

Abstrak

Komunikasi merupakan kebutuhan mendasar manusia, namun penyandang disabilitas tunawicara kerap menghadapi kendala verbal karena aplikasi Augmentative and Alternative Communication (AAC) berbasis Picture Exchange Communication System (PECS) saat ini umumnya masih menggunakan text-to-speech (TTS) generik dengan pelafalan bahasa Indonesia yang kaku. Penelitian ini bertujuan mengadaptasi model TTS mutakhir IndexTTS2 ke dalam bahasa Indonesia menggunakan teknik Low-Rank Adaptation (LoRA) serta mengintegrasikannya ke dalam aplikasi AAC Android bernama TUTUR. Pengembangan sistem menerapkan metodologi CRISP-DM dengan dataset bersih sebanyak 25.823 sampel audio (30,37 jam) dari Common Voice, FLEURS, dan ID2. Pelatihan dilakukan melalui eksperimen lima variasi konfigurasi rank dan alpha LoRA. Hasil pemodelan menetapkan konfigurasi $r = 32$ dan $\alpha = 64$ sebagai model terbaik karena terbukti stabil, tidak mengalami crash, serta menghasilkan ukuran adapter yang sangat ringkas (± 41 MB). Evaluasi objektif transkripsi wicara menggunakan Whisper ASR pada 407 sampel uji menghasilkan Word Error Rate (WER) sebesar 12,45%. Pengujian subjektif kualitas suara melibatkan 10 responden di SLB ABC Muhammadiyah Banjarsari dan memperoleh skor Mean Opinion Score (MOS) sebesar 4,23 dari skala 5,00. Evaluasi kegunaan sistem menghasilkan skor System Usability Scale (SUS) sebesar 79,00 dengan kategori Acceptable (Good). Meskipun inferensi cloud API masih memiliki latensi 8,8–25 detik akibat proses rendering akustik, aplikasi TUTUR berhasil menghadirkan solusi AAC fungsional dengan artikulasi suara bahasa Indonesia yang alami untuk mendukung kemandirian komunikasi tunawicara.

Kata kunci: Kata Kunci: Augmentative and Alternative Communication, IndexTTS2, Low-Rank Adaptation, PECS, Text-to-Speech, Munawara.

Abstract

Communication is a fundamental human need, yet individuals with speech impairments often face verbal barriers because current Picture Exchange Communication System (PECS)-based Augmentative and Alternative Communication (AAC) applications predominantly rely on generic text-to-speech (TTS) engines with unnatural Indonesian pronunciation. This study aims to adapt the state-of-the-art IndexTTS2 model into Indonesian using Low-Rank Adaptation (LoRA) and integrate it into a Flutter-based Android AAC application named TUTUR. Following the CRISP-DM methodology, a cleaned dataset of 25,823 audio samples (30.37 hours) was constructed from Common Voice, FLEURS, and ID2. Five variations of LoRA rank and alpha configurations were systematically evaluated. The configuration of $r = 32$ and $\alpha = 64$ was selected as the optimal model due to its training stability, convergence smoothness, and compact adapter size (± 41 MB). Objective speech transcription evaluation across 407 test samples using Whisper ASR yielded a Word Error Rate (WER) of 12.45%. Subjective audio quality evaluation involving 10 respondents at SLB ABC Muhammadiyah Banjarsari achieved a Mean Opinion Score (MOS) of 4.23 out of 5.00. Furthermore, usability testing demonstrated a System Usability Scale (SUS) score of 79.00, categorized as Acceptable (Good). Although cloud API inference latency averaged between 8.8 and 25 seconds due to acoustic rendering constraints, TUTUR successfully delivers a functional AAC solution with natural Indonesian speech synthesis to enhance communication independence for speech-impaired individuals.

Keywords: Augmentative and Communication, IndexTTS2, Indonesian Language, Low-Rank Adaptation, PECS, Speech Impairment, Text-to-Speech