Green University of Bangladesh
Department of Computer Science and Engineering (CSE)
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Arduino-Based Smart Traffic Light System

Project Proposal

Course Title: Microprocessor and Microcontroller Lab
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Chapter 1

Introduction

1.1 Overview

The Arduino-Based Smart Traffic Light System aims to improve traffic management and safety by using an Arduino microcontroller combined with sensors to prioritize emergency vehicles such as police cars and ambulances. The system leverages Doppler radar to detect vehicle speed and sound sensors to identify emergency sirens, allowing the traffic lights to change dynamically, and reducing the likelihood of accidents at intersections.

1.2 Problem Domain

Intersections are common sites for traffic accidents, often involving emergency vehicles due to the need for quick response times. The project seeks to address these challenges by creating a smart traffic light system that can detect approaching emergency vehicles and manage traffic flow to reduce collisions.

1.3 Motivation

The project is motivated by the increasing number of accidents at intersections, particularly those involving emergency vehicles. The goal is to save lives by ensuring that emergency vehicles can pass through intersections safely and quickly, minimizing delays caused by regular traffic.

1.4 Objectives

The objectives of the lab project are as follows:

- To design and implement a functional prototype of a smart traffic light system using Arduino.

- To integrate sensors and actuators, such as Doppler radar, LEDs, and servo motors, for real-time traffic control.
- To develop a system that can detect and prioritize emergency vehicles for smooth traffic management.
- To optimize the performance and accuracy of the traffic control system to adapt to various traffic conditions.
- To test and evaluate the efficiency of the system in controlling traffic flow and reducing potential accidents at intersections.

1.5 Feasibility Study

1.5.1 Technical Feasibility

The system is technically feasible, as it utilizes widely available and cost-effective components. The Arduino microcontroller serves as the core of the system, providing a flexible and easy-to-program platform that can integrate various sensors and control devices. A Servo motor is used to control physical movements, such as changing traffic light positions or barriers, enhancing the system's real-time responsiveness. LEDs (Red, Yellow, Green) are employed as visual indicators for traffic signals, ensuring clear communication with drivers. Additionally, 100 ohm resistors are integrated into the circuit to regulate the current flowing through the LEDs, ensuring their safe and efficient operation. While the system's basic structure is sound, adjustments to sensor accuracy and range may be required to ensure optimal performance in various traffic environments.

1.5.2 Operational Feasibility

Operationally, the system is feasible as it automates traffic light management based on real-time input from sensors. However, its effectiveness in complex urban environments with pedestrian and cyclist traffic needs to be considered. Some limitations may arise from sensor interference, particularly in densely built environments.

1.5.3 Financial Feasibility

The project is financially feasible due to the use of low-cost components, making it suitable for large-scale implementation. The estimated costs of the key components used in the system are detailed in **Table 1.1**. For instance, the Arduino Uno, which serves as the core controller, is estimated to cost 1,050 BDT, while other essential items like LEDs, resistors, and a breadboard contribute to keeping the total cost low, with the overall expenditure estimated at 1,500 BDT. This makes the system not only efficient but also affordable, though installation and long-term maintenance should be considered for widespread deployment.

Table 1.1: Components and Estimated Costs

Component	**Quantity**	**Estimated Cost (BDT)**
Arduino Uno	1	1,150
Servo Motor	1	200
LEDs (Red, Yellow, Green)	3	10
100 Ohm Resistors	3	10
Breadboard	1	80
Jumper Wires	10	10
Battery (9V)	1	40
Total		1,500

1.6 Application

This system can be applied at intersections, particularly those in high-traffic areas or locations where emergency vehicles frequently pass. It can be implemented in cities with heavy traffic to optimize the movement of emergency vehicles, ensuring they reach their destinations without unnecessary delays.

References

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