

PERSONALIZED AUTONOMOUS KNOWLEDGE UNIT (PAKU)

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CERTIFICATE

This is to certify that the Project Synopsis entitled, Self-Adaptive Agentic Personal AI Clone submitted by Chahat Gupta, Yashika, Nikhil Gupta, Nischal Sharma to **The NorthCap University, Gurugram, India**, is a record of bonafide synopsis work carried out by them under my supervision and guidance and is worthy of consideration for the partial fulfilment of the degree of **Bachelor of Technology** in **Computer Science and Engineering** of the University.

We further certify that this work has not been submitted elsewhere, and the report bears a plagiarism level of **not than 10%**, as per university guidelines.

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1. ABSTRACT

The increasing shift toward digital communication and remote academic workflows has created significant pressure on educators and professionals to manage multiple duties simultaneously, such as lectures, administrative meetings, assignment evaluation, student support, research activities and documentation. In many cases, these responsibilities overlap, making it difficult for individuals to be present everywhere with consistent effectiveness. While a number of AI tools and meeting bots are available in the current market, most of them offer only limited assistance in the form of transcription, summarization or static voice cloning. Their dependence on cloud infrastructure raises concerns regarding data privacy, lack of personalization, network delays and limited autonomy, making such solutions inadequate for confidential and real-time academic environments.

This project proposes a Self-Adaptive Agentic Personal AI Clone, an intelligent system capable of creating a digital representation of the user that can mimic their voice, facial expressions, communication style and decision-making patterns. The most significant feature of the system is its privacy-first design, where all operations, including speech synthesis, face generation and knowledge processing, take place entirely on personal edge devices such as laptops and mobile phones. This ensures that sensitive academic content, emails, student submissions and meeting conversations remain fully local without reliance on external cloud servers. The model integrates Small Language Models for personalized reasoning, Retrieval-Augmented Generation for contextual memory and LoRA-based fine-tuning to support evolving user behaviour over time.

The AI clone is capable of autonomously participating in various academic and professional tasks, including administrative meetings, viva examinations, grant proposal discussions, student office hour interactions and assignment evaluations. Through distributed inference between devices, the system reduces latency and improves responsiveness without compromising user privacy. By automating repetitive tasks, improving accountability in meetings and delivering continuous support aligned with the user's communication style, the proposed solution aims to significantly reduce workload and enhance productivity.

Overall, the Self-Adaptive Agentic Personal AI Clone represents a transition from passive AI assistance toward autonomous, context-aware and self-improving digital agents. The system has the potential to reshape the way educators and professionals handle time-intensive roles by offering a secure, scalable and efficient approach to AI-based personal representation.

2. INTRODUCTION

The rapid growth of artificial intelligence in recent years has transformed the way people communicate, learn and work in technologically driven environments. With the increasing use of digital platforms for academic and professional commitments, individuals are now required to engage in multiple modes of interaction simultaneously, including online meetings, classroom teaching, administrative coordination, research collaboration and documentation. Although technology has improved connectivity, it has also increased the demand for continuous presence, multitasking and instant decision-making. This imbalance has resulted in rising workload, cognitive fatigue and reduced productivity, especially for educators and academic professionals who must manage several overlapping responsibilities on a daily basis.

Traditional AI assistants and meeting automation tools have attempted to reduce some of this burden. However, these systems remain limited because they focus on narrow functionalities such as transcription, summarization or single-modality voice cloning. They do not possess the ability to understand user-specific context, maintain consistency of communication style or make decisions on behalf of the user. Furthermore, most commercial AI solutions function through cloud servers and external data centers, leading to privacy concerns regarding sensitive academic material, student data, confidential discussions and research information. These challenges highlight the need for a system that can extend the user's presence without compromising confidentiality, personalization or autonomy.

The concept of a Self-Adaptive Agentic Personal AI Clone emerges as a response to this need. Instead of serving as a passive digital assistant, the AI clone acts as a proactive digital extension of the user that can independently communicate, understand context, make decisions and represent the user when required. By incorporating voice imitation, face generation, communication style adaptation and memory of past interactions, the system aims to replicate the user's presence in a realistic and meaningful way. Unlike existing solutions, the proposed clone operates entirely on personal devices using edge computing, ensuring complete privacy while reducing dependency on network connectivity.

The growing reliance on intelligent automation in professional and academic spaces indicates that future systems must be capable of autonomous adaptation, personalized reasoning and ethical deployment. The proposed AI clone aligns with this direction by providing a scalable and secure approach toward supporting educators and professionals in managing responsibilities. It creates the possibility of reducing burnout while maintaining high-quality engagement across all tasks, establishing a foundation for a new generation of AI systems that prioritize privacy, personalization and productivity.

3. BACKGROUND STUDY

Over the past decade, the nature of academic and professional work has undergone a major transformation due to the increasing integration of digital communication platforms. Educators, researchers and administrative professionals now engage in a hybrid ecosystem where physical responsibilities are combined with online tasks such as video meetings, digital classrooms, remote collaborations and virtual student support. Although these advancements have enabled efficient information sharing, they have simultaneously increased expectations for constant availability and multitasking. As a result, academic professionals are often required to manage overlapping duties without sufficient time to focus on core teaching and research activities.

To address the rising workload, artificial intelligence tools—particularly transcription services, meeting bots and virtual assistants—have entered mainstream use. These solutions have been helpful in automating tasks such as recording discussions, summarizing conversations and responding to general queries. However, they still fall short of

addressing the practical needs of educators because they lack personalization, contextual understanding and autonomous decision-making. Most importantly, available tools function as passive systems rather than as active representatives of the user. Even when they provide support, the responsibility of participation, discussion and decision-making still remains with the individual.

Another major limitation of existing AI systems relates to privacy and security. Many commercial AI tools rely on cloud servers for processing and data storage, which requires users to upload confidential information such as academic records, research data, student submissions, emails and meeting discussions to third-party environments. For educational institutions and academic professionals, the risk of exposing sensitive information remains a significant concern. The dependency on uninterrupted internet connectivity also restricts these solutions from functioning effectively in all scenarios.

Advancements in machine learning, speech synthesis, face generation, retrieval-based memory systems and on-device computing have created an opportunity to design a system capable of functioning as a meaningful digital extension of the user. Instead of acting as a simple tool, such a system can adapt its communication style, recall previous interactions and autonomously participate in professional activities while maintaining complete data privacy. These innovations have laid the foundation for the concept of a Self-Adaptive Agentic Personal AI Clone that not only imitates the user's voice and facial expressions but also aligns with their decision-making patterns and work preferences.

The background for this project therefore lies in bridging the gap between limited, cloud-dependent AI assistants and the need for a secure, context-aware, self-improving agent capable of representing an individual in academic and professional environments. With advancements in edge computing, compact language models and multimodal synthesis, it is now feasible to build an on-device autonomous clone that enhances productivity while safeguarding confidentiality and personal identity.

4. FEASIBILITY STUDY

Four major dimensions were examined to determine the feasibility of developing and implementing the Self-Adaptive Agentic Personal AI Clone: technical feasibility, economic feasibility, operational feasibility and legal feasibility. These factors ensure that the system can be built realistically and can function effectively in real academic and professional environments.

4.1. Technical Feasibility

The proposed system is technically feasible because the technologies required to implement it already exist and are accessible. Recent advancements in edge computing and compact language models allow multimodal AI (voice, face and text) to run directly on laptops and mobile devices without cloud dependency. Retrieval-Augmented Generation supports contextual memory, and LoRA-based adaptation enables the AI clone to learn user communication style without heavy computational requirements. Distributed inference between devices further ensures fast processing and real-time performance. Therefore, the system can be developed with current hardware and open-source software.

4.2 Economic Feasibility

The system is economically feasible because it does not depend on expensive commercial platforms or paid cloud services. All processing takes place on the user's personal devices, removing the need for additional infrastructure. The reliance on open-source tools significantly reduces development cost. In the long term, the

system can also help decrease institutional workload associated with administrative meetings, assignment evaluation and viva scheduling, leading to indirect cost savings.

4.3 Operational Feasibility

The project demonstrates strong operational feasibility because it aligns with the actual working environment of educators and professionals. The clone supports tasks such as attending meetings, conducting viva examinations, reviewing assignments and assisting students without changing existing institutional procedures. Since the system reflects the user's natural voice, behaviour and communication pattern, no special training or technical expertise is required to operate it. Full on-device execution builds trust and encourages adoption because the user remains in control of personal and academic data.

4.4 Legal Feasibility

The legal feasibility of the system is ensured through complete on-device processing of data. No audio, video or text information is transferred to external cloud servers, which protects sensitive academic records, student submissions and personal communications from unauthorized access. This approach supports data privacy policies followed by educational institutions and prevents ethical concerns related to identity misuse. The user retains full ownership of their digital identity and decides where and how the clone can be used.

5. STUDY OF EXISTING SOLUTIONS/LITERATURE SURVEY

The current landscape of AI-powered virtual assistants and meeting tools reveals several categories of solutions, each addressing different aspects of digital presence and automation, but none providing comprehensive personal representation.

- A. **Cloud-Based Virtual Assistants:** Google Gemini Live and Microsoft Copilot represent the current state-of-the-art in conversational AI systems. These platforms offer sophisticated natural language processing capabilities and can handle complex, multi-turn conversations. However, they operate exclusively in cloud environments, creating latency issues and privacy concerns. Research by Singh et al. demonstrates that cloud-based systems introduce significant delays that are unacceptable for real-time applications.
- B. **Voice Cloning Technologies:** Eleven Labs and similar platforms have achieved remarkable progress in voice synthesis, capable of generating highly realistic voice clones from minimal audio samples. Studies show that modern voice cloning systems can create convincing replicas using as little as three seconds of audio. However, these solutions are primarily cloud-based and focus solely on voice synthesis without integration of personality or decision-making capabilities.
- C. **Meeting Automation Tools:** Platforms like, Fireflies, and IndiqAI UltiMeet provide transcription, analysis, and summarization of meetings. These tools excel at passive information processing but lack the capability to actively participate in meetings or represent the user. Research indicates that while these tools improve meeting productivity, they cannot replace human presence or decision-making.
- D. **Video Avatar Systems:** Synthesia and similar platforms create lip-synced video avatars from scripted text. These systems demonstrate the feasibility of real-time face synthesis but are limited to pre-written content and cannot engage in spontaneous conversations or make autonomous decisions.
- E. **Edge AI and Distributed Inference:** Recent research by Moussa et al. introduces the concept of Data and Dynamics-Aware Inference and Training Networks (DA-ITN), providing frameworks for distributed AI processing. This work demonstrates the feasibility of moving AI inference closer to data sources, reducing latency

and improving privacy. Studies by Zhang et al. on privacy-preserving speech synthesis show that edge-based processing can effectively protect user voice data from unauthorized cloning.

- F. **Parameter-Efficient Fine-Tuning:** The emergence of Low-Rank Adaptation (LoRA) techniques has transformed the fine-tuning of large language models. Research shows that LoRA can achieve results akin to fully fine-tuning while requiring orders of magnitude less compute power, making patronizable AIs feasible for edge computing.
- G. **Retrieval-Augmented Generation (RAG):** Research in RAG systems shows large gains in AI accuracy and relevance through the coupling of language models and external knowledge bases. By using a RAG approach, this improves the shortfall of static training data and the availability of more recent and situational information.

6. Comparison with Existing Software Solutions

A comprehensive analysis of existing solutions reveals significant limitations that our proposed system aims to address:

Feature	Google Gemini Live	ElevenLabs	<u>Fireflies.ai</u>	Synthesia	Our Solution
Deployment	Cloud-only	Cloud-only	Cloud-only	Cloud-only	100% Edge-based
Modality	Voice/Text	Voice only	Audio transcription	Video/Text	Multi-modal (Voice, Face, Text)
Personalization	Limited	Static cloning	Generic summaries	Scripted content	Adaptive learning
Privacy	Data transmitted	Data transmitted	Data transmitted	Data transmitted	Complete local processing
Autonomy	Reactive	Passive synthesis	Passive recording	Scripted playback	Autonomous decision-making
Real-time Response	Network dependent	Network dependent	Post-meeting only	Pre-scripted	Instant local processing
Memory	Session-based	No memory	Meeting-specific	No memory	Long-term hierarchical
Cost	Subscription model	Pay-per-use	Subscription model	Pay-per-video	One-time setup

- a) **Comparison of Performance:** Studies have shown that distributed inference systems can deliver 2-5 times faster response times than cloud solutions with complete avoidance of network latency. Research published on Small Language Models reveals that an edge deployment with optimized algorithms can maintain 70-90% of the full model accuracy with 75% less memory.
- b) **Considerations Regarding Privacy:** Current third-party cloud-based solutions expose the user's data and raises the risk of data leaks and unauthorized access. The research conducted by Kurniawan et al. illustrates the importance of privacy-preserving machine learning in an edge computing context. Our local processing approach totally mitigates these risks by ensuring that sensitive data remains on the user's devices.
- c) **Summary Related to Scalability:** Unlike cloud solutions which will have moments of bottlenecks during peak- usage, an edge-deployed system scales inherently to the number of devices being used. Since each user's AI clone works independently of other user's clones and never competes for a shared resource, performance is unaffected regardless of system-wide usage.

7. GAP ANALYSIS

Six significant gaps that are not sufficiently addressed by current technologies are revealed by the examination of literature and existing solutions:

- A. Cloud Dependency and Privacy Risks:** Because of their heavy reliance on cloud infrastructure, current solutions have a high carbon footprint and privacy vulnerabilities. Zhang et al.'s studies show that unapproved voice cloning attacks can affect cloud-based voice processing systems. Existing solutions violate privacy principles and legal requirements by requiring users to send sensitive personal data to third-party servers.
- B. Limitations of Single Modality:** The majority of existing solutions concentrate on one modality, such as text processing, voice synthesis, or face generation, but are unable to combine these skills in a coherent manner. According to research, multi-modal AI systems perform noticeably better in terms of user acceptability and efficacy than single-modality approaches.
- C. Lack of Long-term Personalization:** Existing systems provide static or periodic cloud retraining but fail to adapt continuously to user preferences and communication patterns. Studies on personalization in AI systems indicate that users require adaptive systems that evolve with their changing preferences and contexts[9][10].
- D. Limited Autonomous Capabilities:** Current meeting bots can only transcribe and analyze but cannot actively participate, make decisions, or represent the user's interests. Research demonstrates that passive AI tools provide limited value compared to autonomous agents capable of decision-making[4].
- E. Generic Response Generation:** Existing productivity tools generate generic summaries and insights that lack personalization and contextual awareness. Studies show that personalized AI responses achieve significantly higher user satisfaction and effectiveness.
- F. Scalability and Cost Issues:** Cloud-based solutions face scalability bottlenecks and require ongoing subscription costs, making them economically unsustainable for many users. Research on edge computing demonstrates superior scalability and cost-effectiveness for personalized AI applications.

Our proposed solution addresses these gaps through 100% on-device inference with compact Small Language Models[14], integrated multi-modality combining real-time voice, face, and decision-making capabilities, two-stage memory system using RAG for short-term memory and LoRA adapters for evolving personality[10], autonomous virtual presence that can attend, respond, and make decisions independently, personalized insights and context-aware responses tailored to individual users[11], and local data processing with encrypted storage and distributed inference architecture[12][13].

8. PROBLEM STATEMENT

The increasing dependence on digital platforms in academic institutions has resulted in educators and professionals being responsible for multiple parallel tasks, such as conducting lectures, attending administrative and departmental meetings, evaluating assignments, interacting with students, managing research activities and maintaining institutional documentation. These responsibilities often occur at the same time, and each task requires focused attention, clear communication and timely decision-making. As a result, it becomes difficult for a single individual to be present in every activity simultaneously with consistent productivity, leading to high stress, mental workload and reduced efficiency.

Although several artificial intelligence tools exist for transcription, summarization, voice cloning and meeting notes, they work only as partial assistive solutions and do not address the full scope of the problem. These tools cannot actively participate in meetings, understand contextual history, communicate in the user's tone or take decisions on their behalf. Their functioning is limited to passive listening or scripted responses, and they cannot replace the physical or digital presence of an educator in professional interactions. Moreover, since most of these systems operate through cloud servers, they require continuous data transmission, which raises privacy concerns when dealing with confidential institutional information and student records.

Because of these limitations, educators and academic professionals continue to experience excessive workload, have difficulty managing overlapping commitments and struggle to balance administrative duties with teaching, research and student mentoring. The lack of an autonomous system that can act as a digital extension of the user results in inefficient use of time and increases dependency on manual effort. Therefore, there is a clear need for a system that can securely replicate the user's presence, communication behaviour and decision-making capability, while functioning locally on personal devices to ensure privacy and confidentiality. Such a solution should operate autonomously, learn user preferences over time and support educators in reducing workload while maintaining the quality of academic and administrative interactions.

9. OBJECTIVES

In order to help educators better manage their academic, administrative, and professional obligations while protecting data privacy and minimising reliance on cloud services, this project aims to design and prototype an on-device, self-adaptive AI clone. The project's goal is to combine developments in knowledge retrieval, computer vision, speech processing, and natural language processing into a single system that can represent the user in everyday situations.

- A. Enable On-Device AI Execution:** Implement compact large language models (LLMs) and supporting pipelines (speech recognition, video generation, OCR) that can run entirely on personal devices such as laptops and mobile phones. This ensures that sensitive academic data—emails, chats, assignments, meeting notes—remains private and under the direct control of the user, eliminating reliance on cloud-based servers.
- B. Develop Voice and Face Cloning Models:** Create lightweight yet effective models for real-time replication of the teacher's voice tone, style, and face animation, enabling the clone to actively participate in meetings, conferences, or oral examinations. These models will prioritize efficiency so they can run on edge devices without compromising latency or quality.
- C. Build Retrieval-Augmented Generation (RAG) with Knowledge Graphs:** Design a local, hierarchical memory system that organizes personal and academic data into structured graphs. This will enable the AI clone to answer questions, recall past interactions, and provide contextual decision-making support, aligned with the teacher's own communication and teaching philosophy.
- D. Prototype Distributed Inference Across Devices:** Introduce a hardware-assisted mechanism where a mobile device can trigger a laptop via Bluetooth when higher computational power is needed. This distributed workflow allows the phone to manage lightweight tasks while offloading heavier inference to the laptop, ensuring both efficiency and responsiveness in real-world usage.
- E. Address Teacher-Specific Use Cases:** Tailor the system to core academic needs, such as (a) automating administrative meeting participation and note-taking, (b) reviewing and filtering large volumes of student assignments, (c) conducting viva and oral examinations with consistency, (d) extending virtual office hours for students, and (e) representing the teacher in grant proposal meetings, funding presentations, or

academic conferences.

- F. Promote Sustainability and Efficiency:** Achieve significant reductions in energy consumption and carbon footprint by avoiding reliance on large-scale data centers. By leveraging compact, open-source models and distributed inference on personal devices, the system aims to deliver an eco-friendly and cost-effective alternative to conventional cloud-hosted AI solutions.

Together, these objectives focus on building a practical yet forward-looking system that not only addresses current gaps in personalization, privacy, and efficiency but also demonstrates how edge AI clones can transform the productivity and presence of teachers in both academic and professional environments.

10. TOOLS AND PLATFORM USED

The development of the Self-Adaptive Agentic Personal AI Clone involved a combination of programming languages, machine learning frameworks, model customization tools, retrieval systems and development platforms. Each tool was chosen considering the requirements of on-device AI execution, multimodal processing, privacy-preserving memory and adaptive behaviour.

- A. Programming Languages:** Python was used to develop the core AI pipeline, including model loading, pre-processing, retrieval modules and personality fine-tuning. It was selected due to its strong machine learning ecosystem and rapid prototyping capabilities. JavaScript / Node.js was used where lightweight user interface components or local API endpoints were required for device-level interaction.
- B. Machine Learning Frameworks:** PyTorch served as the primary framework for training, loading and fine-tuning Small Language Models (SLMs), speech synthesis models and face-generation components. TensorFlow/Keras was used selectively for performance comparison and experimentation with alternative lightweight models suitable for edge devices.
- C. Model Personalization and Optimization Tools:** LoRA (Low-Rank Adaptation) was used for parameter-efficient fine-tuning to match the clone with the user's communication patterns without requiring high computational resources. GGUF and other quantization toolkits were used to compress models for real-time on-device execution while maintaining model performance.
- D. Retrieval and Memory Systems:** Vector databases such as ChromaDB or FAISS were implemented to support Retrieval-Augmented Generation (RAG) and enable long-term contextual memory retention. Sentence Transformer-based embedding models were used to convert documents and conversations into vector representations for efficient memory lookup.
- E. Speech and Voice Technologies:** On-device Text-to-Speech (e.g., Coqui TTS or other lightweight engines) was used to generate real-time personalized speech output. A small speaker-embedding voice cloning toolkit was incorporated to create a secure voice clone without uploading audio to cloud servers.
- F. Face and Avatar Generation Tools:** Diffusion-based avatar models were used to generate facial animation and lip synchronization for video-based presence. MediaPipe and OpenCV were used for facial tracking, expression alignment and video rendering.
- G. Development and Execution Platforms:** A local laptop or desktop served as the main execution environment for training, testing and inference to maintain complete privacy and eliminate cloud dependency. Google Colab and Jupyter Notebook were used during the experimental phase for prototyping, testing models and comparing

performance.

- H. Version Control and Documentation:** Git and GitHub were used to maintain version control, track improvements and support team collaboration. Microsoft Word and Google Docs were used to prepare technical documentation, reports and evaluation submissions.
- I. Additional Development Tools:** Postman and similar API testing tools were used to test communication between system modules. VS Code and PyCharm served as the primary IDEs for coding, debugging and integration of project components.

11. DESIGN METHODOLOGY (WORKFLOW+ARCHITECTURE)

The design methodology for the Self-Adaptive Agentic Personal AI Clone follows a structured, modular and iterative process to ensure reliable functioning, privacy-focused execution and smooth integration of multiple AI components. The methodology covers requirement analysis, system architecture planning, model integration, personalization, testing and workflow optimization.

11.1. Requirement Analysis

The project began with identifying the key requirements of educators who manage online classes, meetings, viva evaluations and administrative tasks. The need for an autonomous assistant that can reflect user behaviour, communicate independently, and maintain privacy shaped the system's functional and non-functional requirements.

11.2. System Architecture Planning

A modular architecture was designed to integrate language models, voice synthesis, face animation, retrieval systems and device-level processing. The architecture supports multimodal interactions and ensures secure, on-device execution. Distributed inference was planned to divide processing loads between the laptop and mobile device.

11.3. Data Collection and Preprocessing

Voice samples, communication style examples and reference text data were collected with user consent. Audio was cleaned and normalized for speaker embedding extraction, while text data was processed to learn user tone, vocabulary and communication pattern. All data was stored locally to maintain privacy.

11.4. Model Selection and Integration

Lightweight and efficient models were selected to support on-device execution. Small Language Models handled reasoning and conversation. Speaker embedding models enabled voice cloning. Diffusion-based modules supported face generation, while the RAG system provided contextual memory. These models were integrated into a unified multi-modal pipeline.

11.5. Personalization Using LoRA

LoRA-based fine-tuning was applied to personalize the language model according to the user's style of speaking and decision-making. This technique allowed the system to learn behavioural patterns with minimal computational resources, enabling real-time personalization.

11.6. On-Device Execution Setup

Model quantization and optimization strategies were applied to reduce size and improve performance on laptops and mobile devices. No part of the system relies on external servers, which ensures full privacy and zero cloud dependency.

11.7. Implementation of Distributed Inference

Distributed inference strategies were implemented to divide tasks between devices. High-compute tasks such as face animation and language reasoning were executed on the laptop, while mobile devices handled audio capture, lightweight processing and user interaction. This ensured stable, low-latency performance.

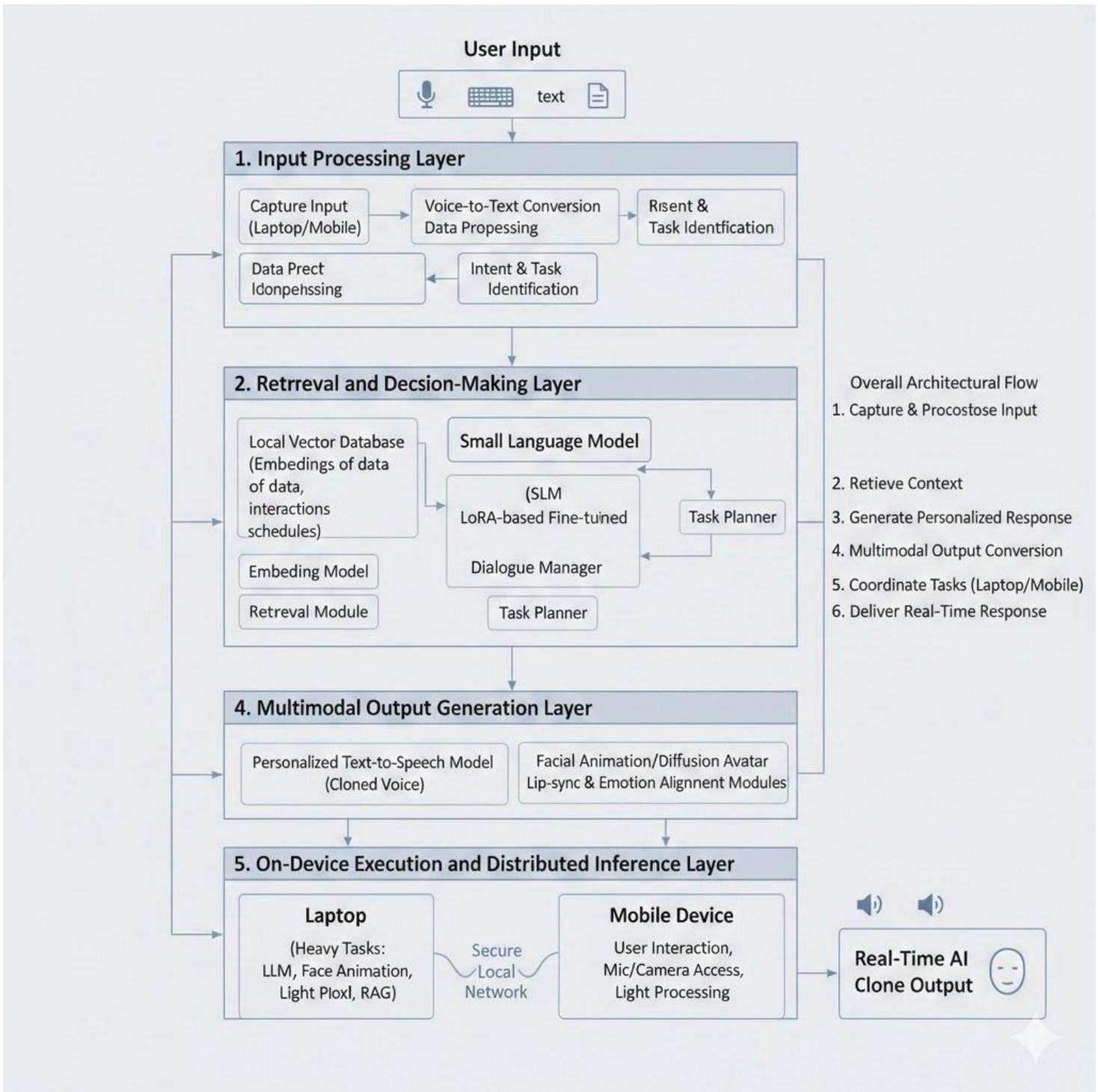
11.8. Testing and Evaluation

Each module was tested independently before evaluating the system as a whole. Voice similarity, facial animation quality, response relevance, memory accuracy and interaction speed were examined. Latency measurements ensured smooth performance during live academic tasks.

11.9. Iterative Improvement

Based on test results, system components were refined. LoRA fine-tuning was updated, memory entries were expanded, retrieval accuracy improved and device communication optimized. The system was iteratively enhanced until stable operation was achieved.

WORKFLOW OF THE AI SYSTEM



The workflow of the Self-Adaptive Agentic Personal AI Clone consists of a sequence of well-defined steps that enable real-time multimodal interaction. The process is designed to ensure privacy, contextual accuracy and seamless performance across devices.

- **User Input Capture:** The system receives voice, text or task instructions from the user through either the laptop or mobile interface.

- **Context Retrieval Through RAG:** The system fetches relevant past interactions, documents or memory entries from the local vector database to understand context.
- **Language Model Reasoning:** The Small Language Model processes the input along with retrieved context to generate accurate and personalized responses.
- **Personality Alignment:** LoRA fine-tuned layers adjust the generated response to match the user's communication style, tone and behaviour.
- **Voice and Face Generation:** The system converts the response into the user's cloned voice and generates synchronized facial animation for digital presence.
- **Distributed Inference Execution:** The laptop handles resource-heavy tasks such as voice and face generation, while the mobile device manages lightweight interaction.
- **Output Delivery:** The final response, voice or video avatar is presented as the AI clone's output, ready for meetings, student interactions or administrative tasks.
- **Technological Innovation Highlights:** The Self-Adaptive Agentic Personal AI Clone introduces several technological innovations that distinguish it from existing digital assistants and meeting tools.
- **Fully On-Device Multimodal AI Execution:** The entire system operates locally on personal devices, ensuring privacy and eliminating dependency on cloud servers.
- **Autonomous Personal Representation:** The system is capable of representing the user independently in meetings, viva evaluations and academic discussions.
- **Integrated Multimodal Framework:** Combines language modelling, voice cloning, face animation, contextual memory and reasoning within one cohesive platform.
- **Distributed Inference Mechanism:** Dynamic allocation of tasks between laptop and mobile enhances speed and responsiveness.
- **Behaviour and Personality Modelling Through LoRA:** The AI clone adapts to the user's communication style with efficient fine-tuning, enabling realistic interaction.
- **Retrieval-Augmented Memory System:** RAG provides accurate contextual understanding using local data storage, supporting personalized and informed responses.
- **Privacy-Preserving Architecture:** All data — including voice, text and meeting content — remains strictly stored and processed on devices under user control.

12. EXPECTED OUTCOMES

The expected outcomes of this project include the successful design, development, and demonstration of a self-adaptive, privacy-preserving AI clone for teachers. The system will integrate speech, vision, NLP, and distributed inference modules into a single framework capable of reducing academic workload, improving meeting productivity, and enabling sustainable AI deployment. The key outcomes are as follows:

- Working Prototype of AI Clone:** A functional system capable of replicating a teacher's voice, face, and communication style in real-time scenarios such as meetings, vivas, and conferences.
- Retrieval-Augmented Memory System:** A hierarchical RAG framework using vector databases and knowledge graphs to store and recall academic records, past interactions, and contextual insights, enabling the AI to provide personalized and context-aware responses.
- Distributed Inference Prototype:** Demonstration of a phone–laptop collaborative inference mechanism, where lightweight tasks run on the phone and resource-heavy inference is dynamically offloaded to the laptop, triggered via Bluetooth.

- D. Meeting Productivity Tools:** Automated note-taking, decision tracking, accountability mapping, and productivity measurement, along with personalized meeting summaries reflecting the teacher's style and priorities.
- E. Teacher-Centric Use Case Validation:** Application of the system across key academic tasks, including assignment filtering, viva automation, extended office hours, grant proposal presentations, and conference participation, showing measurable reductions in workload.
- F. Performance Benchmarks:** Evaluation of system performance in terms of speed, accuracy, personalization quality, and latency, ensuring practical usability for educators.
- G. Documentation & Knowledge Contribution:** Comprehensive documentation of methods, integration pipeline, and testing results, serving as a foundation for future research in on-device AI clones and distributed inference systems.

The screenshot shows the 'Auto-Lab Grader Pro' interface within the EduAssist platform. On the left sidebar, 'Lab Manuals' is selected. The main area displays three steps: 1. Mandatory Reference Material (with fields for 'Empty Template File' and 'Ideal Solution'), 2. Grading Rules (with 'CLASS / SECTION' set to 'AIML-A' and 'EXP. COUNT' set to '12'), and 3. Import Student Files (with 'Google Drive Import' and 'Local Folder Upload' tabs, and a 'Fetch' button). A status bar at the top right indicates 'System Online', 'Support', and 'JD'. A user profile for 'nischal sharma' is visible on the left.

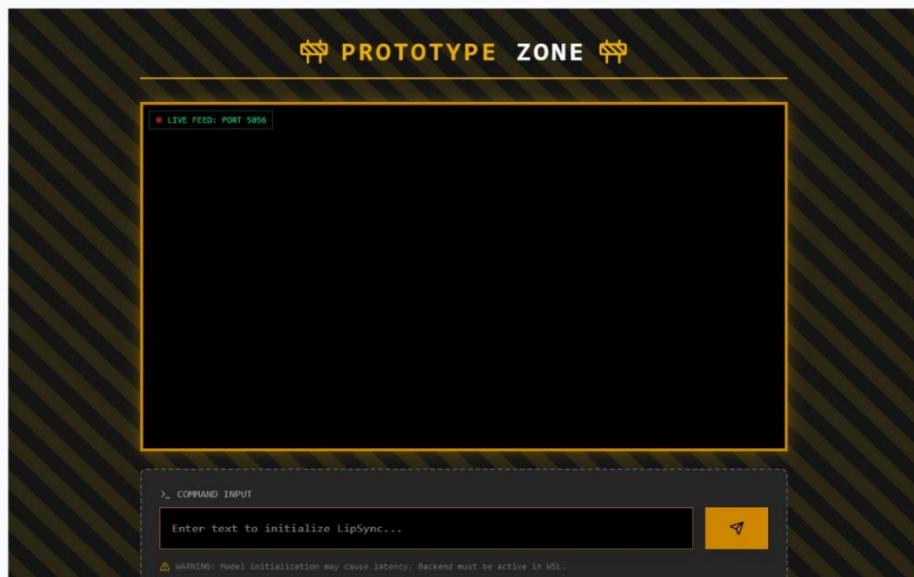
The screenshot shows the 'Assignment AI Grader' interface within the EduAssist platform. On the left sidebar, 'Assignment Checker' is selected. The main area displays two steps: 1. Evaluation Settings (with 'DIFFICULTY LEVEL' set to 'MEDIUM', 'DEADLINE' set to 'dd-mm-yyyy --:-', 'LATE PENALTY (%)' set to '10', and a note about 'Text-Only Check'), and 2. Import Submissions (with 'Drive' selected and a 'Fetch' button). A status bar at the top right indicates 'System Online', 'Support', and 'JD'. A user profile for 'nischal sharma' is visible on the left.

-  Dashboard
-  Calendar
-  Assignment Checker
-  Lab Manuals
-  Meeting Assistant
-  Settings

**nischal sharma**
Developer

[Sign Out](#)





Good Morning, Professor.

Saturday, November 29



"Death is the easiest of all things after it, and the hardest of all things before it."

— ABU BAKR (R.A.)

ATTENTION NEEDED
4
Classes to be rescheduled

QUICK NOTE
Type a reminder here...

GRADING UPDATE
100%
Lab manuals assessed

View All Notifications

 **Operating Systems**
3rd Year CSE • 54 Students

 **Programming in Python**
2nd Year • 60 Students

 **DBMS**
3rd Year • 48 Students

Gurugram



12° C

3.6 km/h Wind

Humidity High

Today's Agenda

3 Events

erg 09:00 • default

ily 09:00 • default

hi 09:00 • default

Latest Updates

Technology AI Science Education

Apple kicks off its official 2025 Black Friday Shopping Event - 9to5Mac

EduAssist

System Online | Support | JD

Today's Agenda 3 Events

- erg 09:00 • default
- ijy 09:00 • default
- hi 09:00 • default

Latest Updates

Technology AI Science Education

- Apple kicks off its official 2025 Black Friday Shopping Event - 9to5Mac 28/11/2025
- Best Black Friday TV deals 2025: Samsung, LG, TCL, and Hisense at record lows - Mashable 28/11/2025
- Walmart's Black Friday laptop deals are wild this year — our TOP picks - Windows Central 27/11/2025
- Black Friday AirPods 4 and AirPods Pro deals: Apple's latest now at the best prices ever from \$6... 28/11/2025
- All of the best Black Friday deals: Google Pixel gear, Nest, Samsung Galaxy, tech accessories, mo... 28/11/2025

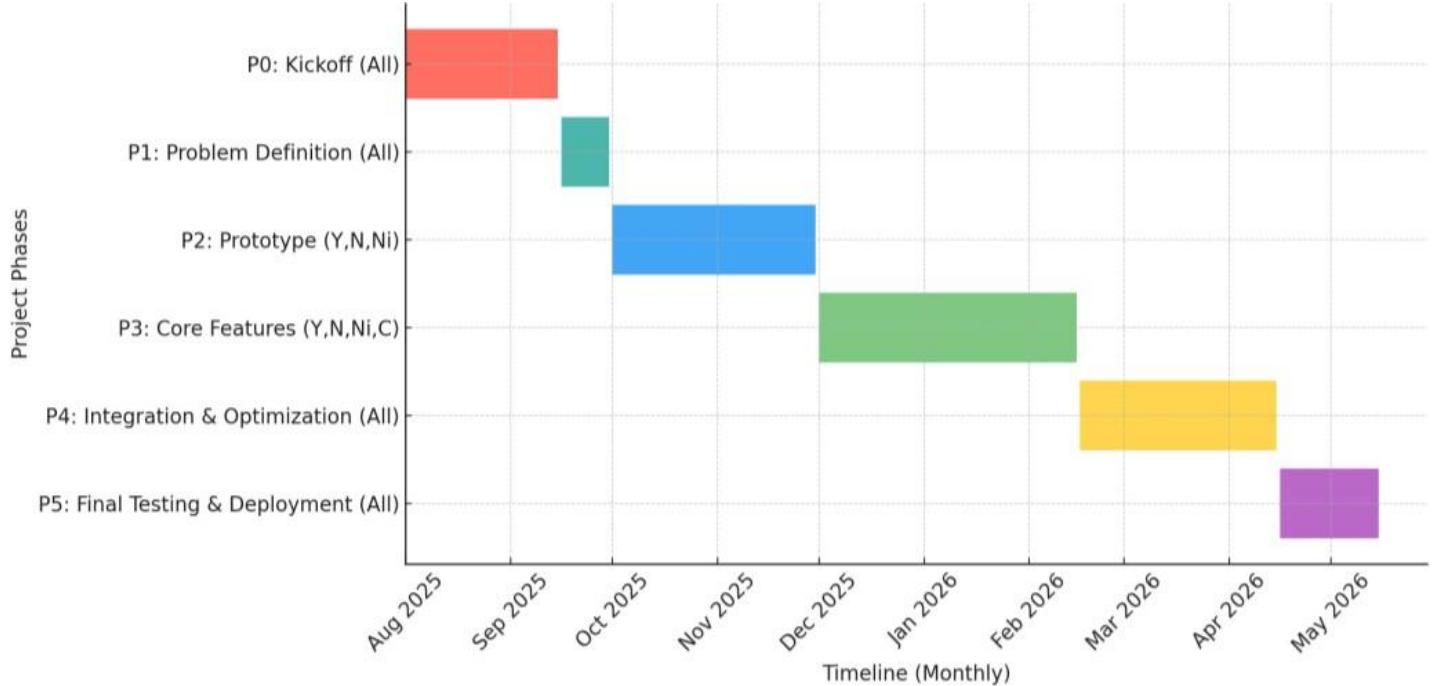
Operating Systems
3rd Year CSE • 54 Students
+ Create Assignment View Students Set Reminders

Programming in Python
2nd Year • 60 Students

DBMS
3rd Year • 48 Students

13. GANTT CHART

Project Timeline: August 2025 - May 2026



14. RESPONSIBILITY CHART

Phase	Tasks	Computer Vision & Edge Computing	Speech Processing & Deep Learning	NLP, OCR & AI Applications	Large Models	Language & Knowledge Retrieval
	Person(s)	Nischal	Yashika	Nikhil	Chahat	
Kickoff & Setup	Literature survey (voice, video, RAG, edge inference)	A, R	R	R	A, C	
	Dataset collection & preprocessing	A, R	R	R	C	
	Tool & framework selection	A, R	C	C	A, R	
Model Development	Video Cloning Model (face + lip-sync)	A, R	C	I	C	
	Audio Cloning Model (few-shot voice replication)	C	A, R	I	C	
	Handwriting-to-Text (OCR + NLP pipeline)	C	I	A, R	C	
	LLM Query Answering (RAG)	C	I	C	A, R	
	Distributed Inference Module (multi-device partitioning)	A, R	C	C	A, C	
Integration & Prototype	Step 1–2: Audio + Video cloning integration	A, R	A, R	I	C	
	Step 3–4: Query answering + cloned modules	C	C	C	A, R	
	Step 5–6: RAG creation & testing	C	I	C	A, R	
	Step 7–8: Full integration + latency optimization	A, R	C	C	A, R	
	Step 9: Training text-style cloning	I	C	A, R	A, R	
	Step 10–12: System integration, auto data collection, reinforcement learning	A, R	C	C	A, R	
Testing & Deployment	Unit testing of each model	A, R	A, R	A, R	A, R	
	End-to-end workflow validation	A, R	C	C	A, R	
	Performance evaluation (speed, accuracy, personalization)	A, R	A, R	A, R	A, R	
	Documentation, report & final presentation	C	C	C	A, R	

15. MARKET ANALYSIS AND SWOT ANALYSIS

The increasing use of digital platforms for academic communication, online meetings, remote evaluations and administrative coordination has created a significant market opportunity for privacy-focused intelligent assistants. Current AI tools offer conversation, transcription or avatar features separately, but there is no unified system that provides autonomous representation of a user while being fully privacy-preserving and on-device. The Self-Adaptive Agentic Personal AI Clone addresses this gap by combining speech, face animation, memory, reasoning and personality modelling into a single deployable system.

15.1. Market Need Analysis

15.1.1. Growing Digital Academic Workflows

Educational institutions increasingly rely on digital platforms for meetings, viva examinations, assignment evaluations, student support and documentation. Faculty often face workload stress due to overlapping responsibilities, creating a demand for intelligent automation tools.

15.1.2. Demand for Privacy-Preserving AI

Most available AI assistants operate on cloud servers, raising privacy, data leakage and institutional compliance concerns. There is strong market demand for AI systems that work fully on-device without sharing sensitive academic or personal data externally.

15.1.3. Need for Personalized and Autonomous Communication

Existing AI tools generate generic responses and lack the ability to represent a user's voice, face or communication behaviour. Institutions require tools that can:

- a) Maintain Continuity In Academic Decisions,
- b) Follow A User's Style,
- c) Interact Independently In Meetings Or Viva Panels.

15.1.4. Remote and Hybrid Education Growth

Post-pandemic educational models continue to incorporate hybrid and remote practices. This shift increases the need for autonomous digital agents that can aid in coordination, student support and administrative tasks.

15.1.5. Market Gap in Unified Multimodal AI Systems

Solutions like Gemini, Copilot, Otter.ai, ElevenLabs and Synthesia provide partial features but do not integrate reasoning, memory, multimodal output and autonomous participation into one on-device system. This gap creates a strong niche opportunity.

15.2. Market Differentiators

The Self-Adaptive Agentic Personal AI Clone stands out in the market due to the following unique features:

15.2.1. Fully On-Device Execution

Unlike cloud-based assistants, the system ensures complete data privacy by processing all information on personal devices. This is a major differentiator for educational institutions handling confidential data.

15.2.2. Autonomous Digital Representation

The system can participate in meetings, viva sessions and evaluations independently — something no current tool or assistant offers.

15.2.3. Multimodal Personalization

The AI clone integrates:

- a) voice cloning,
- b) face animation,
- c) personality modelling,
- d) memory-based reasoning.

This unified multimodal capability differentiates it from single-function tools.

15.2.4. Distributed Inference for Real-Time Performance

Execution is intelligently split between laptop and mobile, providing low latency and smooth operation even without cloud servers.

15.2.5. RAG-Based Contextual Memory

The system remembers past interactions, academic details, and documents using Retrieval-Augmented Generation, enabling high contextual relevance.

15.2.6. Ethical and Privacy-Focused Architecture

The system aligns with institutional data governance rules, making it suitable for academia unlike commercial AI assistants.

15.3. SWOT ANALYSIS

Strengths	Weaknesses
Fully on-device processing ensures strong privacy and security.	Requires sufficient device hardware for smooth multimodal processing.
Autonomous user representation in meetings and academic tasks.	Initial setup and model personalization may require time.
Multimodal integration (voice, face, reasoning, memory).	Limited scalability for extremely heavy workloads compared to cloud servers.
Highly personalized communication through LoRA tuning.	Requires user training data for accurate behaviour modeling.
Low recurring cost due to no cloud subscription.	Running multiple models locally may affect battery life on mobile devices.
Opportunities	Threats
Growing adoption of AI in education, administration and remote work.	Competition from rapidly advancing commercial AI assistants.
Potential expansion to healthcare, customer service or enterprise collaboration.	Rapid changes in AI regulations may require compliance updates.
Increasing demand for privacy-preserving AI solutions globally.	Misuse of voice/face cloning technologies by unethical actors.
Integration with institutional LMS, ERP and HR systems.	Dependence on hardware performance and compatibility issues.

16. APPLICATION IMPACT AND SDG MAPPING

The Self-Adaptive Agentic Personal AI Clone offers wide-ranging applications across academic, administrative, professional and remote working environments. Its on-device, privacy-preserving architecture ensures that the system can be used responsibly while delivering meaningful technological, educational and institutional impact. The system also aligns with several United Nations Sustainable Development Goals (SDGs) by promoting quality education, digital innovation, responsible data practices and institutional efficiency.

16.1. Applications of the AI System

16.1.1. Academic Administration

The AI clone can autonomously participate in faculty meetings, generate summaries, manage administrative coordination and assist in documentation. This reduces faculty workload and enhances administrative efficiency.

16.1.2. Remote Viva and Examination Support

The system can assist or represent faculty members during viva examinations, conduct preliminary questioning, evaluate responses based on stored criteria and maintain logs of interactions.

16.1.3. Student Support and Mentoring

The AI agent can conduct doubt-clearing sessions, offer personalized feedback, explain lecture content and provide immediate assistance to students even outside faculty working hours.

16.1.4. Research and Documentation Assistance

The AI clone retrieves research material, drafts documentation, organizes data and helps in literature review—making the research workflow more efficient.

16.1.5. Professional and Corporate Meetings

Outside academia, the system can represent professionals in meetings, deliver reports, or summarize discussions—particularly useful for individuals managing multiple simultaneous responsibilities.

16.1.6. Accessibility Enhancement

For users with disabilities, health issues or mobility limitations, the AI clone acts as a digital extension capable of communication and presence on their behalf.

16.1.7. Training and Learning Modules

The system can act as a personalized digital tutor, helping students and professionals learn faster through multimodal explanations and interactive guidance.

16.2. Application Impact

16.2.1. Improved Efficiency and Productivity

By automating repetitive and time-consuming tasks, educators and professionals can focus on high-value activities such as research, mentorship and strategic planning.

16.2.2. Enhanced Student Learning Experiences

Immediate assistance, personalized guidance and consistent feedback elevate the quality of learning for students and reduce delays in academic communication.

16.2.3. Better Data Privacy and Ethical Compliance

With local, on-device processing, the system eliminates data exposure to third-party cloud services and ensures safer digital communication.

16.2.4. Reduced Workload and Burnout

By assisting with scheduling, evaluation and communication, the system supports better mental well-being for faculty and staff.

16.2.5. Promotion of Digital Literacy

Using advanced AI tools encourages academic institutions to adopt modern technologies responsibly and strengthen digital competency.

SDG MAPPING

The AI clone contributes to global development priorities by supporting responsible AI adoption, privacy protection, efficient institutions and inclusive education. The system aligns with multiple Sustainable Development Goals, as highlighted below.

SDG Goal	SDG Title	Relevance to the AI Clone System
SDG 4	Quality Education	Enhances personalized learning, improves student support, assists in academic evaluations and makes education more accessible.
SDG 8	Decent Work and Economic Growth	Improves productivity, reduces workload stress and supports efficient academic operations.
SDG 9	Industry, Innovation and Infrastructure	Promotes innovation in edge AI, distributed inference and responsible digital transformation.
SDG 10	Reduced Inequalities	Provides accessibility support for faculty or students with disabilities or time constraints.
SDG 11	Sustainable Communities	Supports sustainable digital practices through energy-efficient on-device AI.
SDG 12	Responsible Consumption and Production	Reduces reliance on high-energy cloud infrastructure and encourages sustainable digital usage.
SDG 16	Peace, Justice and Strong Institutions	Supports transparent documentation, improves governance, ensures privacy compliance and prevents misuse of sensitive data.
SDG 17	Partnerships for the Goals	Enables scalable AI models that can integrate with educational platforms, research collaborations and administrative systems.

17. RISK ANALYSIS AND FUTURE PLANNING

The development and deployment of the Self-Adaptive Agentic Personal AI Clone involve technological, operational, ethical and organizational risks. A structured risk analysis helps identify potential challenges and define strategies to mitigate them. Future planning ensures the system can be improved, scaled and adapted to emerging requirements in academic and professional environments.

17.1. RISK ANALYSIS

The following risks have been identified during the development of the system:

17.1.1. Technical Risks

On-device execution may face limitations due to hardware constraints, model size or latency issues. Inadequate optimization may affect performance, particularly during multimodal tasks such as face generation.

17.1.2. Data Privacy and Ethical Risks

Although the system is designed for on-device processing, any future extension involving network communication or collaboration features must strictly maintain user privacy. Misuse of voice or face cloning by unauthorized individuals poses ethical concerns.

17.1.3. Operational Risks

Users may face difficulties during initial setup or personalization, especially if they lack sufficient technical knowledge. Additionally, reliance on distributed inference means that unstable local network connections could affect system performance.

17.1.4. User Behaviour Modelling Risks

Inaccurate LoRA fine-tuning or insufficient training data may result in responses that do not accurately represent the user's behaviour, potentially causing miscommunication in academic or professional settings.

17.1.5. Security Risks

Local devices may be vulnerable to malware, unauthorized access or system-level vulnerabilities. Compromised devices could result in exposure of model files and memory data.

17.1.6. Institutional Acceptance Risks

Academic institutions may be cautious in adopting autonomous AI systems due to concerns related to evaluation integrity, ethical standards or policy compliance.

RISK ANALYSIS TABLE

Risk Category	Description of Risk	Impact Level	Mitigation Strategy
Technical	Limited hardware capability may reduce performance during real-time processing.	Medium	Use quantized models, optimize pipelines, provide device-specific configurations.
Data Privacy	Possibility of misuse of cloned voice/face data.	High	Enforce strong encryption, local storage, device authentication and access control.
Operational	User difficulty in personalization or setup.	Medium	Provide guided setup tools, tutorials and automated calibration modules.
User Modelling	Inaccurate behavioural tuning may cause incorrect communication patterns.	Medium	Increase training samples, refine LoRA layers and apply continuous learning.
Security	Device malware or unauthorized access to files.	High	Use secure local storage, device-level encryption and mandatory authentication.
Institutional Acceptance	Resistance due to ethical or regulatory concerns.	Medium	Provide policy-compliant deployment guidelines and transparency features.
Network Reliability	Distributed inference may fail if local network is unstable.	Low	Enable fallback single-device mode and local caching mechanisms.

18. FUTURE SCOPE

The project presents significant potential for expansion and enhancement. Future development will focus on improving performance, increasing adaptability and broadening application areas.

18.1. Scalability and Multi-User Support

Future versions may support multiple profiles on a single device, allowing educators, researchers or administrative teams to use the system collaboratively.

18.2. Integration with Institutional Platforms

The system can be integrated with Learning Management Systems (LMS), ERP modules, research repositories and meeting platforms to automate workflows more effectively.

18.3. Expansion to Other Professional Domains

Beyond academic environments, the AI clone can be adapted for:

- a) Healthcare Assistance
- b) Customer Service
- c) Government Administration
- d) Legal And Corporate Documentation

This expands its market reach and utility.

18.4. Enhanced Real-Time Avatars

Future versions may incorporate higher-quality 3D facial animation, emotional expression modelling and realistic gesture synthesis.

18.5. Advanced Behaviour Modelling

More sophisticated fine-tuning methods can be developed for replicating decision-making patterns, communication tone, and emotional cues more accurately.

18.6. Offline Collaboration and Peer AI Communication

AI clones could collaborate with each other locally to coordinate multi-user meetings or group evaluations without internet reliance.

18.7. Stronger Security Framework

System updates may include:

- a) secure boot mechanisms,
- b) hardware-backed encryption,
- c) tamper-proof identity verification,
- d) anti-spoofing voice and face protection.
- e) This ensures safe long-term adoption.

18.8. Mobile-First Deployment Optimization

The system can be further optimized for low-power mobile devices, enabling fully portable AI assistants for educators on the move.

18.9. Ethical Compliance Framework

A dedicated module can be developed to ensure adherence to AI ethics, academic integrity and institutional guidelines.

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20. Annexures

ANNEXURE - I

Similarity Plag

The screenshot shows a Turnitin AI Writing Assessment report for a 'MID TERM VII SEMESTER SYNOPSIS REPORT'. The document title is 'Self-Adaptive Agentic Personal AI Clone'. The report indicates 7% similarity. A sidebar on the right provides links to 'FAQs', 'Resources', and 'Guides', and includes a disclaimer about AI detection. The main content area displays the submitted synopsis report, which includes the title, submission details, and student names.

Similarity 7% Flags AI Writing *%

Self-Adaptive Agentic Personal AI Clone
MID TERM VII SEMESTER SYNOPSIS REPORT
Submitted in partial fulfillment of the requirement of the degree of

BACHELORS OF TECHNOLOGY
to
The NorthCap University
by
Chahat Gupta 22CSU205
Nischal Sharma 22CSU211
Yashika 22CSU235
Nikhil Gupta 22CSU244

Page 1 of 14 3437 words 238%

*% detected as AI ⓘ
AI detection includes the possibility of false positives. Although some text in this submission is likely AI generated, scores below the 20% threshold are not surfaced because they have a higher likelihood of false positives.

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Our AI-writing assessment is designed to help educators identify text that might be prepared by a generative AI tool. Our AI writing assessment may not always be accurate (i.e., our AI models may produce either false positive results or false negative results), so it should not be used as the sole basis for adverse actions against a student. It takes further scrutiny and human judgment in conjunction with an organization's application of its specific academic policies to determine whether any academic misconduct has occurred.

AI Content Plag

The screenshot shows a Turnitin AI Content Assessment report for a 'mid-term major project evaluation synopsis report.pdf'. The document title is 'Self-Adaptive Agentic Personal AI Clone'. The report indicates 7% overall similarity. The sidebar on the right shows match groups and sources, with a detailed breakdown of 23 matches found. The main content area displays the submitted synopsis report, which includes the title, submission details, and student names.

mid-term major project evaluation synopsis report.pdf

Similarity 7% Flags AI Writing *%

Self-Adaptive Agentic Personal AI Clone
MID TERM VII SEMESTER SYNOPSIS REPORT
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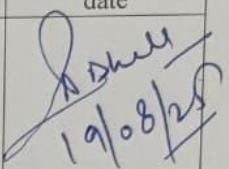
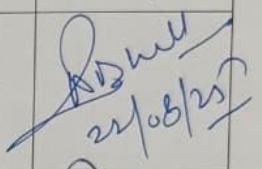
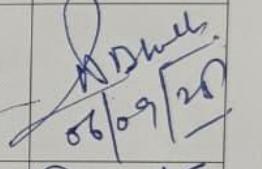
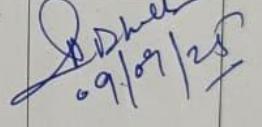
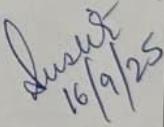
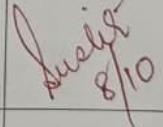
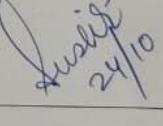
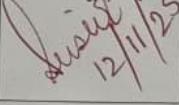
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2 Submitted works The NorthCap University, Gurugra... 1%
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ANNEXURE - II--

Annexure

Supervisor's comments

Week no.	Supervisor's Comment (about general project progress and individual contribution towards the project)	Supervisor's Signature with date
WEEK 1	19/8/25 - Initial Overview and Idea proposal of the project	 19/8/25
WEEK 2	22/8/25 - Discussion on the possible modules to be integrated and use case. Finalisation of project title	 22/8/25
WEEK 3	6/9/25 - Discussion on participation in hackathons and the idea proposal for the same	 6/9/25
WEEK 4	9/9/25 - Patent Draft Discussion and Review	 9/9/25
WEEK 5	16/9/25 - Patent Draft review, showcasing of model. Discussion on hackathon draft.	 16/9/25
WEEK 6	8/10/25 - Discussion on improvements to be made in the project.	 8/10
WEEK 7	24/10/25 - GenAI Hackathon discussion and showcasing the project / prototype that was made	 24/10
WEEK 8	12/11/25 - Final submission of GenAI hackathon review	 12/11/25