AUTO ZONE

At Misr International Computer & AI, we prioritize productivity and vocational training, equipping individuals with essential skills for the future in our Department of Artificial Intelligence and Embedded Systems.

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Auto Zone
Graduation team

In Memory and Gratitude to Our Late School Owner

We mourn the passing of **MR./Ahmed Hamdy**

Heartfelt Acknowledgments

Expressing appreciation for invaluable support

- **Gratitude to Dr. Micheal Nassif Micheal**

  We appreciate his valuable guidance and support through the project.

- **Thanks to Eng. Hassan Talal Hetta**

  His technical insights and feedback were crucial in this project.

- **Appreciation for professors and colleagues**

  We thank everyone who provided mentorship and motivation during this journey.

- **Gratitude for Family and Friends**

  Their unwavering belief and encouragement were our source of strength.

Milestones Achieved

September 2024

Project kickoff initiated.

October 2024

Prototype development completed.

December 2024

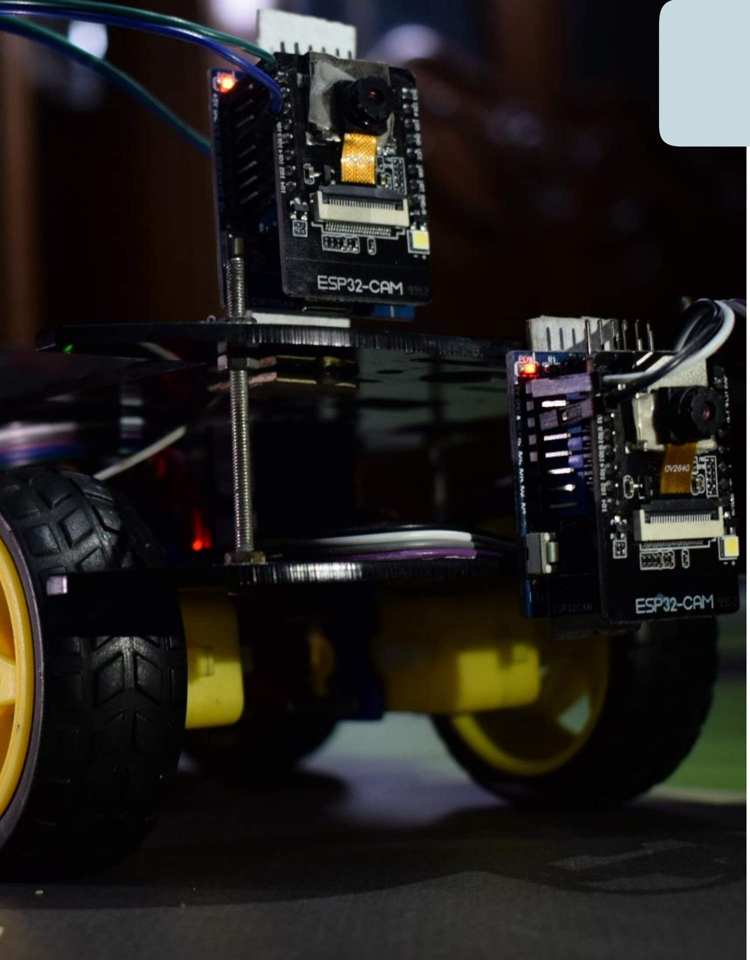
Algorithm implementation finalized.

January 2025

Testing phase commenced.

April 2025

Final review conducted.



Introduction to the Project

Project Idea Overview

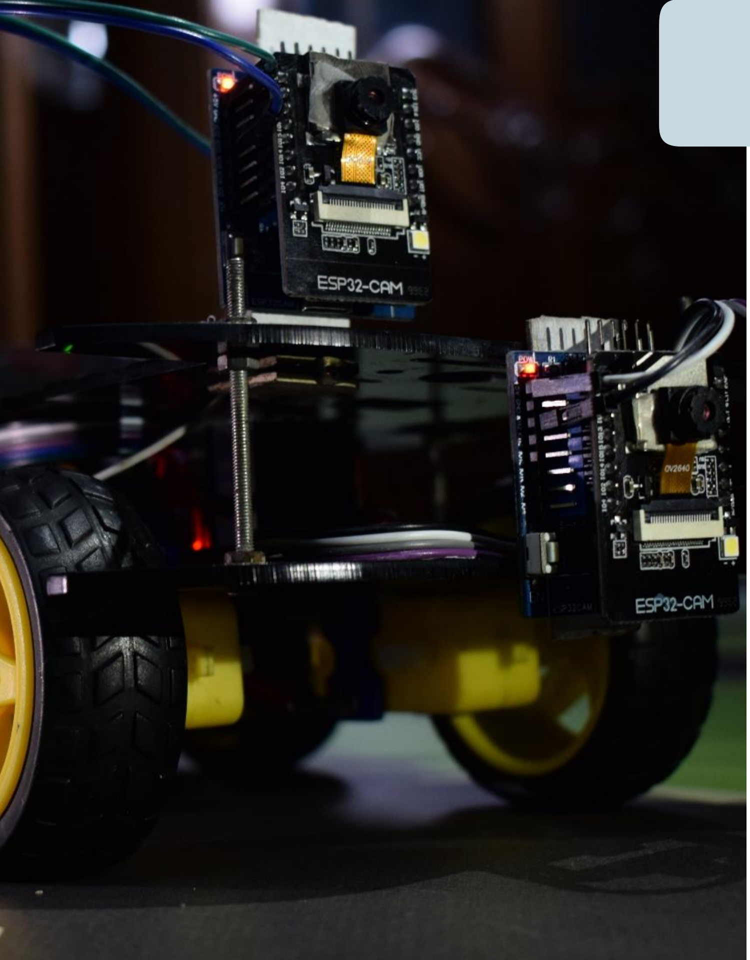
Creating a miniature model resembling advanced self-driving cars through feature analysis.

Objective of the Project

Develop self-driving cars adapted to Egypt's unique road conditions, focusing on local innovation.

Environmental Impact

Aim to reduce pollution by minimizing reliance on fuel combustion through autonomous vehicle technology.



Introduction to the Project

Technological Expertise Gained

Learned Python programming, embedded systems , IoT, AutoCAD for vehicle map design.

Implementation Tools

Utilized a high-end laptop, car chassis, and a customized map for the project developments.

Economic Potential

Demonstrated Egypt’s capability to manufacture competitive self-driving vehicles and AI models.

Evolution of Self-Driving Cars

A Historical overview of Autonomous Vehicles

Phase 1: Conceptualization

Early 20th Century saw initial ideas of autonomous vehicles through fiction and simple experiments.

Phase 2: Prototyping Begins

From the 1980s, practical prototypes like Carnegie Mellon's self-sufficient vehicles emerged.

Key Milestone: 1920s Innovations

Introduction of radio-controlled cars and automatic guidance system laid foundational concepts.

Phase 3: Rapid Advancement

In the 2010s, significant improvements in AI and sensor tech accelerated AV developments

Evolution of Self-Driving Cars

A Historical overview of Autonomous Vehicles

Deep Learning Revolution

Deep learning algorithms transformed computer vision, enabling precise environmental interpretation

Sensor Fusion Technology

AVs now utilize multiple sensors for a comprehensive understanding of their surroundings through fusion.

Technical Components and Hardware

1 **Motor Control**

The system utilizes motor control pins for managing motors Initialization of motor pins is crucial for effective operation.

2 **ESP-32 Camera**

The ESP-32 Cam integrates a powerful microcontroller with a camera for video processing.

It supports Wi-Fi and Bluetooth connectivity, enhancing its functionality.

3 **Arduino-Uno**

Arduino-Uno is a microcontroller board based on the ATmega328P.

It is responsible for motor control of the AV.

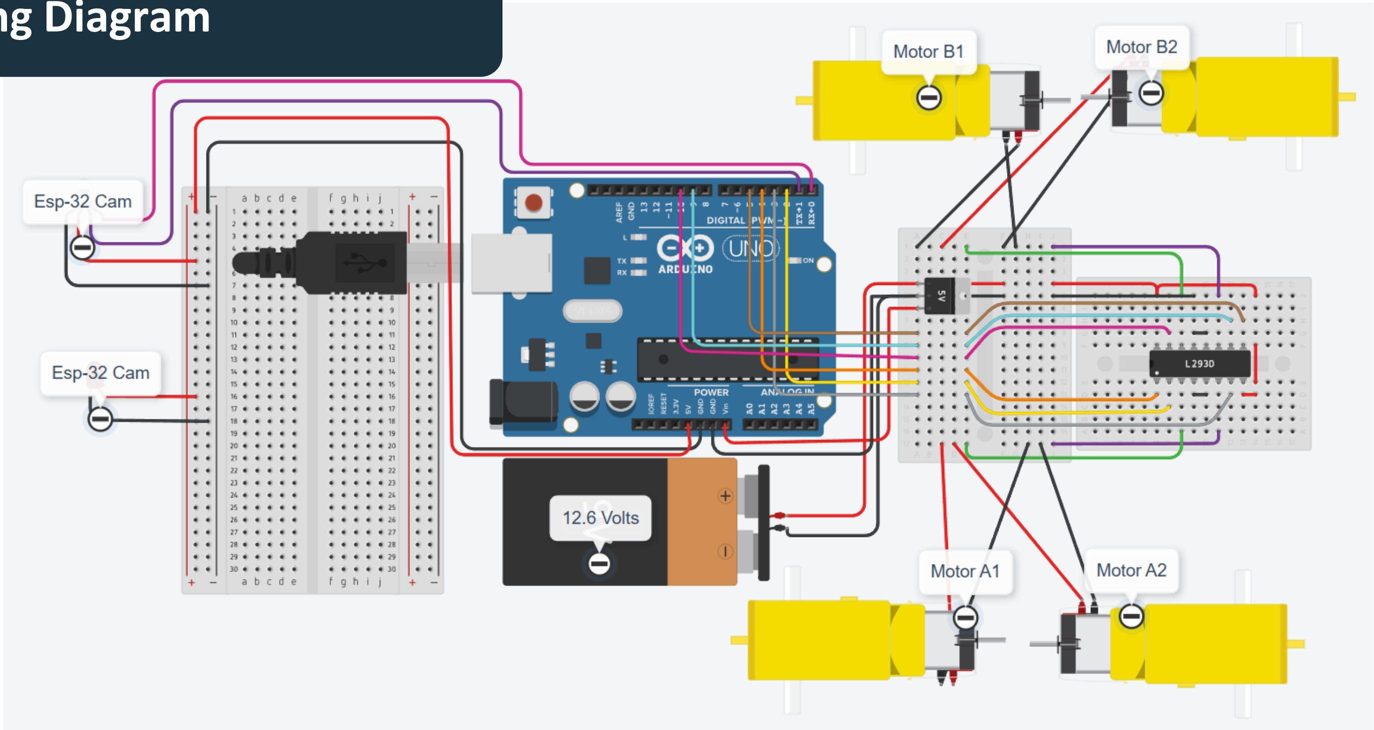
4 **L298-H Bridge**

The L298 is an integrated monolithic circuit.

it contains two H bridges, allowing to control four motors parallelly.

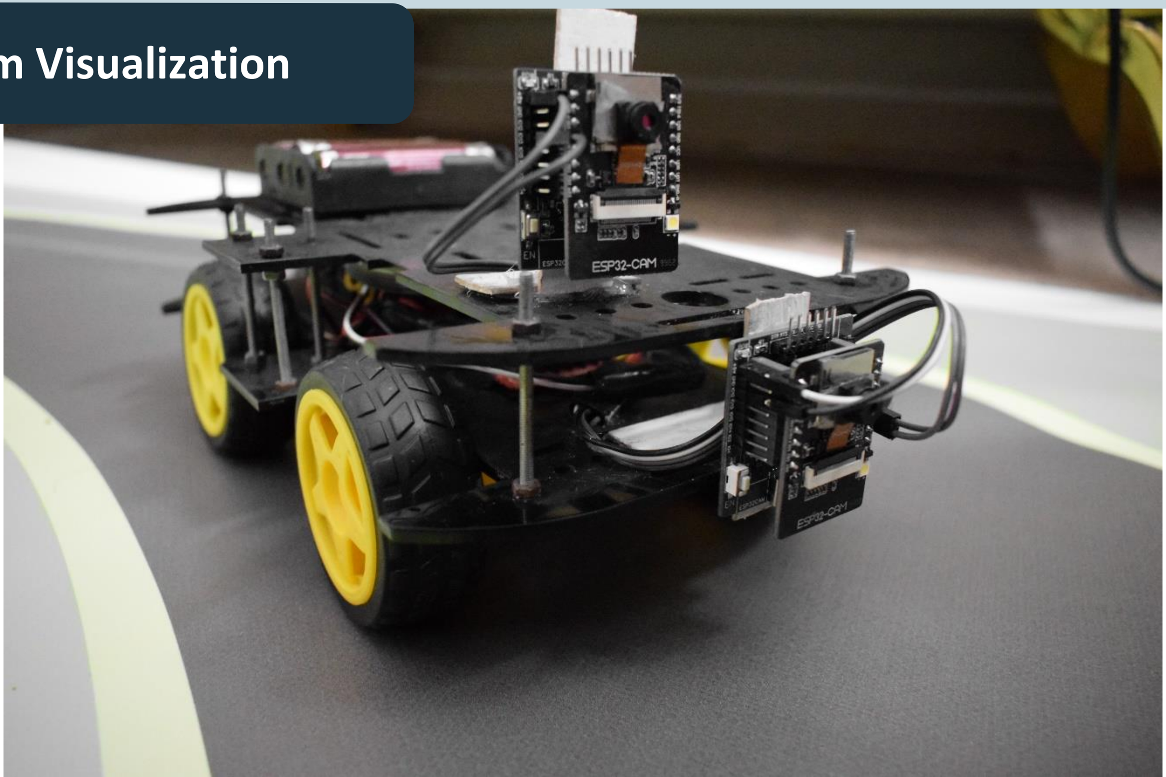
Technical Components and Hardware

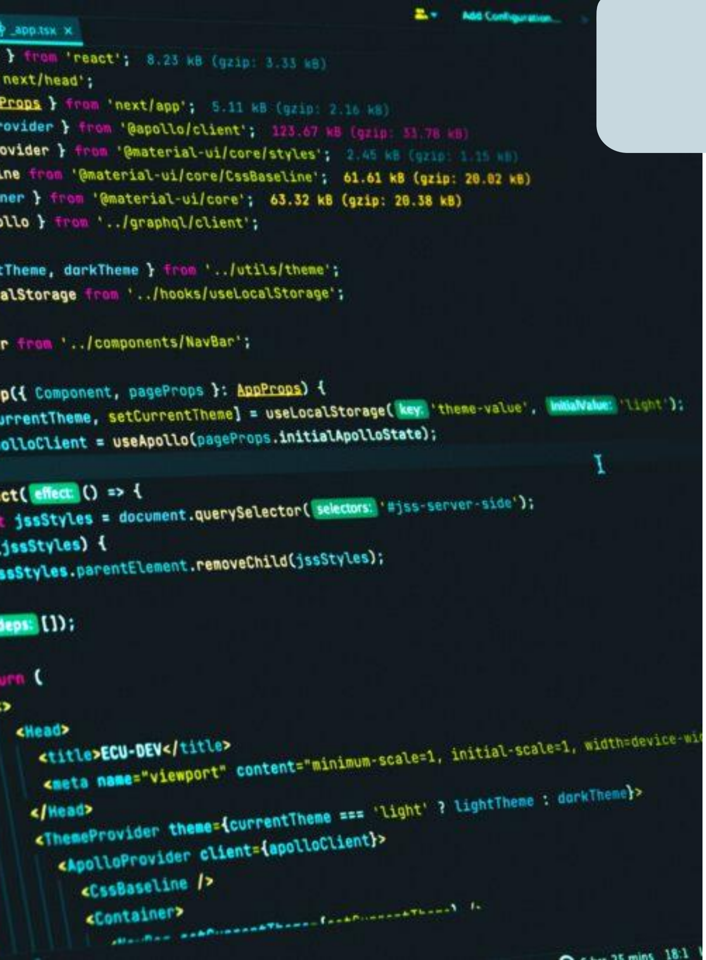
Wiring Diagram



Technical Components and Hardware

Final System Visualization





Programming and Libraries

Python Programming

Python is the primary programming language used for the AI system.
It is favored for its extensive libraries and ease of use.

OpenCV Library

OpenCV is a powerful open-source library for image processing.
It enables real-time analysis and object detection in computer vision applications.

Dlib and YOLO

Dlib is utilized for facial landmark recognition and driver monitoring.
YOLO is an advanced object detection algorithm known for its real-time performance.

Real-time Processing and State Management

Frame Processing

Continuous video frames are captured and resized. Frames are transformed and converted to HSV color space.

Lane Positioning

Histograms are analyzed to identify lane positions. Contours are used to refine lane detection.

Rate Control

Processing rate is controlled to maintain real-time performance. Frame rate consistency is ensured using time delays.

Resource Management

Motor control pins are initialized and managed. Camera stream connection is verified and maintained.

Lane Detection Algorithm

Frame Processing

The video frames are resized to a standard resolution for consistent analysis.

Each frame undergoes perspective transformation to align with the lane detection algorithm.

HSV Thresholds

The algorithm defines HSV color thresholds to isolate lane markings in the video feed.

These thresholds help in filtering out irrelevant colors, enhancing lane visibility.

Perspective Transform

Parameters for perspective transformation are established to map the camera view to a top-down perspective.

This transformation is crucial for accurate lane detection and positioning.

Lane Identification

The algorithm calculates histograms from the processed frames to identify lane positions.

Contour detection techniques are employed to refine the identification of lane boundaries.

Error Management

A connection error handling mechanism ensures the camera stream is accessible for processing.

This step is vital for maintaining the robustness of the lane detection system.

Comparison of Lane Detection Techniques

Traditional Techniques

Traditional lane detection uses image processing methods like edge detection and Hough transforms.

They require manual tuning for different environments.

These techniques struggle with varying lighting and complex road scenarios.

They may not generalize well to unseen data or diverse lane markings.

Deep Learning Approaches

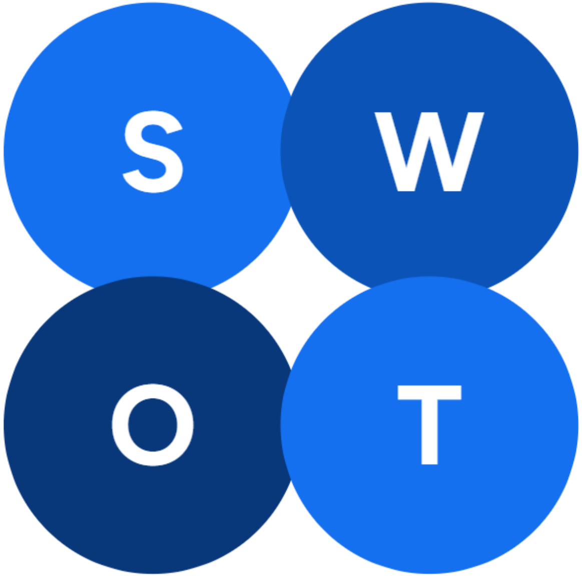
Deep learning techniques utilize neural networks to learn features from data automatically.

These approaches adapt to various conditions and improve accuracy with more data.

They can handle complex scenarios, including different lane types.

Deep learning models often require GPUs and large datasets for effective training.

SWOT Analysis of the Project



Strengths

- The project employs advanced AI algorithms for object detection.
- This enables autonomous operation in various environments.

Weaknesses

- Resource constraints may limit hardware availability.
- Funding limitations could affect scalability.

Opportunities

- There is increasing market demand for autonomous vehicle technology.
- This creates potential for partnerships with automotive manufacturers.

Threats

- Compliance with transportation regulations is crucial for success.
- Navigating these regulations may delay project deployment.

Summary and Conclusion

Project Overview

The Auto Zone project develops an autonomous vehicle system using AI and computer vision.

Team Contributions

The team successfully made an IoT integration which made a real-time data transfer among vehicle components.

Real-Time Processing

Key components include ESP32-CAM for vision processing and Arduino Uno to enable efficient automation.

Programming & Libraries

Implemented YOLO, Dlib, and image moment for navigation.

Lane Detection Algorithm

The algorithm employs HSV color thresholds for lane tracking.

DESTINATION 1

AUTO ZONE

Thank You for Your Attention

We appreciate your time and interest in our work. For any questions or collaboration opportunities, We are all ears.