# SIGN LANGUAGE TRANSLOATOR USING ESP32-CAM


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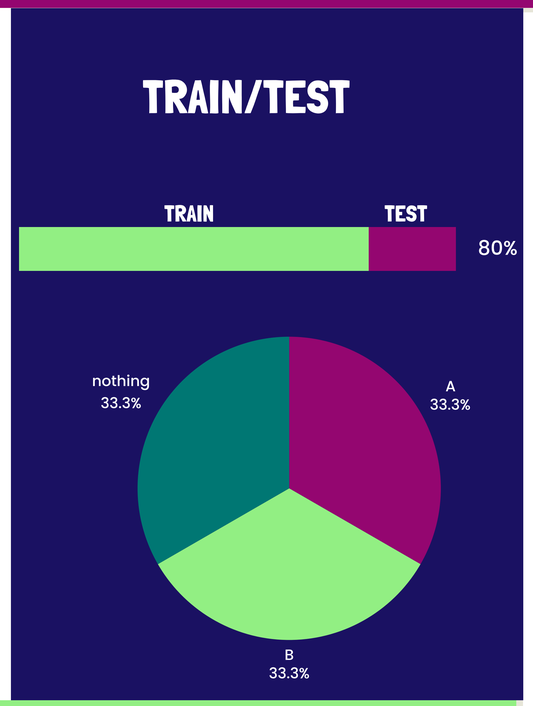
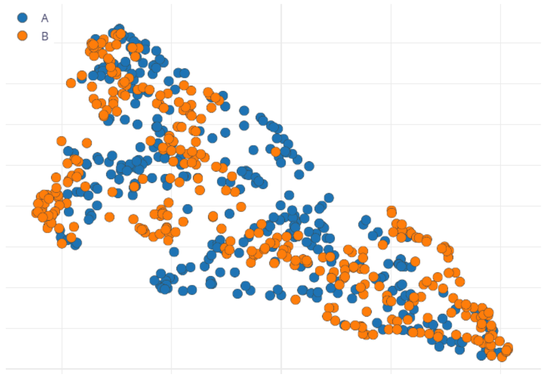
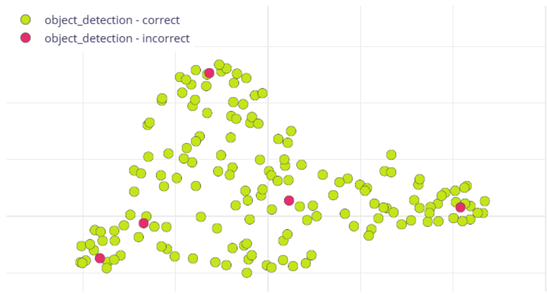
## INTRODUCTION

This project aims to improve communication accessibility for individuals with speech or hearing impairments through an ASL recognition system. Using Convolutional Neural Networks (CNNs), it processes ASL alphabet gestures and translates them into letters. Deployed on low-power hardware like the ESP-32 CAM module, the system ensures real-time, edge-device compatibility. The initiative seeks to reduce barriers for the deaf and hard-of-hearing communities, fostering better interaction and understanding.




## RESULTS/FINDINGS

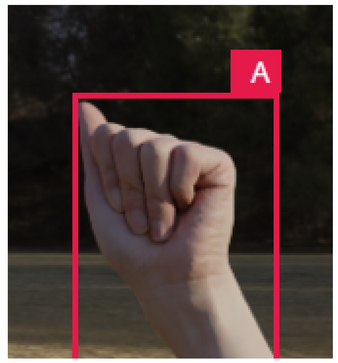


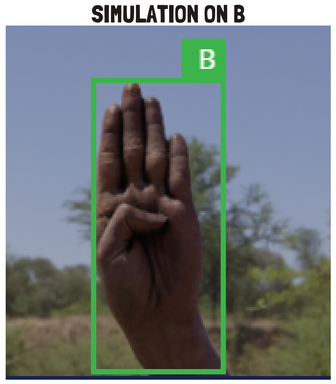

Confusion matrix (validation set)

| | BACKGROUND | A | B |
|---|---|---|---|
| BACKGROUND | 100% | 0% | 0% |
| A | 1.7% | 98.3% | 0% |
| B | 0% | 0% | 100% |
| F1 SCORE | 1.00 | 0.99 | 1.00 |

SIMULATION ON A

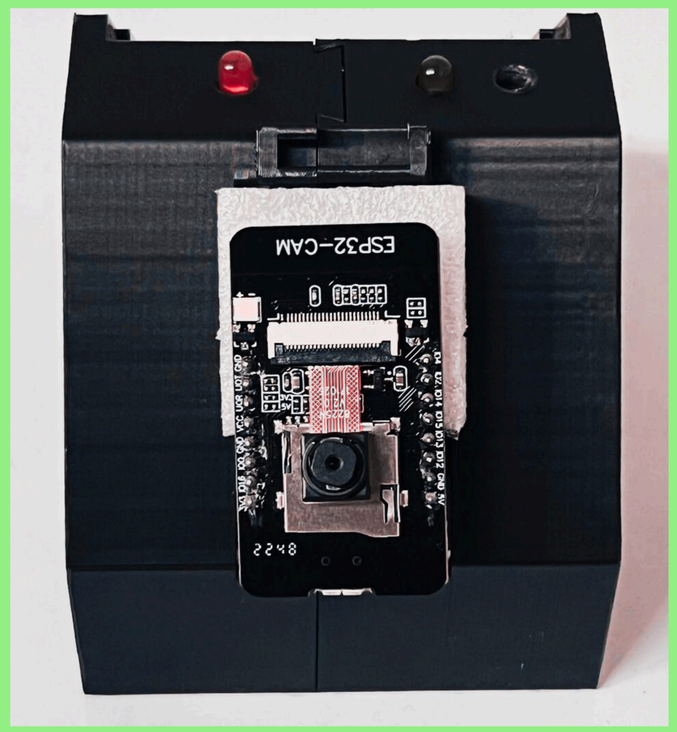



SIMULATION ON B




F1 SCORE
99.6%

## HARDWARE




## PROBLEMS

We encountered several challenges during the development of this project.

- First, incorporating the entire alphabet significantly increased the size of the model, exceeding the capabilities of the ESP32-CAM. To address this limitation, we reduced the scope to include only three letters (A, and B), ensuring compatibility with our hardware.
- Second, we observed that the model struggled to detect hand gestures in the presence of busy backgrounds. To improve its performance, we retrained the model using RGB images with complex backgrounds to enhance its accuracy under such conditions.
- Lastly, while we initially intended to display the results on a liquid crystal display (LCD), budget constraints led us to opt for LEDs as an alternative for indicating predictions. This approach provided a cost-effective solution while meeting the project's requirements.