THE HONG KONG POLYTECHNIC UNIVERSITY
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DEPARTMENT OF COMPUTING
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COMP4431 GROUP PROJECT PROPOSAL
(Up to 2 pages)

PART I. Group Information

Project Title	CultiTrans – AI-Powered Culturally Adaptive Translation and Response System
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Abstract

Traditional translation systems such as Google Translate or DeepL are effective at conveying literal meanings but often fail to reflect cultural context and social appropriateness. CultiTrans is an AI-powered conversational translation assistant that goes beyond direct translation. It accepts speech input, generates an accurate translation, and then provides contextually and culturally suitable response suggestions based on the user's target culture. For example, when translating into Japanese, the system will recommend more polite phrasing; for Western contexts, it will suggest direct and confident responses. Technically, CultiTrans integrates speech recognition, large language models (LLMs), and a Retrieval-Augmented Generation (RAG) module that draws on cultural etiquette data. The system aims to promote smooth cross-cultural communication and enhance the emotional intelligence of translation software.

PART II. DETAILS OF THE RESEARCH PROPOSAL

a. Motivation and potential impact of the project.

Most translation tools focus solely on semantics — what is said — while ignoring how it should be said in a given cultural setting. This often leads to communication breakdowns in international business, travel, and education. CultiTrans addresses this issue by introducing cultural intelligence into translation. The system detects the cultural background of the communication scenario, analyzes tone and politeness levels, and provides real-time suggestions to improve cultural appropriateness. The project's potential impact extends to international education, diplomacy, tourism, and cross-border commerce. By bridging linguistic and cultural gaps, CultiTrans can improve global communication and reduce misunderstandings.

b. The main functionalities of the project.

1. Speech-to-Text Input: The user speaks in their native language; the system uses an Automatic Speech Recognition (ASR) model (e.g., Whisper API) to transcribe speech into text.

2. Cultural-Aware Translation: The transcribed text is translated into the target language using a neural translation model (e.g., Google Translate API or Hugging Face transformers). A cultural context layer then adjusts tone and word choice based on the target culture (e.g., indirect politeness in Japanese, confidence in American English).

3. Response Recommendation: The system generates possible context-aware replies suitable for the ongoing conversation.

4. Cultural Feedback Module (Real-time Correction): The model monitors user responses and provides feedback such as suggestions for more polite phrasing.

5. RAG-based Cultural Knowledge Base: A retrieval module integrates cultural etiquette data (greetings, taboos, tone patterns) to ensure factual cultural accuracy and adaptability.

6. Voice Output (Optional): The system can convert final translations or recommended replies back into speech for real-time communication.

c. The expected research/implementation method.

System Architecture:
Frontend: Streamlit or React web interface with a microphone input and live chat panel.
Backend: Python (Flask/FastAPI) managing ASR, translation, and cultural analysis.
AI Components:
• ASR: Whisper / SpeechRecognition
• Translation: Hugging Face “m2m100” or Google Translate API
• Cultural Context Analysis: LLM (OpenAI GPT or Claude) with persona prompts
• RAG: LangChain + custom cultural dataset (curated etiquette examples)
Database: SQLite or MongoDB for storing conversation logs and user preferences.

Key Technical Innovations:
1. Culturally Adaptive Translation Layer modifying tone and politeness.
2. Real-time Conversational Feedback monitoring speech and responses.
3. Speech-Based Pipeline integrating voice, text, and cultural analysis.
4. Dynamic Persona Prompting simulating diverse communication styles.