Development of Speed Control System for On-road Vehicles using STM32 Microcontroller.

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Project Guide

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Introduction

With the advancements in automative technology and the significant increase in the number of vehicles on the road, the use of new technologies in the prevention of accidents and collision has become an important concern in the automotive industry. Speed control is one such safety measure that plays a vital role in mitigating these risks. This project aims to develop an embedded system that senses and adapts to external conditions, thereby controlling the speed. This would lead to a substantial decrease in human error, providing an additional layer of safety independent of the driver's actions.

By monitoring parameters such as proximity, motor speed and temperature, and tire pressure, the system alerts the driver as well as adapts the speed accordingly to prevent collisions. This system also detects driver fatigue by monitoring the eye movements of the driver.

Introduction

This could go a long way in preventing accidents on highways that occur due to exhaustion and sleep deprivation of commercial drivers at high speeds. The model that this project presents can be further extended to Electric Vehicles (EVs) as well, allowing it to develop in accordance with the advancements in the automotive industry while also being sensitive to environmental concerns.

Objectives

To design and develop microcontroller-based speed control system with adaptive control, and decision-making features.

The features in this work include

- **Proximity detection:** Detects proximity of vehicle/obstacle ahead using IR sensor and determine course of action on a case-by-case basis.

- **Driver fatigue detection:** Detects fatigue using IR glasses and provides warning through buzzer for the 1st time and reduces speed on 2nd time.

- **Motor temperature and current:** Senses motor current and prevents overheating/high current flow by suitable speed adjustment.

- **Tire pressure:** Simulate Tire pressure by supplying linearly proportional voltage through potentiometer. If tire pressure exceeds the acceptable threshold, speed is reduced by a certain percentage.

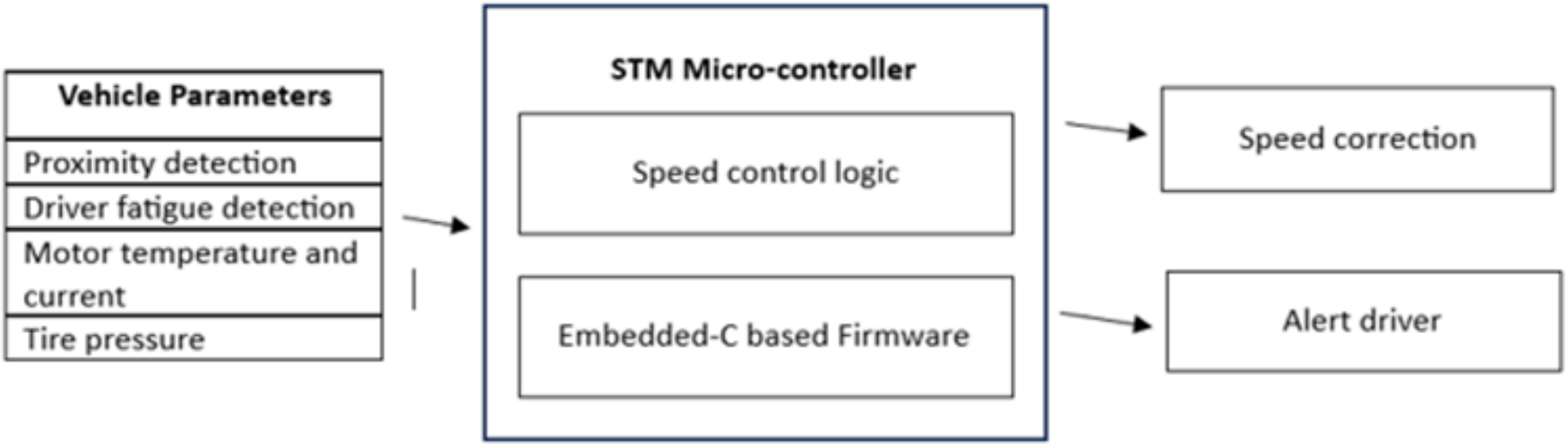
Motivation

- As the demand for transportation increases, it is vital that safety systems are put into place in vehicles to ensure the well-being of the driver as well as the people in the surroundings.

- In this case, a mechanism that would control the speed of the vehicle and send the required alert becomes essential.

- This project aims to integrate various already-existing safety systems into one, and make an effective speed control and alert system that utilises sensors to collect data and adjusts the speed in accordance with the appropriate algorithm provide to it.

Block diagram



Novelty of the Project

- **Integration of Multiple Parameters:** This project aims to develop a speed control system that goes beyond the traditional methods by integrating a wider array of parameters (proximity detection, driver fatigue detection, tire pressure and motor temperature and current). The combination of these factors can provide a more responsive and adaptive speed control system.

- **Real-Time Decision Making:** Unlike existing systems that rely heavily on predefined algorithms or limited input data, this project aims to introduce a system capable of real-time, dynamic decision-making using sensors that can continuously adapt to changing conditions, ensuring optimal speed control.

- **Safety Enhancements:** As road safety remains a critical issue globally, any advancement in speed control technology that can reduce accidents and improve driver response times is of significant value. This project could contribute to lowering accident rates by providing more nuanced and responsive speed control.

Novelty of the Project

- **Contribution to Autonomous Vehicle Development:** The project could also play a role in the broader field of autonomous vehicle development. By pushing the boundaries of how vehicles interpret and respond to various driving parameters, it may offer insights or technologies that can be applied in self-driving cars.

- **Commercial and Consumer Benefits:** Finally, the project has the potential to offer both commercial benefits (e.g., more advanced vehicle features) and consumer benefits (e.g., increased driving comfort and safety), making it a valuable addition to the automotive industry.

Deliverables

- Real-time monitoring and control of vehicle parameters.
- Semi-automatic speed adjustment.
- Additional security using alert system.
- Extended applications to EVs

Target beneficiaries of the proposed work:

- Automobile Companies
- Individual Consumers
- Commercial Drivers
- Suppliers
- Universities and Research Labs

Time Schedule of Activities

S.no	Activity	Months				
		1-3	4-5	6-7	8-9	10-12
1.	Literature Survey	■				
2.	Circuit Design		■			
3.	Prototype Development			■		
4.	Integrating the system				■	
5.	Overall Testing					■

Budget Estimates

Item	Budget
STM32 microcontroller	₹4000
BLDC motor 500 W, 24 V	₹6000
Inverter with driver	₹5000
Sensors	₹2000
Miscellaneous	₹3000
Total	**₹20,000**

Budget Justification

The budget has been allocated to cover expenses related to research materials, equipment, personnel, and other necessary expenses. The justification for major equipment and specific budget items is as follows:

- Hardware expenses, including the purchase of the microcontroller and all required sensors amount to around ₹6000 (STM and sensors).
- Cost of the motor used to simulate the car motor is around ₹11000
- There are no software expenses applicable as of now for this project. Hence, it is omitted.
- Miscellaneous expenses such as the purchase of basic circuit material vital to testing the project are allocated ₹3000.

Conclusion

- This project, aims to address the growing need for intelligent safety measures in modern vehicles. By integrating parameters such as proximity detection, driver fatigue monitoring, motor performance, and tire pressure into a unified system, the project provides a novel approach to enhance vehicular safety and efficiency.
- By utilizing the STM32 microcontroller and embedded systems, this project holds promise for real-time, adaptive speed control solutions that contribute to accident prevention and driving comfort.
- The anticipated outcomes not only address immediate safety concerns but also align with advancements in autonomous vehicle development and sustainable practices.
- This initiative, with its potential applications in academic research and industrial innovations, is poised to make an impact on the automotive sector while prioritizing safety and environmental consciousness.

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