

Solar Powered Traffic System with Zebra Crossing Safety

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Abstract: Rapid urban development and the growing vehicle population have increased both the demand for energy and the number of road accidents, especially near zebra crossings where pedestrians are at high risk. This paper presents a Solar Powered Traffic System that integrates renewable energy automation with intelligent traffic control. The system is powered by a solar source and a battery, which are monitored and optimised through IoT sensors and a microcontroller to ensure a reliable and eco-friendly power supply. An Arduino UNO processes inputs from IR sensors and a vehicle detection unit and drives LED traffic signals according to real-time pedestrian and vehicle movement. The system is expected to control traffic signals automatically and improve zebra crossing safety, supporting a sustainable and secure smart city.

Keywords: Solar Energy, Smart Traffic Control, Zebra Crossing Safety, Arduino UNO, IoT.

I. INTRODUCTION

Modern urban development has led to a rapid rise in vehicle population and a steady increase in energy demand. Traffic signals and road-side safety equipment run continuously and add to the load on the conventional grid, while the growing traffic volume has increased the number of road accidents. Renewable energy sources, particularly solar energy, offer a clean and reliable way to power such roadside infrastructure [1], [3].

This paper proposes a Solar Powered Traffic System that addresses these two challenges together. The system integrates energy automation, in which a solar source and battery are monitored and optimised using IoT sensors and a microcontroller, with intelligent traffic control that responds to real-time pedestrian and vehicle movement near zebra crossings.

II. PROBLEM STATEMENT

Rapid growth in vehicle population in urban areas has increased the number of road accidents, especially near zebra crossings where pedestrians are at high risk. In many areas drivers fail to maintain a safe stopping distance near zebra crossings, leading to unsafe conditions and accidents. Automated pedestrian detection at signalised crossings has been reported to reduce vehicle–pedestrian conflicts [2].

III. OBJECTIVE AND SCOPE

A. Objective

To develop an integrated system that automates renewable energy generation and implements an intelligent traffic control system with zebra crossing safety for a sustainable and secure smart city.

B. SCOPE

The scope of the work is a fully automated traffic control system that responds to real-time pedestrian and vehicle movement, powered by a solar energy source.



IV. PROPOSED SYSTEM

A. System Overview

The proposed system consists of a solar power source, a battery, IR sensors, a vehicle detection unit, an Arduino UNO microcontroller and LED traffic signals. The solar source charges the battery, which supplies the controller and the signal LEDs, so that the system operates as an eco-friendly and self-sustained installation. The IR sensors and the vehicle detection unit provide real-time pedestrian and vehicle information to the Arduino UNO, which decides the state of the traffic signals. The block diagram is shown in Fig. 1.

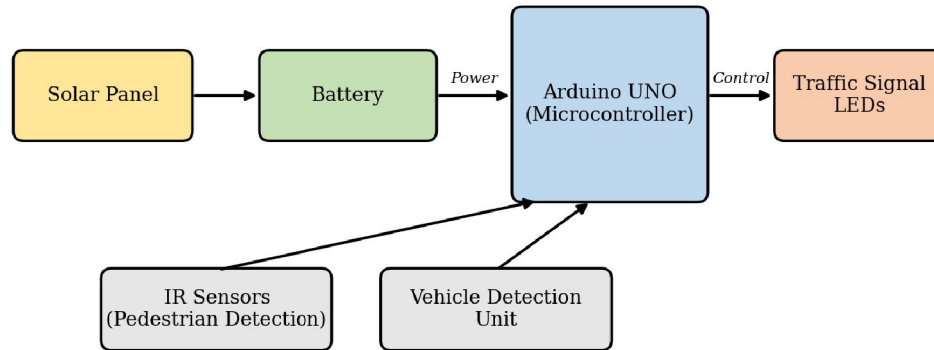


Fig. 1. Block diagram of the proposed solar powered traffic system

B. Hardware Requirements

The main components of the system are listed in Table I.

TABLE I: Hardware Components of the System

Component	Function
Solar power source	Generates electrical energy from sunlight to power the system
Battery	Stores the solar energy and supplies power to the controller and LEDs
IR sensors	Detect pedestrian presence at the zebra crossing
Vehicle detection unit	Detects approaching vehicles
Arduino UNO	Reads the sensor inputs and controls the traffic signals
LEDs	Indicate the traffic signal states to drivers and pedestrians

C. Working Principle

The solar source supplies energy that is stored in the battery, and the energy status is monitored by the IoT sensors and the microcontroller to ensure a reliable power supply. The IR sensors, which are widely used to detect vehicles and people passing a point [1], and the vehicle detection unit continuously send pedestrian and vehicle data to the Arduino UNO. Based on this real-time data, the Arduino UNO automatically controls the LED traffic signals so that vehicles are warned and stopped when a pedestrian is waiting to cross the zebra crossing.

V. EXPECTED RESULTS

The system is expected to automatically control traffic signals based on real-time vehicle and pedestrian detection. Combining solar power with intelligent signal control is expected to provide a reliable and eco-friendly power supply and to improve pedestrian safety at zebra crossings.



VI. CONCLUSION

A Solar Powered Traffic System that combines renewable energy automation with intelligent, sensor-based traffic control has been proposed. By using solar energy and automatic detection of pedestrians and vehicles, the system aims to reduce accidents near zebra crossings while lowering dependence on grid power, contributing to a sustainable and secure smart city.

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