WriteMate

**PROJECT SYNOPSIS OF MAJOR PROJECT**

**BACHELOR OF TECHNOLOGY**

Branch: Computer Science and Engineering

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# Abstract

WriteMate is a portable assistive technology solution designed to enable individuals with physical disabilities to write independently. It captures inputs via voice or Indian Sign Language (ISL), processes them using machine learning on a Raspberry Pi 5, and converts the recognized text into physical writing using a CNC machine. WriteMate empowers users by removing dependency on human scribes, ensuring accessibility and dignity in academic, healthcare, and professional scenarios.

# Introduction

WriteMate bridges the gap between individuals with physical disabilities and independent writing by leveraging multimodal input (voice and ISL), real-time processing, and automated CNC-based output. Users can interact with the system using voice commands or ISL gestures, which are processed locally and written onto paper using G-code-driven CNC machinery.

# Rationale

Individuals who are blind, mute, or have non-functional arms often depend on human writers during exams and other documentation tasks, facing issues like unavailability, miscommunication, or loss of independence. WriteMate eliminates these challenges by providing a self-capable, plug-and-use solution that enables real-time writing with no human assistance.

# Objectives

1. To design a self-contained system capable of writing text based on voice or ISL input.
2. To implement real-time processing of inputs using ML on Raspberry Pi 5.
3. To integrate a CNC machine that writes converted text onto paper.
4. To provide flexibility in pen type, paper size, and language.
5. To empower differently-abled individuals with independence and dignity.

# Literature Review

The literature review covers various approaches, including:

1. **Speech Recognition:** Real-time conversion of voice to text using NLP.
2. **Gesture Recognition:** Machine learning techniques for sign language interpretation.
3. **Assistive Technology:** Trends in accessibility tools for education and healthcare.
4. **Embedded Systems:** Efficient use of Raspberry Pi for multimodal processing.
5. **CNC Automation:** Application of G-code for precision writing on paper.

# Feasibility Study

**Technical Feasibility:** Built on Raspberry Pi 5, integrating camera, mic, and CNC hardware with open-source ML models.

**Economic Feasibility:** Cost-effective due to minimal external requirements and use of affordable components.

**Operational Feasibility:** Simple setup with high usability for non-technical users in exam or home

settings.

# Methodology/Planning of Work

1. Requirement Analysis Identify user needs and accessibility constraints.
2. Hardware Setup: Connect mic, camera, and CNC machine to Raspberry Pi 5.
3. Software Integration: Develop ML modules for voice and gesture recognition.
4. G-code Generation: Translate recognized text into CNC instructions.
5. Interface Design: Create user-friendly controls for input mode and writing preferences.
6. Testing & Validation Assess accuracy, speed, and reliability of the writing process.
7. Deployment: Package the system as a portable and scalable assistive device.

# Facilities Required for Proposed Work Software:

* + Python for ML and Raspberry Pi programming.
  + OpenCV and TensorFlow for gesture recognition
  + SpeechRecognition and NLP libraries.
  + CNC command software (G-code generator).

# Hardware:

* + Raspberry Pi 5.
  + Microphone and NOIR camera.
  + CNC Machine with servo-controlled pen holder.
  + Power supply and portable case setup.

# Expected Outcomes

* + An inclusive, real-time writing system for differently-abled individuals.
  + Independence from human scribes during exams and documentation.
  + A customizable, multi-language support device.
  + Real-world deployment in educational institutions, offices, and public centers.

# References

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