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Engineering

Team 33: ASL Interpreter App

Final Update

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Project Overview

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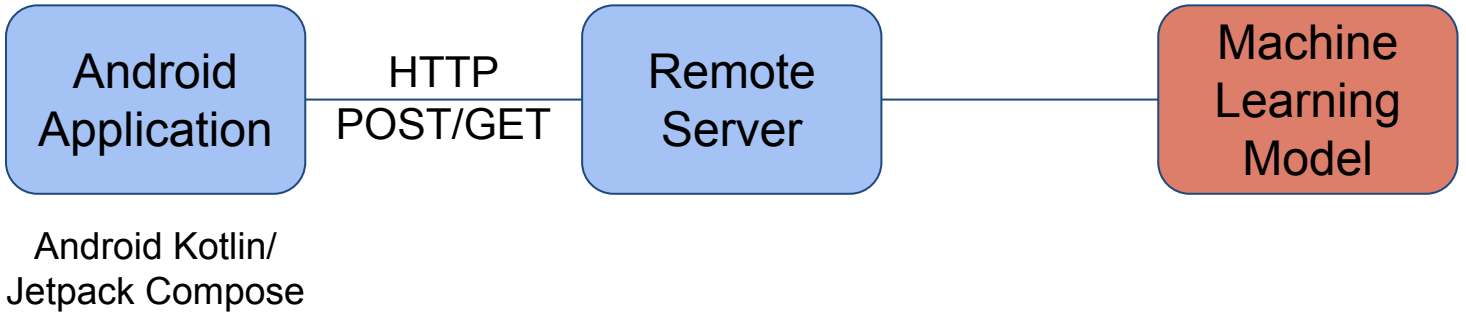

Ray Cook

Android Application/ Server

Jadepan Thedthong

Machine Learning

Project Deliverables:

- Android application to provide user with access to translation
- Machine learning model that translates short video clips of ASL signs into English text
- Server to house ML model to store user data and offload processing from mobile device

Android Application Subsystem Overview

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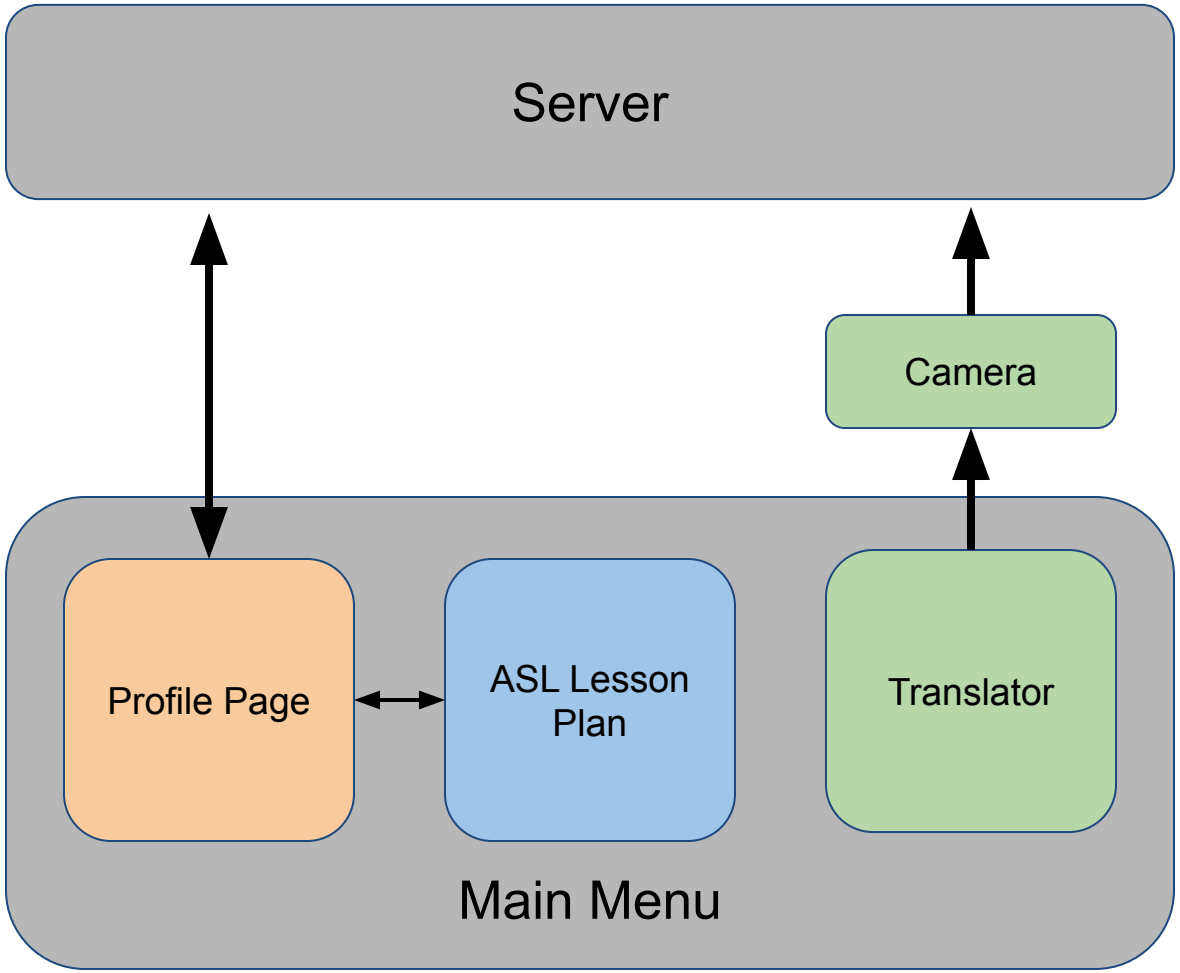

- ASL lesson plan offers short lessons to teach commonly used phrases
- Profile page stores and pulls user data from server
- Translator utilizes camera and ML model on the server to provide quick translations

Android Application - Translator Flow Chart

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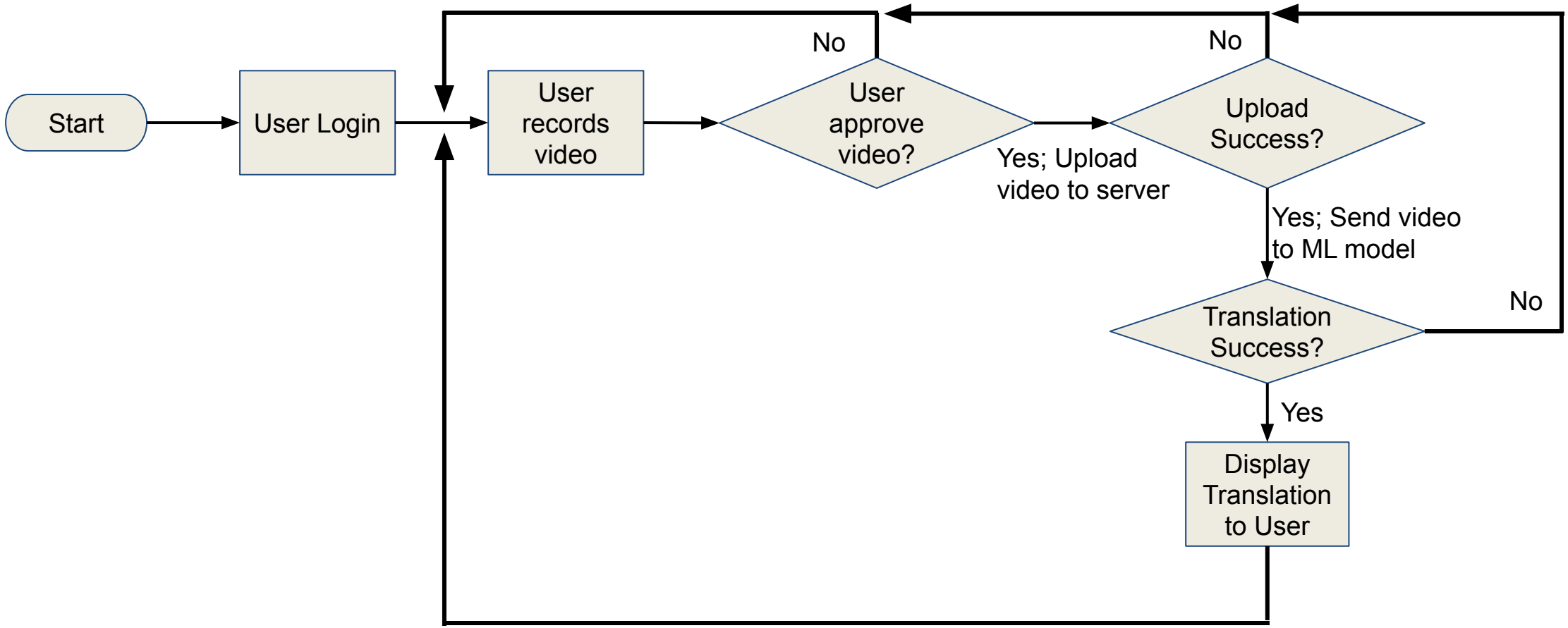

Android Application Subsystem
Major Challenges and Solutions

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Challenges

- Network upload using native Android functionality was difficult for transmitting video files
- Sharing data across multiple views causing synchronization issues
- Needed a unique workflow to record video, upload to server, run through model, retrieve translation from server, and display to user

Solutions

- Shifted to use Retrofit library which handled proper HTTP Request formatting for file uploads
- Created classes and passed them as parameters into views to allow data to be passed between them
- Used user's email as UID for videos and translations server-side to streamline the workflow

Android Application Subsystem
Results

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Items	Specification	Actual
Space Required on Disk	< 100MB	23.25MB
RAM Usage	< 200MB	157MB (Maximum)
Time For Translation	<= 15 Seconds	9.87 Seconds (Average)
ASL Lesson Plan	10 Lessons	Accomplished
User Data Storage	Server-based, cross-device	Accomplished

Machine Learning Subsystem Overview

Jadepan Thedthong

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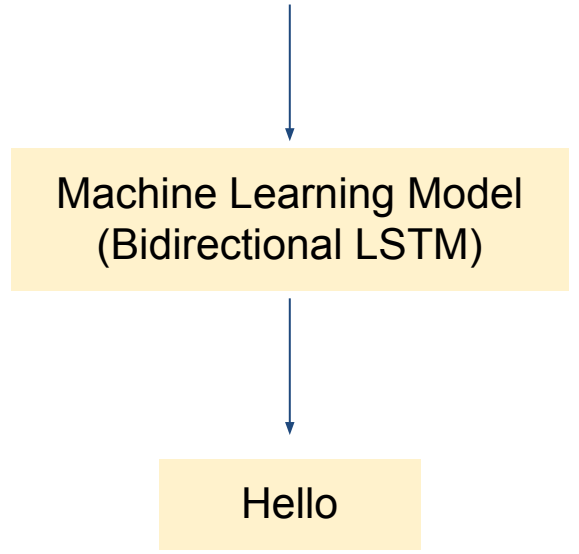
- Key Objectives
  - Detect the keypoints of the signer
  - Translate (at word-level) ASL from the keypoint sequence to English



Machine Learning Subsystem
Major Challenges and Solutions

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Challenges

- Unorganized, small sample size per word in initial dataset (average of 20 samples per word for 2000 words)
- Low accuracy with the initial dataset
- Overfitting when trained on 100 samples per word

- Lost significant portion of the dataset when working on building a larger dataset (hardware failure)

Solutions

- Retrieve missing samples and organize them by word

- Focus on increasing the sample count per word in the dataset
  - Data augmentation to increase variety in the dataset

- Re-record and re-populate dataset to train model for deployment

Machine Learning Subsystem
Results

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Model Trained with 150 videos per word

Items	Specification	Actual
Accuracy	60%	22.44%
Word Count	50	50

Additional Data

Items	Value
Precision	20.18%
Recall	23.44%
F1 Score	18.26%

Machine Learning Subsystem
Results

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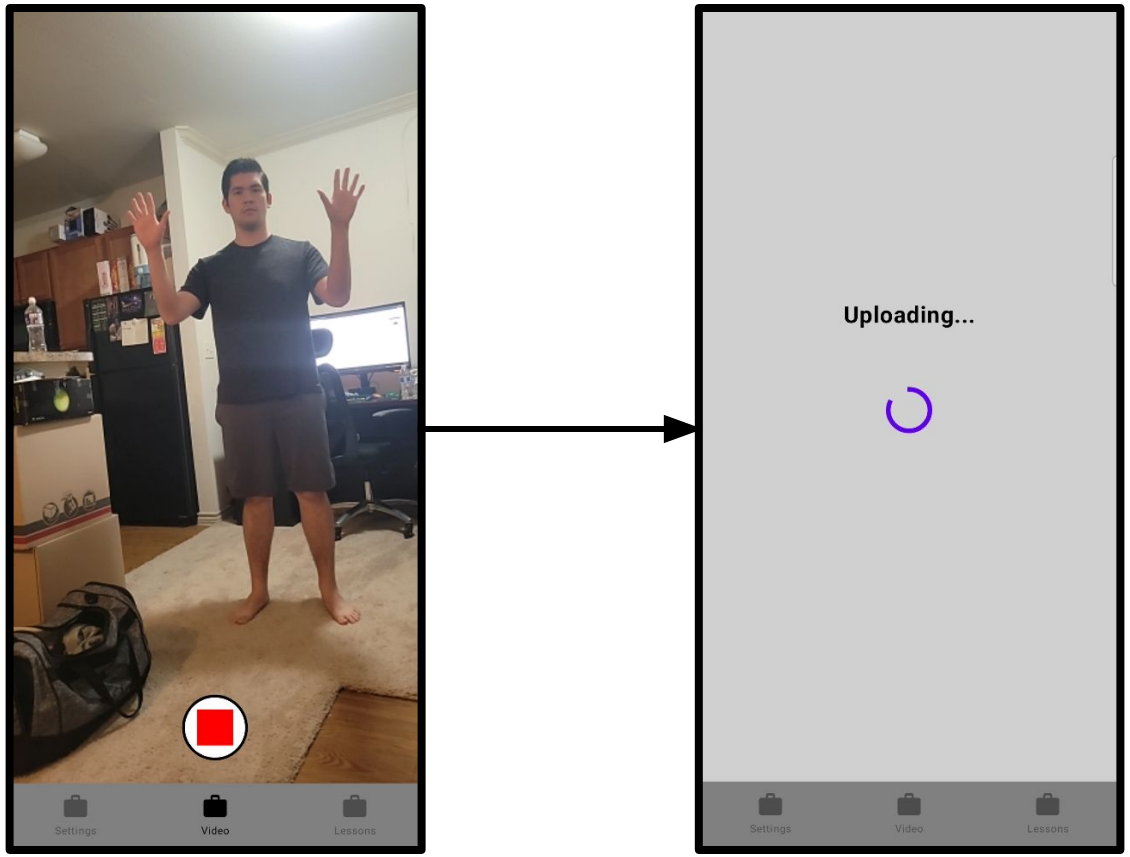
Model Trained with 500 videos per word

Items	Specification	Actual
Accuracy	60%	94.4%
Word Count	50	10

Additional Data

Items	Value
Precision	94.93%
Recall	94.40%
F1 Score	94.36%

Integrated System Results



Integrated System Results

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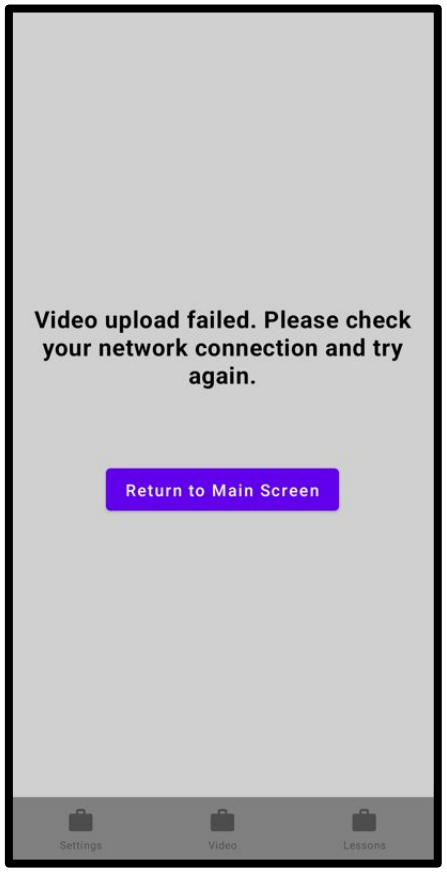

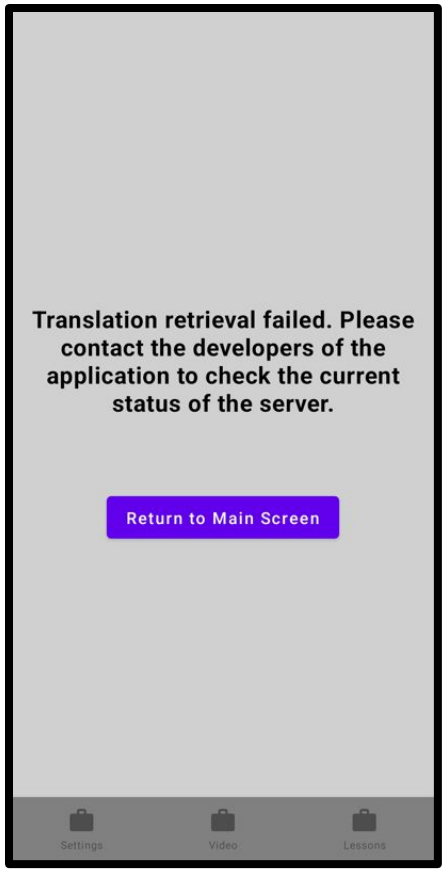

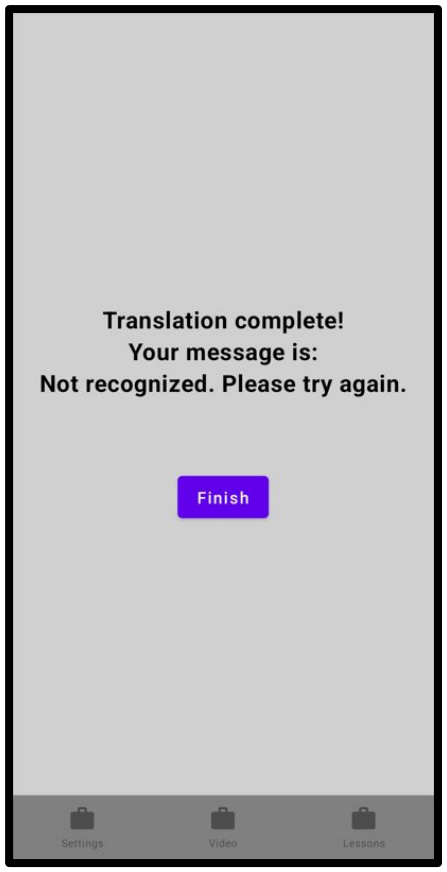

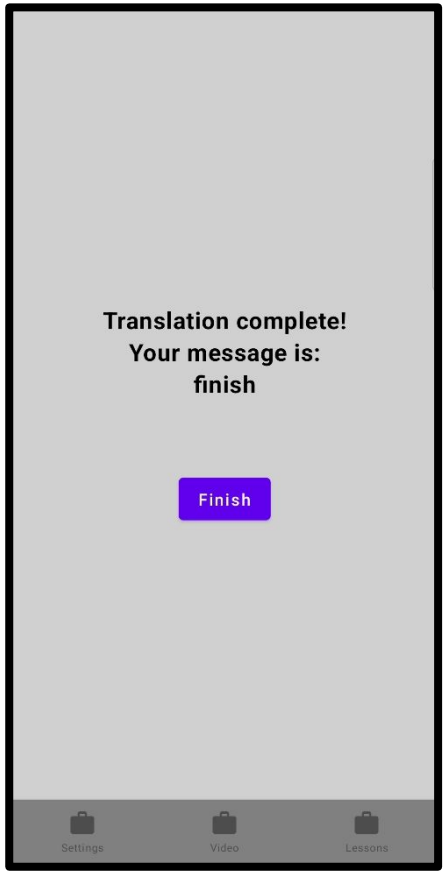

Conclusions

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- System has been fully integrated
- Experiencing difficulty creating a dataset large enough to properly train a gesture-based machine learning model
  - Led to reduction in scale to following requirements:
    - 60% Accuracy
    - Word-level translation
    - At least 50 word vocabulary
- Nearly all deliverables have met project goals:
  - Application has been fully developed
    - Has screens to inform user when errors has occurred to help troubleshoot
    - Fulfills requirements of having a small storage footprint and using minimal computational resources
  - Server has been prepared with proper PHP files acting as endpoints
  - Machine learning model is still not up to specification

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Thank you for your time!