduces user engagement.
- Lack of Support for Academic Workflows: Most existing models are not designed to handle academic-specific tasks such as exam fee verification, department-level notifications, or backlog identification, resulting in continued reliance on manual administrative processes.

These limitations emphasize the need for a smarter, emotionally adaptive, personalized, and mobile-accessible AI solution like AIClerk.

1.3 Objectives of the Study

The primary objective of this study is to design and implement a smart, AI-powered office assistant named AIClerk that enhances user experience by integrating emotional intelligence, personalization, and real-time accessibility. The system is tailored for academic and administrative environments to improve productivity, reduce manual overhead, and provide an interactive, user-centric interface.

The specific objectives of the study are as follows:

- To develop a multi-agent AI system capable of understanding natural language commands and managing tasks intelligently.
- To implement an emotion detection module that analyzes user input and adjusts task behaviour and response tone accordingly.
- To design a memory-driven personalization engine that remembers user preferences, past behaviours, and frequently performed tasks to improve accuracy and efficiency.
- To build an auto-correction and alert mechanism that detects execution errors, retries tasks, and provides user feedback or alternative suggestions.
- To integrate the assistant with WhatsApp using APIs to enable mobile-first interaction and real-time task notifications.
- To introduce a unique academic workflow feature where students can upload exam fee payment proof, enabling the system to identify the student and automatically notify the relevant department.
- To provide a unified and accessible platform that simplifies routine academic and office operations through intelligent automation.

These objectives aim to demonstrate how artificial intelligence can be effectively applied to solve practical problems in a college or institutional environment, offering a blend of efficiency, adaptability, and user-friendly design.

1.4 Scope and Contribution

This project focuses on the development of a smart, multi-agent AI assistant — AIClerk — that is capable of performing personalized and emotion-aware task automation in academic and office environments. The system is designed to function as a virtual assistant that not only understands and executes tasks but also adapts to user behavior and emotional tone to improve user experience and overall efficiency.

The scope of this project includes:

- Designing a modular, AI-driven system that accepts user inputs through text, voice, or WhatsApp and performs task execution through intelligent agents.
- Implementing natural language understanding (NLU), emotion detection, and memory-based personalization using AI models and vector databases.
- Automating office and academic workflows such as meeting scheduling, report generation, and task reminders.
- Creating a dedicated feature for academic institutions to manage exam fee submissions via QR-based screenshot uploads, with automatic identification and department notifications.
- Providing multi-platform accessibility, including WhatsApp integration, to ensure real-time, mobile-friendly interactions.

The key contributions of this work include:

- A novel integration of emotion detection and memory-based personalization in a smart office assistant.
- The use of a multi-agent architecture to break down tasks and execute them efficiently using specialized sub-agents.
- Real-world applicability through WhatsApp interaction, which makes the system accessible to students, faculty, and staff on mobile devices.
- An original academic workflow automation feature that addresses real-time fee tracking and reduces manual processing in educational institutions.

Through these contributions, AIClerk demonstrates the practical application of artificial intelligence in solving daily operational challenges in academic and administrative domains.

1.3 Literature Survey

his section presents a survey of key research papers and projects related to emotion-aware AI systems, personalization in virtual assistants, workflow automation, and messaging platform integrations. While these studies contributed significantly to the advancement of intelligent assistants, they also present limitations that this project — AIClerk — aims to overcome.

Several researchers have explored the development of emotion-aware frameworks and AI agents for domain-specific applications. However, many of these systems focus on individual aspects such as chatbot-based therapy, basic intent recognition, or limited automation workflows. A summary of selected papers, the technologies they used, their drawbacks, and the improvements introduced by our proposed model is presented in Table 1.

Table-1: Comparison of Existing Works with Proposed AIClerk Model

Author & Year	Technology Used	Limitations in Existing Work	Our Contribution / Improvements
Emotion AWARE, 2022 [1]	BERT + LSTM for Emotion Detection	Detects emotion but doesn't adapt tasks or interaction style accordingly	Emotion-aware task handling and tone adjustment using fine-tuned transformer model
AI Personalization, 2021 [2]	Collaborative Filtering, Static Preferences	No memory or learning over time	Memory-based personalization using vector embeddings and user history
AutoFlow, 2023 [3]	Workflow generation using LLMs	No fallback or auto-correction if task fails	Auto-correction and alert system with error tagging and retry logic
Therapy Chatbot, 2023 [4]	WhatsApp Bot with LLM (LLM4Therapy)	Limited to mental health; no practical task automation	WhatsApp-based interaction for real-world office and academic task execution
AutoGen, 2023 [5]	Multi-agent LLM framework	Generic agents, no emotion or memory integration	Customized agents for task planning, emotion, memory, and platform communication

2. METHODOLOGY

The proposed system, AIClerk, is designed using a modular multi-agent architecture powered by Artificial Intelligence (AI), Natural Language Processing (NLP), and integration APIs. The methodology involves a sequence of intelligent agents working together to handle user commands in a human-like, adaptive, and reliable manner. Each module uses specific technologies and coding implementations to perform its role.

2.1 Input Collection and Preprocessing

Users interact with AIClerk through three channels: Web Interface, Voice Commands, and WhatsApp Chat. The system first captures the input and applies preprocessing steps such as:

- Tokenization
- Lemmatization
- Removal of stop words

If the input is in voice format, it is converted to text using the Whisper Speech-to-Text API or Google Speech Recognition API.

- Technologies Used: Python (NLTK, SpaCy), Whisper / Google Speech API, Flask for interface input routing.

2.2 Emotion Detection Module

This module determines the user's emotional state (e.g., stressed, neutral, happy) based on their message. This is done using a pre-trained transformer model such as:

- BERT
- DistilBERT
- LSTM for voice emotion features (optional)

The result helps the system adjust the task's urgency or tone.

- Technologies Used: HuggingFace Transformers (BERT/DistilBERT), PyTorch, Scikit-learn, Custom classification logic

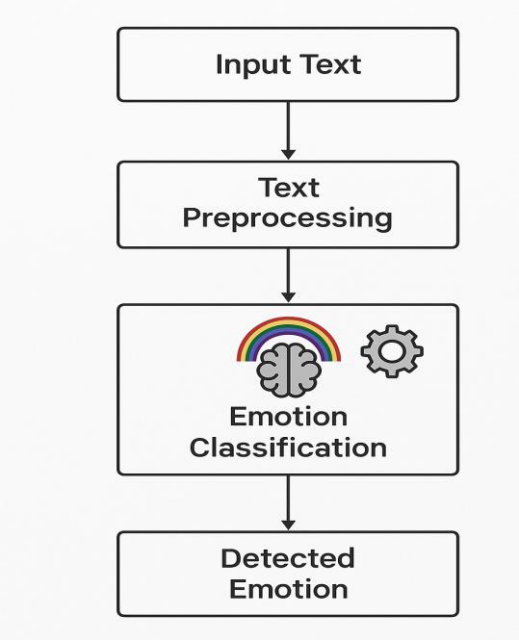

Figure 1- Emotion detection

2.3 Task Understanding (Intent Recognition)

This module identifies the purpose behind the user's input (e.g., "Send report to HR," "Remind me tomorrow"). It extracts:

- Intent
- Named Entities (e.g., names, dates, times)
- Context

We use a fine-tuned LLM (e.g., OpenAI GPT-3.5 or Cohere) and Named Entity Recognition (NER) models.

- Technologies Used: OpenAI API / Cohere API, HuggingFace Transformers, spaCy NER

2.4 Planner Agent

This agent determines how to complete the task by generating a logical sequence of sub-tasks and assigning them to appropriate agents (execution, alert, or memory).

- Generates multi-step workflows based on input complexity
- Uses if-else logic and context awareness

- Technologies Used: Python (custom rule engine), AutoFlow-style planning, JSON-based task templates

2.5 Memory-Driven Personalization Agent

This agent retrieves past user interactions to adapt responses. For example, if a user always prefers reports as PDFs, it remembers and auto-applies this.

- Stores user habits/preferences using embeddings

- Stores metadata such as frequency of tasks and preferred times

- Technologies Used: FAISS or Chroma (vector DB), SQLite/JSON for local history, SentenceTransformers for embeddings

2.6 Task Execution Agent

This is the core module that performs the desired action, such as:

- Sending an email
- Scheduling a task
- Generating a report
- Organizing a file

- Technologies Used: Python (smtplib for emails, openpyxl for Excel), Google Calendar API, Pandas for data handling, Flask for routing

2.7 Auto-Correction and Alert System

This agent checks whether the task was executed successfully. If not, it either:

- Retries with fallback logic
- Suggests alternative paths
- Sends real-time alerts

The system also logs the error with emotion tag (e.g., error during stress).

- Technologies Used: Python (try-except handlers), custom logging functions, alert system via Twilio/Mail API.

2.8 WhatsApp Integration

Users can interact with AIClerk directly through WhatsApp. The system receives the message, processes the task, and sends the response back.

- Incoming messages are handled via webhook
- Task progress and alerts are sent as real-time messages

- Technologies Used: Twilio or 360Dialog API, Flask/Django backend, WhatsApp Business Platform

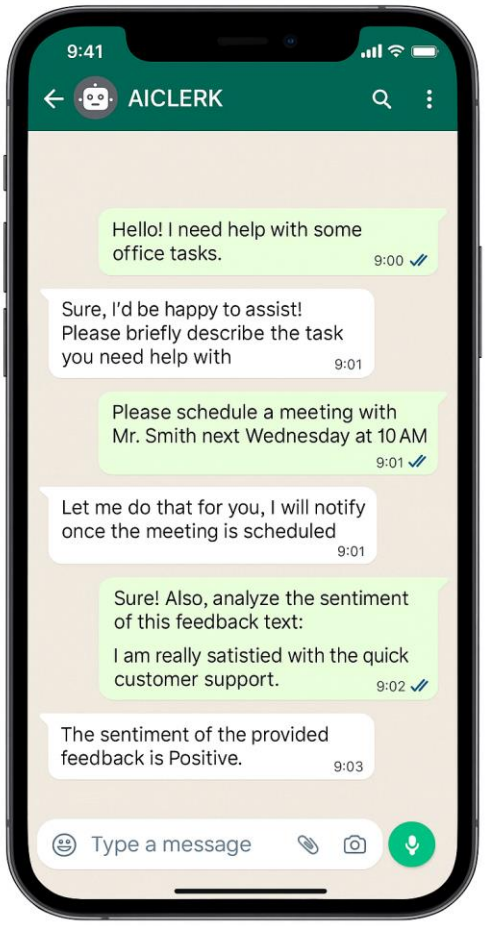

Figure 2- Conversation between user and AIClerk

2.9 Multi-Agent Orchestration

All above agents are coordinated by a central controller. It decides:

- Which agent should run
- In what order
- How to pass data between them

This ensures the system behaves like a team of intelligent assistants working together.

- Technologies Used: Python (modular classes for agents), AutoGen-inspired architecture.

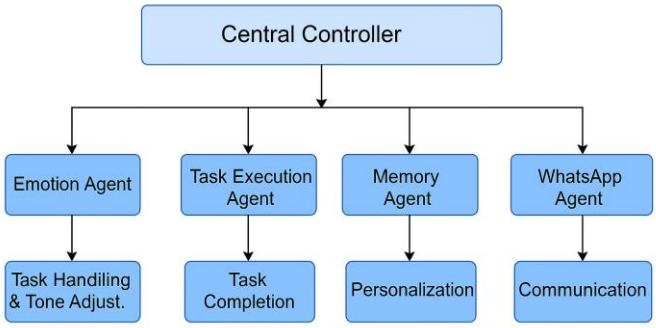

Figure 3- Multi-Agent system flow

2.10 Response Generation and Logging

Once the task is completed, the system:

- Forms a natural language response
- Logs the task, emotion, time, and result for future use

This ensures traceability and helps in memory-based learning.

- Technologies Used: OpenAI / GPT for response generation, SQLite/JSON for log storage, Markdown/Text formatting for replies

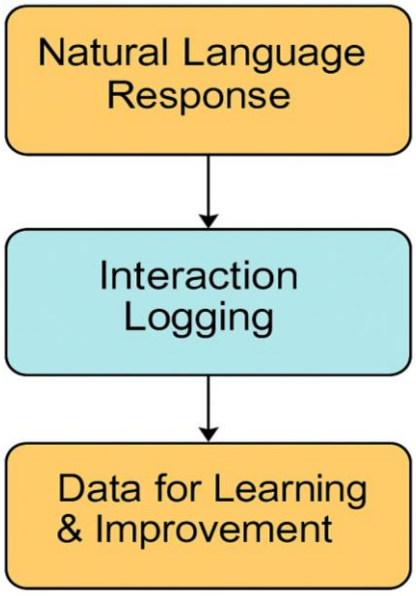

Figure 4- Response generation and logging

2.11 WhatsApp Payment Automation for Exam Fee Verification (Optional Feature)

To address the common problem of exam fee submission delays and verification chaos in academic institutions, AIClerk introduces a unique academic workflow module that automates student fee verification and department notifications using WhatsApp and OCR.

The process begins when the university announces exam fee payment deadlines. Students pay the fees via the college's provided QR code and are then prompted to upload a screenshot of their payment receipt (containing UTR number) through the AIClerk interface or WhatsApp.

Once the screenshot is received, the system performs the following steps:

- Extracts student details (Name, USN, UTR) using Optical Character Recognition (OCR).
- Verifies the format and ensures UTR number is present.
- Identifies the department based on the USN.
- Automatically sends a confirmation alert to the respective department, indicating that the student has successfully paid the fee and is eligible for form filling.

This system helps reduce manual paperwork, errors in fee verification, and backlogs in form processing. It provides transparency to both students and administrators while streamlining institutional operations.

Technologies used:

- EasyOCR or Tesseract for image-to-text conversion
- WhatsApp API via Twilio/360Dialog for screenshot collection
- Python (Pillow, OpenCV) for image preprocessing
- SQLite/JSON for data logging and tracking

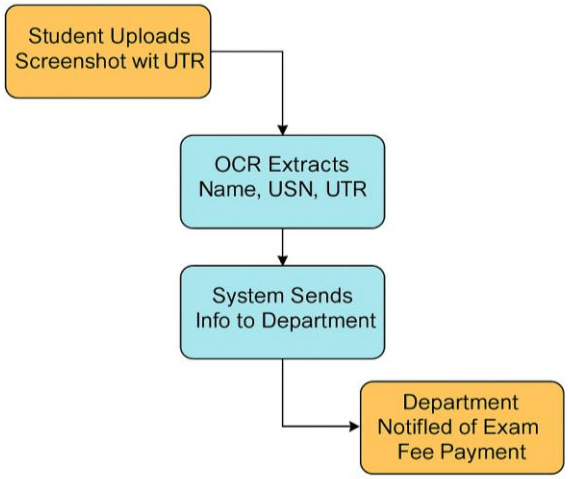

Figure 5- Payment confirmation notification to department

3. User Interface Designing

The user interface (UI) of AIClerk is designed to be simple, intuitive, and accessible across both desktop and mobile platforms. The system supports input through web forms,

WhatsApp chat, and voice, making it flexible for academic and office use. The interface ensures seamless task interaction, notification updates, and screenshot uploads.

3.1 Frontend

The frontend is responsible for capturing user input, displaying responses, and providing a user-friendly dashboard for staff and students. It includes web pages and visual components that guide user interaction.

Technologies and Languages Used:

- HTML5 – For basic page structure
- CSS3 – For styling and layout
- JavaScript – For interactivity and validation
- Bootstrap – For responsive design and mobile compatibility
- React.js (optional) – For creating dynamic components and scalable frontend structure.

Optional Channels:

- WhatsApp Chat Interface (via Twilio API) – for mobile-first interaction with no custom app required

3.2 Backend

The backend handles logic processing, API integration, data flow, emotion detection, memory management, and task execution. It connects the UI with all AI services and manages the internal communication between agents.

Technologies and Languages Used:

- Python – Core backend logic and model integration
- Flask / Django – Web framework to handle HTTP requests and routes
- SQLite / JSON – For lightweight local storage
- FAISS / Chroma – For memory-driven personalization using vector embeddings
- HuggingFace Transformers – For BERT/DistilBERT-based emotion recognition and NLP
- Twilio / 360Dialog API – For WhatsApp message handling
- Tesseract / EasyOCR – For extracting data from uploaded screenshots

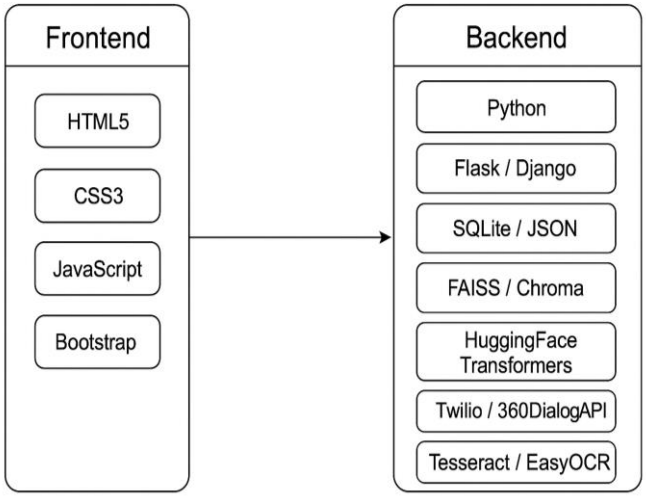

Figure 6- Frontend and backend

3. CONCLUSIONS

The AIClerk system demonstrates a practical and innovative application of artificial intelligence in streamlining academic and office workflows. By integrating emotion detection, intent recognition, memory-based personalization, task automation, and WhatsApp communication into a unified multi-agent framework, the system addresses the limitations of traditional digital assistants.

Through the use of advanced NLP models, vector memory databases, and real-time messaging APIs, AIClerk not only enhances user experience but also reduces administrative burden, improves task reliability, and supports personalized task execution. The addition of a smart academic module — capable of handling exam fee verification and departmental notifications — further shows the system's relevance and usability in institutional environments.

Overall, AIClerk offers a scalable, mobile-accessible, and intelligent assistant solution that can be adapted to various organizational needs, bridging the gap between user-friendly interaction and complex task automation.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to our respected guide, Prof. Shraddha H, Assistant Professor, Department of Artificial Intelligence and Data Science, Angadi Institute of Technology and Management, Belagavi, for her continuous guidance, motivation, and valuable insights throughout the development of this project.

We also extend our thanks to the Head of the Department , project co-ordinator and all faculty members for providing the necessary resources and a supportive academic environment.

Finally, we thank our friends and family for their encouragement and feedback, which helped us improve the quality and direction of our work.

REFERENCES

[1] A. Panda, A. Bera, and D. Manocha, "Emotion AWARE: An AI framework for adaptable emotion recognition," IEEE Trans. Affective Comput., vol. 13, no. 2, pp. 469–482, 2022.

[2] [2] X. Li and J. Xu, "AI-driven personalization in digital marketing," ACM Comput. Surv., vol. 54, no. 3, pp. 1–28, 2021.

[3] [3] H. Zhang, K. Wu, and A. Dubey, "AutoFlow: Automated workflow generation for LLM agents," arXiv preprint arXiv:2308.00032, 2023.

[4] [4] M. Cohen, T. Levy, and D. Israel, "Narrative therapy chatbot on WhatsApp using LLM," Comput. Human Behav. Rep., vol. 9, p. 100216, 2023.

[5] [5] R. Song et al., "AutoGen: Enabling multi-agent LLM collaboration," AutoGen Framework, Microsoft Research, 2023. [Online]. Available: https://github.com/microsoft/autogen

[6] [6] J. Devlin, M. Chang, K. Lee, and K. Toutanova, "BERT: Pre-training of deep bidirectional transformers for language understanding," in Proc. NAACL-HLT, 2019, pp. 4171–4186.

[7] [7] S. Hochreiter and J. Schmidhuber, "Long short-term memory," Neural Comput., vol. 9, no. 8, pp. 1735–1780, 1997.

[8] [8] A. Radford et al., "Language models are few-shot learners," OpenAI GPT-3 Paper, arXiv preprint arXiv:2005.14165, 2020.

[9] [9] K. Xu et al., "Emotion recognition from text using LSTM and attention," IEEE Access, vol. 9, pp. 11064–11075, 2021.

[10] [10] A. Vaswani et al., "Attention is all you need," in Adv. Neural Inf. Process. Syst., 2017, pp. 5998–6008.

[11] [11] R. Zhang, Y. Sun, and B. Liu, "Personalized virtual assistant design with memory graphs," Springer Artif. Intell. Rev., vol. 55, pp. 143–161, 2022.

[12] [12] Twilio Inc., "Twilio WhatsApp Business API documentation," Twilio Developer Docs, 2024. [Online]. Available: https://www.twilio.com/docs/whatsapp

[13] [13] M. Brown, A. Singh, and L. Patel, "OCR technology for automated data capture in smart apps," J. Intell. Syst., vol. 29, no. 4, pp. 412–426, 2020.

[14] [14] Meta AI Research, "Chroma: Open-source vector database for LLM memory," 2023. [Online]. Available: https://www.trychroma.com

[15] [15] Python Software Foundation, "Working with Flask, SQLite, and JSON for AI workflows," Python.org, 2023. [Online]. Available: https://docs.python.org

BIOGRAPHIES

Sayed Mohd Zayeem Khateeb
is currently pursuing a B.E. in Artificial Intelligence and Data Science at Angadi Institute of Technology and Management, Belagavi. He is passionate about building intelligent AI systems, with interests in natural language processing, automation, and product design. He led the team, focused on methodology, WhatsApp integration, OCR-based screenshot upload module and overall system architecture development for this project.

Javeed Jatagar
is an undergraduate student in the Department of AI and DS at Angadi Institute of Technology and Management. His areas of interest include machine learning, web development, and real-world application design. He contributed to the front-end interface.

Sudeep Kabadagi
is currently pursuing B.E. in AI and Data Science at Angadi Institute of Technology and Management. His interests lie in data structures, backend automation, and UI development. He assisted with backend logic

Sachin Pattar
is a final-year student specializing in Artificial Intelligence and Data Science. His primary areas of interest are deep learning and applied AI. He worked on model integration and overall documentation

Prof. Shradha H
is an Assistant Professor in the Department of Artificial Intelligence and Data Science at Angadi Institute of Technology and Management, Belagavi. She has been actively mentoring students in AI, data science, and emerging technologies. She guided the team throughout the project, providing critical insights in research methodology and implementation.