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Atlantic Technological University

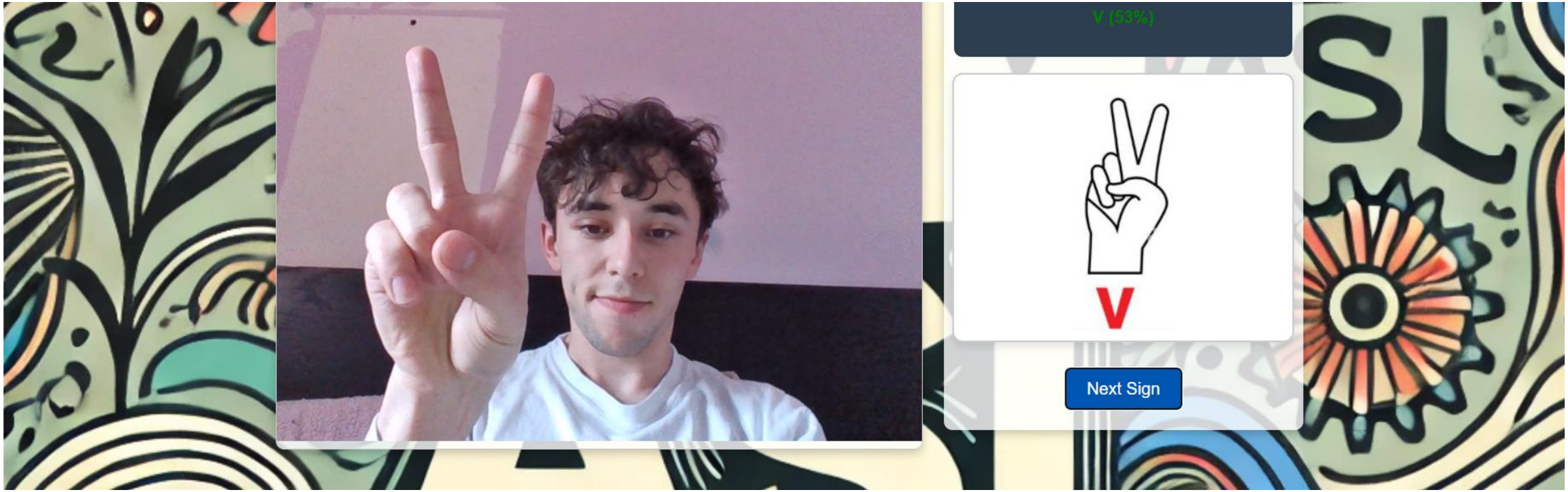
CAMASL Camera-Assisted Machine Learning for American Sign Language

Final Year Project – Sean Conroy

Bachelor of Engineering (Hons) – Atlantic Technological University

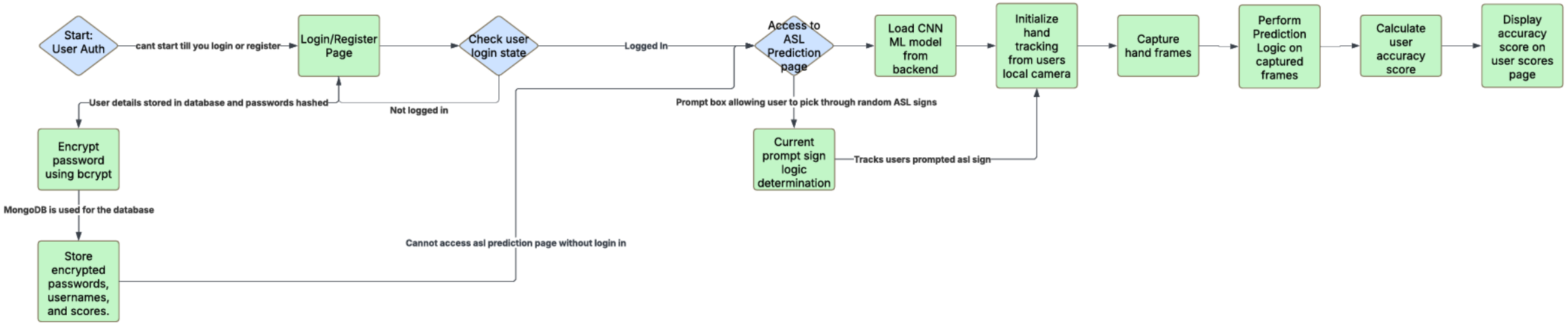
Project Overview

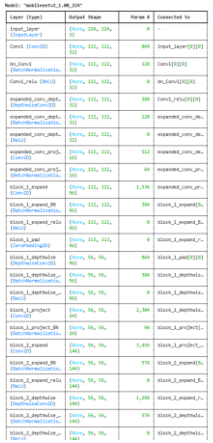
- Goal: Real-time ASL learning platform using only a webcam
- Problem: Lack of interactive, accessible ASL tools
- Solution: ML-based gesture recognition through a web application

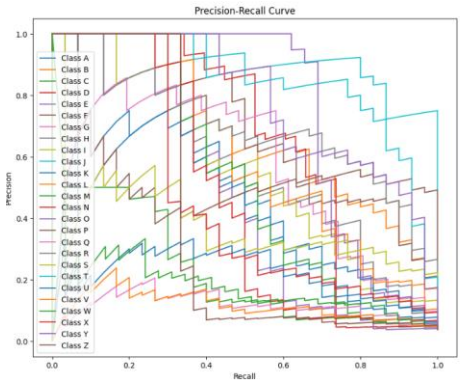


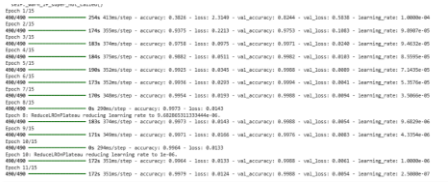
System Architecture Overview

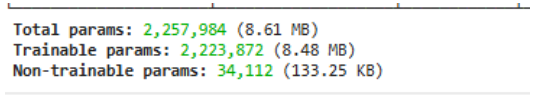
- Frontend: React
- Backend: FastAPI + TensorFlow
- Hand Tracking: MediaPipe
- Database: MongoDB Atlas









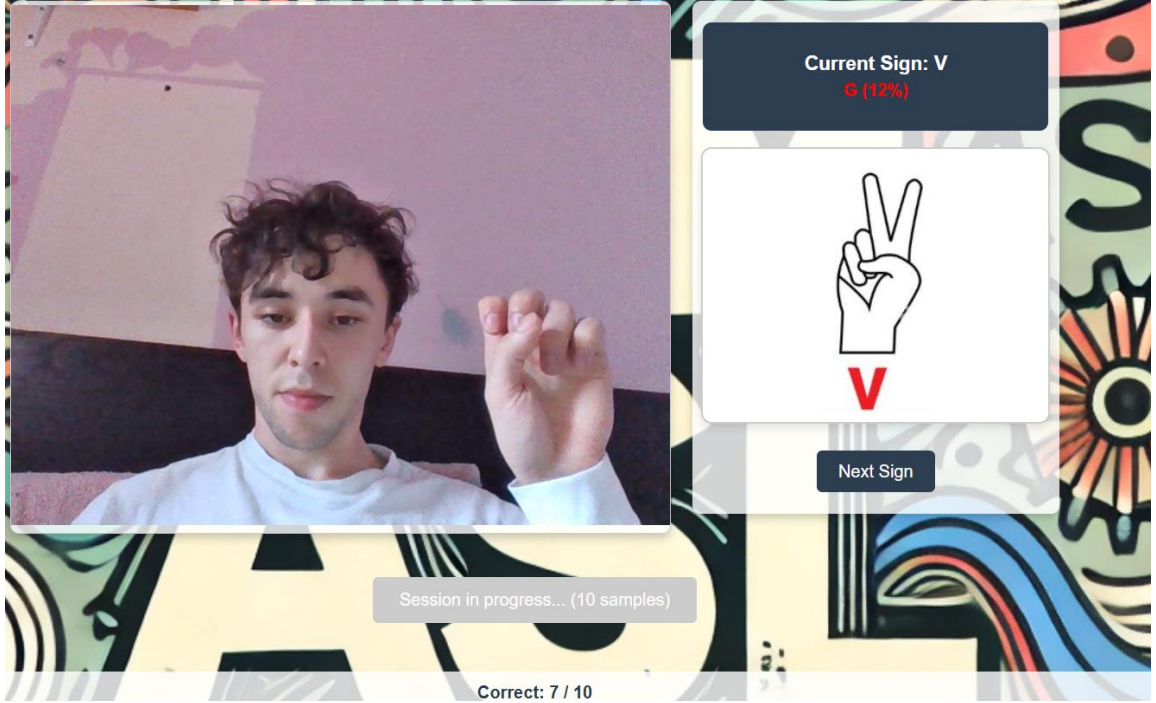


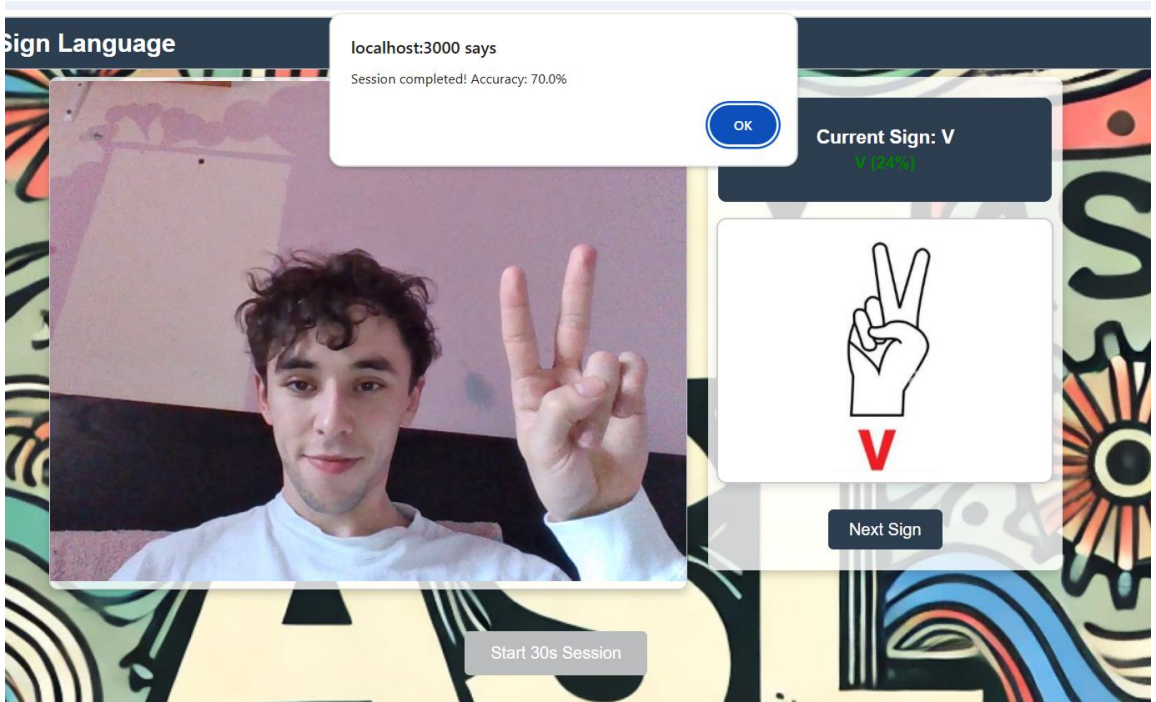
Machine Learning Model

- MobileNetV2 fine-tuned for ASL gestures
- Lightweight, fast inference
- Metrics: Accuracy, Precision, Recall, F1-score

How the Application Works

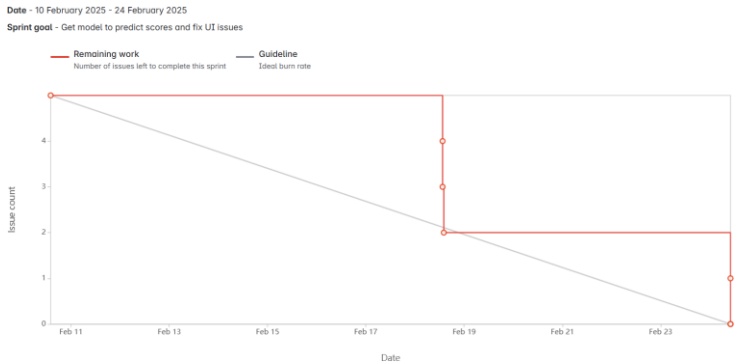
- User login
- Random sign prompt displayed
- Webcam frame sent to backend
- Hand detection → Model prediction → Scoring over 30 frames

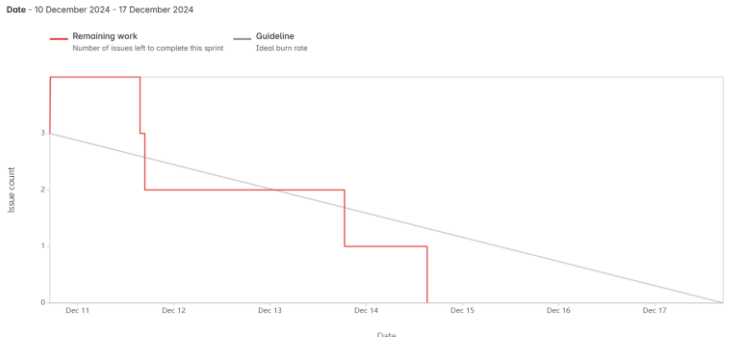


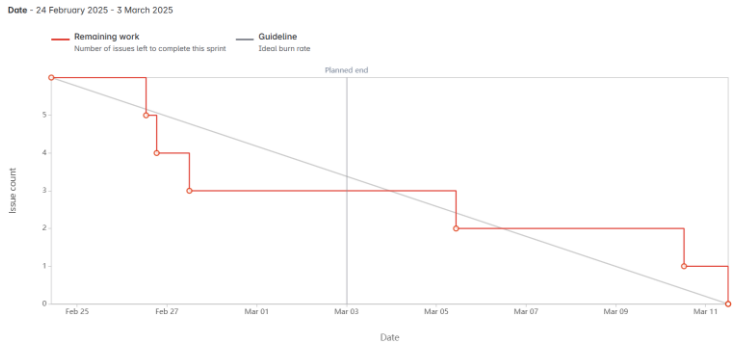


Project Management

- Agile Methodology
- Two-week sprints
- Jira for tracking tasks and progress





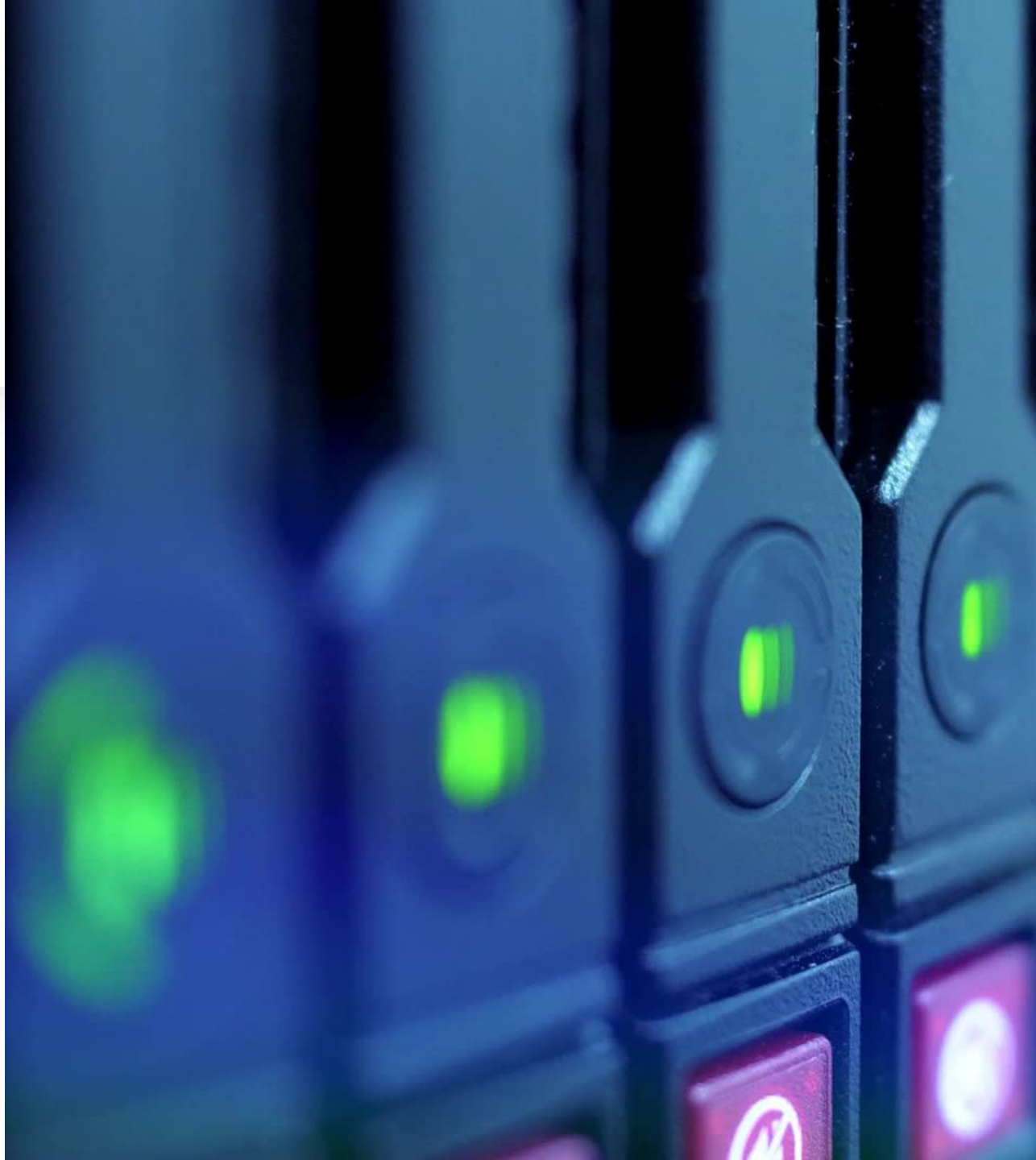


Key Technologies and Libraries

- React, FastAPI, TensorFlow, MediaPipe
- MongoDB
- Tools: GitHub, Google Colab, VS Code

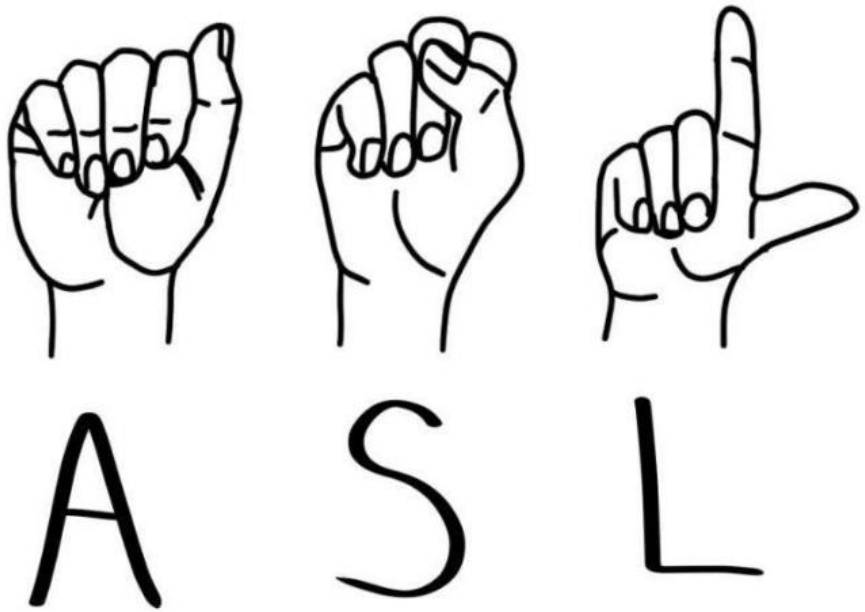
Challenges and Solutions

- TensorFlow.js issues → Moved inference server-side
- Class imbalances in dataset
- Real-time performance optimizations
- Secure authentication with JWT cookies



Ethical Considerations

- Accessibility focus
- No storage of video/image data
- Clear, transparent AI usage



Conclusion

- Real-time ASL learning platform achieved
- Solid foundation for future expansion
- Ready for real-world educational use