Capstone Project

Topic: HAND SIGN RECOGNITION DEVICE

Fourth Year - EIC under the mentorship of

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Jan-Dec 2023

DATE OF SUBMISSION:
20 DECEMBER, 2023

Hand Sign Recognition Device

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Capstone-Project Overview

Hand Sign Recognition System is aimed at assisting deaf and dumb individuals in communication. The project utilizes a Raspberry Pi capturing visual input from a webcam. The system recognizes hand signs and translates them into text, allowing for easier communication between the hearing and non-hearing communities.

Hand Sign Recognition System using ASL

Recognition and Interpretation

Learn how the system utilizes computer vision algorithms to recognize and interpret hand signs, paving the way for effective communication.

Recognizing Different Sign Languages

Learn how the system can be trained to recognize various sign languages, promoting inclusivity.

Enhanced Communication

Discover how hand sign recognition technology bridges the communication gap for individuals with hearing and speech impairments.

Key Aspects

1

Engineering Principles

Apply fundamental engineering principles to ensure the reliability and efficiency of the hand sign recognition hardware system.

2

Software and Mathematical Tools

Explore the software and mathematical tools utilized for image processing, machine learning, and sign language recognition.

3

Project Optimization

Consider various factors, such as environmental, economic, and institutional, to optimize the hand sign recognition system.

Need For Hand Sign Recognition Device

Communication Needs

There is a pressing need for a technology solution that bridges the communication gap, enabling seamless interaction between individuals with impairments and those without.

Real-Time Communication

A Hand-Sign Recognition Device needs to provide immediate and accurate recognition to support real-time communication needs.

Accessibility Needs

Accessibility is a fundamental requirement for individuals with hearing and speech impairments to participate fully in various aspects of life, including education, employment, and social activities.

Engineering Principles

Hardware Components

The hardware components of the Hand Sign Recognition System include a Raspberry Pi and a webcam. The Raspberry Pi serves as the main processing unit for the system, while the webcam captures visual input. And a screen to display text.

Software Components

The software components of the Hand Sign Recognition System include a Python script that runs on the Raspberry Pi. The script processes the visual input from the webcam and recognizes hand signs using machine learning algorithms.

Hardware Components

Camera

Memory

Display Screen

Raspberry Pi-4

Battery

Software Components

The software components of the Hand Sign Recognition System include a Python script that runs on the Raspberry Pi. The script processes the visual input from the webcam and recognizes hand signs using machine learning algorithms.

Libraries

A. OpenCV

B. Numpy

C. MediaPipe, Sklearn

D. Tensorflow

E. Keras

F. MatplotLib

Machine Learning Model

CNN

Convolutional Neural Network

Use Of Convolutional Neural Network

The heart of our sign language recognition system lies in the use of convolutional neural networks(CNN). CNNs empower hand sign recognition systems for deaf individuals by expertly extracting features from gestures, handling variations, enabling real-time communication, adapting to different sign languages, and constantly learning, ultimately bridging the communication gap and fostering inclusivity.

Why CNN ?

Why CNN?

Image Expertise

CNNs excel at understanding and analyzing images, which is crucial for sign language recognition.

Robustness to Variations

Sign language can vary in terms of hand size, lighting, and background. CNNs are robust to these variations, thanks to their ability to learn generalizable features from the data.

Adaptability to Different Sign Languages

The same CNN architecture can be adapted to recognize different sign languages with minimal adjustments.

Continuous Improvement

As more data becomes available, CNNs can be continuously improved and fine-tuned for better accuracy and recognition of a wider range of signs.

WHY YOLOV8?

Object Detection

Identifying and locating objects in images and videos, from cars and people to specific items like tools or animals.

Image Segmentation

Dividing an image into regions based on the objects or categories present, enhancing understanding of the scene.

Pose Estimation

Predicting the pose or keypoints of a person or object, useful for robotics and motion capture.

Instance Segmentation

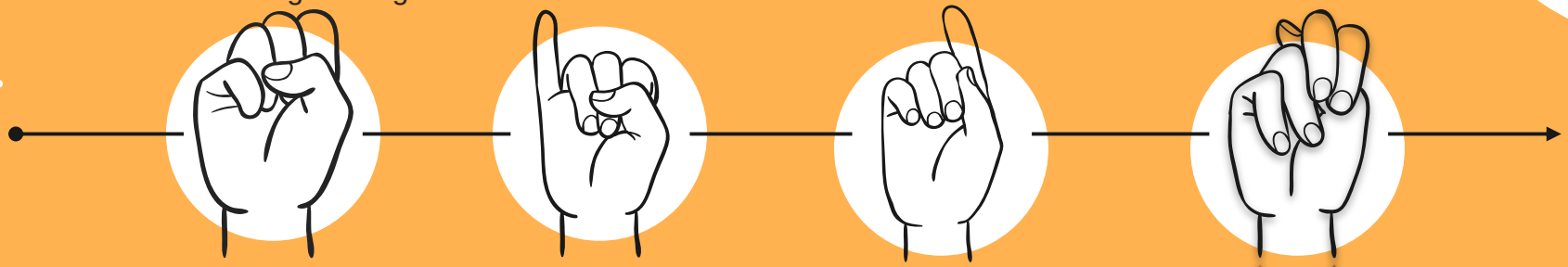
Differentiating between multiple instances of the same object in an image, enabling advanced tracking and analysis.

Leaky

the leaky ReLU activation function is a modification of the standard ReLU function with a small, positive slope for negative inputs to prevent neurons from becoming inactive during training.

Epochs

2000



Dense

each neuron or node in the layer is connected to every neuron in the preceding layer, allowing the network to learn complex relationships in the data.

Confusion Matrix

evaluate the performance of a classification algorithm or model by comparing its predicted classifications with the actual true classifications

Social, Environmental, Ethical, Economic, Financial, Institutional and Commercial Considerations.


COSTS
EQUIPMENT REPLACEMENT
CATASTROPHIC BREAKDOWN
SERVICE CALLS
PM PROGRAM
A customized PM Program pays for itself
The Best Way to Deal with a Problem is to Prevent it

Raspberry Pi

Raspberry Pi as the core hardware for our system due to its energy efficiency
The low power consumption of the Raspberry Pi minimizes the environmental footprint of our project, contributing to sustainability goals

Variable-Length Sequence

Inclusivity and accessibility for the deaf and mute community are not mere buzzwords but core principles that have guided our development process. We've implemented safeguards to protect user privacy and data security, ensuring that our system complies with the highest ethical standards.

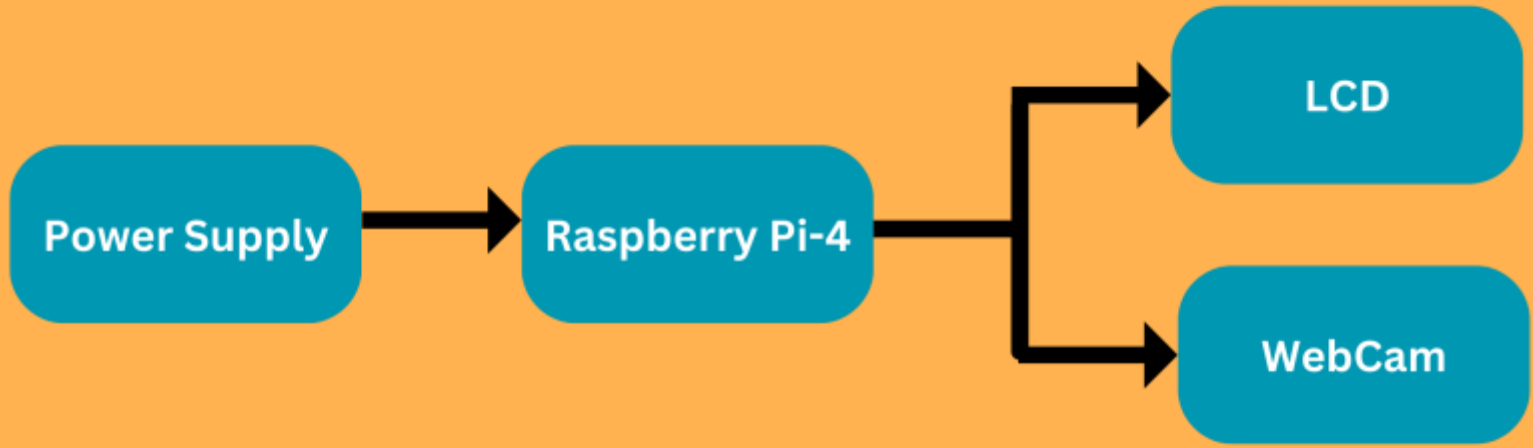
Economic and financial considerations

Economic and financial considerations have also played a significant role in our project. We've worked diligently to keep the cost of the system affordable without compromising quality. This approach ensures that our solution is accessible to a wide range of individuals and institutions, thus maximizing its societal impact.

Institutions, healthcare facilities

We want to explore potential partnerships with educational institutions, healthcare facilities, and non-profit organizations to facilitate the widespread adoption of our Hand Sign Recognition System. By identifying viable business models, we aim to ensure the long-term availability and support for our technology, thereby extending its reach and impact.

Block Diagram of Interconnection Of Components



Achievement of Project Objectives within a Specific Timeframe

Clear Objectives

Outline the project's specific objectives, such as accuracy rates, real-time performance, and integration with existing communication platforms.

Deadline Management

Explore the project management strategies employed to ensure timely completion and adherence to project milestones.

Success Indicators

Discuss the key performance indicators and metrics used to measure the project's success and impact on communication accessibility.

Now let's look at real-time implementation

01

Hello

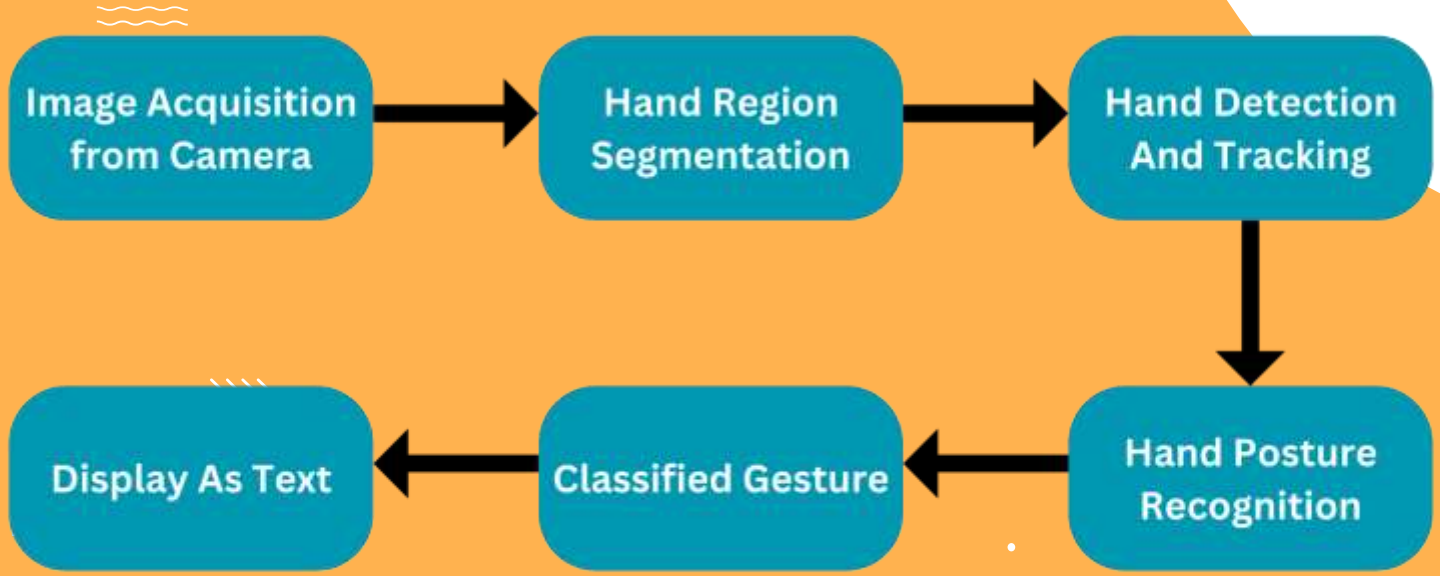
02

Thanks

03

I Like You

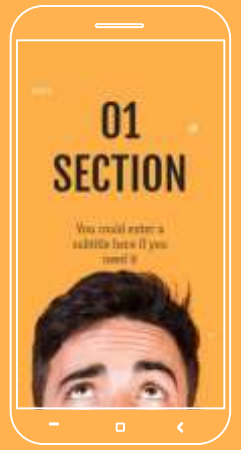
Flow chart with the steps of approach



Different Hand Signs Present

Model Depiction

A PICTURE IS WORTH A THOUSAND WORDS



THANKS

Does anyone have any questions?