IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Analysis Of Accident Prevention And Avoidance Of Congestion Using Machine Learning

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Abstract: The Dynamic Traffic Allotment Module uses a laptop-powered computer vision system to count vehicles in real-time from four traffic lanes. Using the Haar Cascade classifier for vehicle detection, the system calculates the traffic density on each road. It then dynamically allocates the green signal time from a fixed cycle time of 120 seconds, proportional to the density of vehicles on each lane, ensuring optimal traffic flow. The Accident Notification Module employs an IR sensor-based mechanism. IR transmitters are embedded in the road, and a receiver is mounted on a dummy car model. When an "accident" is simulated (i.e., the car stops over a transmitter), the IR link is established, triggering an alert on an LCD and a buzzer inside the car model.

Index Terms -Arduino UNO, USB Web Camera, IR Transmitter and Receiver Module, LCD Display(16x2), Buzzer, LED's, Resistors (220Ω, 1kΩ), Breadboard and Jumper Wires, Python, Haar Cascade classifier .

I.INTRODUCTION

The rapid growth of urban populations and the increasing number of vehicles on the road have exacerbated traffic congestion, making it a critical global challenge. Traditional traffic management systems, which rely on fixed-time signal cycles, are a significant contributor to this inefficiency. These static systems operate on predetermined timers, unable to adapt to the real-time, fluctuating traffic density across different lanes. This rigidity leads to unnecessary delays, increased fuel consumption, higher pollution levels, and driver frustration, especially when one road remains congested while another has a green signal with no traffic.

To address this core issue, this project proposes an intelligent and Dynamic Traffic Allotment System. This system moves beyond static timing by leveraging the power of computer vision and machine learning. Using a standard laptop and a camera, the system captures live video feed from a four-way junction. It employs the Haar Cascade classifier for robust vehicle detection and counts the number of vehicles in each lane in real-time. Based on this density data, it intelligently calculates and allocates the green signal duration from a total cycle time of 120 seconds. A lane with higher traffic density receives a proportionally longer green time, thereby optimizing traffic flow and reducing overall congestion.

Furthermore, the project integrates a crucial safety feature: an Accident Sign Board Detection and Alert System. This module uses a network of IR transmitters embedded on the road and IR receivers mounted on a vehicle. When a vehicle stops over an accident-prone zone, aligning the receiver with the transmitter, an immediate alert is triggered. This alert consists of a warning message on an LCD display and an audible buzzer, notifying the driver of the potential hazard ahead. By combining dynamic traffic control with proactive accident alerts, this project presents a comprehensive, cost-effective solution for building smarter and safer transportation infrastructure.

II.OBJECTIVES

1. Dynamic Traffic Management: To design and implement a system that dynamically adjusts traffic signal timings based on real-time vehicle density at a four-way junction

2. Proactive Accident Alerting: To prototype an IR sensor-based accident notification system that provides immediate visual and audible alerts to a driver within a vehicle model.

III.PROPOSED SYSTEM

This project introduces an intelligent system that integrates adaptive traffic control with real-time accident notification to improve road safety and reduce congestion.
The traffic control module employs computer vision and machine learning techniques. A laptop analyzes live video from cameras at the junction and counts vehicles in each lane using a Haar Cascade classifier. Based on these counts, the system computes the traffic density and adjusts the green signal duration from a total 120-second cycle. Each lane is assigned a proportional green light according to its traffic load. The calculated timing is transmitted to an Arduino, which operates the traffic light LEDs, enabling the signal to adapt dynamically to traffic conditions.

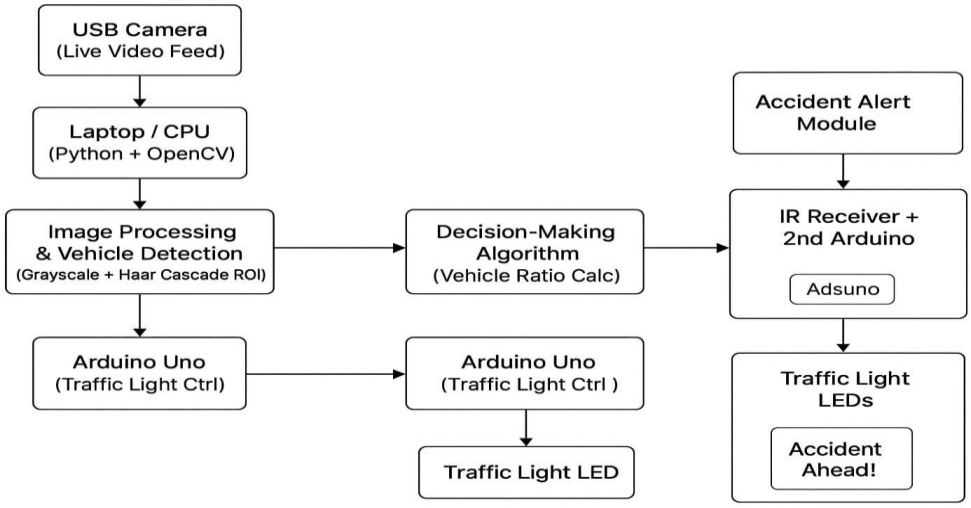
The accident alert module makes use of IR sensors to detect potential hazards. IR transmitters are installed at accident-prone locations on the road, while a receiver is mounted on a vehicle. When the vehicle passes over a transmitter, the Arduino activates an immediate alert inside the vehicle, consisting of a buzzer and an LCD message, warning the driver of the hazard ahead.

By combining lane-wise adaptive signal control with instant accident alerts, this system provides efficient traffic management and enhanced driver safety, helping to reduce congestion and prevent accidents through automated, timely intervention

IV. METHODOLOGY AND WORKING

The project follows a structured design methodology, integrating software and hardware components. The system begins with Data Acquisition, where a USB camera captures a live video feed of the simulated four-road junction. This feed is processed by the Laptop (Central Processing Unit) running a Python script with OpenCV. In the Image Processing & Vehicle Detection stage, the video frames are converted to grayscale, and a pre-trained Haar Cascade classifier scans for vehicles within predefined Regions of Interest (ROI) for each lane. The detected vehicles are counted, and this data is passed to the Decision-Making Algorithm. This algorithm calculates the total number of vehicles and computes the ratio for Seach lane. It then dynamically allots the green light duration for each road by dividing the fixed 120second cycle according to these ratios. The calculated timing data is serially transmitted to the Arduino Uno. The Arduino, acting as the hardware controller, manages the traffic light LEDs, turning them on and off for the precise durations received. Concurrently, the Accident Alert Module works independently. An IR transmitter is placed on the road model. When the dummy car, equipped with an IR receiver and a second Arduino, passes over it, the receiver detects the IR signal. This triggers the Arduino to activate a buzzer and display a warning message (e.g., "Accident Ahead!") on an LCD screen, completing the integrated workflow of the system.

4.1 BLOCK DIAGRAM



V.COMPONENTS

Arduino UNO

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).

IR Sensor

Feature

Easy to assemble and use Onboard detection indication
The effective distance range of 2cm to 80cm
A preset knob to fine -tune distance range
If there is an obstacle ,the indicator lights on the circuit board.

LCD (16X2)

Features

- 16 Characters x 2 lines green backlight
- 5x7 dot matrix character + cursor
- HD44780 Equivalent LCD controller/driver built-in
- 4-bit or 8bit MPU interface
- Standard type
- Works with almost any Microcontroller

V.RESULT

This project focuses on accident prevention and congestion avoidance using machine learning. The system monitors traffic in real-time by counting the number of vehicles in each lane at a junction. Using this vehicle count, the traffic signal timing is dynamically adjusted to optimize traffic flow, reducing waiting time and preventing congestion. By intelligently allocating green signal durations based on lane occupancy, the system ensures smoother movement of vehicles and minimizes the chances of accidents caused by traffic buildup or sudden stops. The integration of machine learning enables accurate vehicle detection and efficient traffic management, making urban roads safer and less congested.

REFERENCE

1. Sutagundar, S. P.,Tippannavar, A. V., & Itti, A. S. (2019). A Smart Traffic Management System for Congestion Control and Warning Using IoT. IEEE International Conference on Electrical, Computer and Communication Technologies (ICECCT).
2. Saleem, M. S., Javed, A., & Ghazal, T. M. (2017). Intelligent Traffic Light Control Using Image Processing. IEEE International Conference on Innovations in Electrical Engineering and Computational Technologies (ICIEECT).
3. Prasad, K. K. R. M. V., Raju, D. A. S. N., & Kumar, P. S. (2018). Vehicle Detection and Counting for Traffic Management System using Background Subtraction. IEEE International Conference on Advanced Computing and Communication Systems (ICACCS).

4. Kodali, R. K., & Gorthi, S. S. (2020). IoT based Intelligent Traffic Signal Control System using Arduino. IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT).
5. Viola, P., & Jones, M. (2001). Rapid Object Detection using a Boosted Cascade of Simple Features. IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR).
6. Sharma, P., & Singh, R. K. (2022). Design and Implementation of a Smart Traffic System using Haar Cascade Classifier. IEEE International Conference on Smart Technologies and Systems for Next Generation Computing (ICSTSN).