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Portable Traffic Control

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A B S T R A C T :

This project introduces a low-cost, portable traffic signal control system designed for temporary deployment. Using an Arduino Uno microcontroller, 3-channel relay modules, and 230V AC indicator bulbs, the system mimics real-life traffic lights. Its portability and simplicity make it ideal for use in road construction zones, event areas, or emergency redirections. It aims to improve safety and traffic flow with a reliable, programmable, and easy-to-operate design. Portable traffic control systems are innovative, mobile solutions designed to manage and regulate traffic flow in temporary or dynamic environments such as construction zones, emergency response situations, and event venues. These systems aim to enhance road safety, reduce congestion, and improve operational efficiency without the need for permanent infrastructure. Typically integrating sensors, wireless communication, and automated signaling, portable traffic control units offer real-time adaptability and ease of deployment. This paper explores the design, components, operation, and applications of portable traffic control systems, highlighting their significance in modern traffic management and future smart city frameworks. This project presents a portable traffic control system designed using microcontroller-based automation, relay modules, and signal lamps. The core of the system is an Arduino-based controller that manages the timing and operation of red, yellow, and green signal lights via relay-driven circuitry. The system is powered through a standard AC supply and can be adapted for battery or solar power, making it suitable for remote or undeveloped areas. The design ensures safety, reliability, and cost-effectiveness, allowing temporary traffic control to be handled without requiring permanent infrastructure

Keywords: Arduino,Relay,Bulbs

1. Introduction

Rapid urbanization and rising vehicular load have created a demand for dynamic traffic control systems. Fixed signal systems don't work well in temporary traffic diversion cases. situations. The proposed system fills this gap by providing a compact, efficient solution to manage such conditions using actual AC bulbs rather than LEDs for realistic simulation.[3]

1.1. Literature

Design and Implementation of Portable Smart Wireless Pedestrian Crossing Control System,-Traffic congestion and pedestrian safety are major concerns in urban and rural areas. The study by on the Design and Implementation of Portable Smart Wireless Pedestrian Crossing Control System presents an innovative approach to traffic signal management, particularly for temporary or emergency traffic situations. The system integrates wireless communication with a smart control mechanism to efficiently manage pedestrian crossings without the need for extensive infrastructure. The research highlights the portability of the system, making it ideal for deployment in temporary locations such as construction zones, school crossings, or emergency traffic diversions. Unlike conventional traffic signals, which require permanent installations and wired connections, this system operates wirelessly, reducing installation costs and complexity. The use of microcontrollers and wireless transmitters ensures seamless communication between pedestrian signals and vehicular traffic lights, improving traffic
flow and safety. For a Portable Traffic Signal Project, this study provides a strong foundation, as it emphasizes the importance of mobility, efficiency, and adaptability. The proposed system can be modified to incorporate IoT-based traffic monitoring, solar-powered operation, and adaptive signal control, enhancing its effectiveness in dynamic traffic conditions.

An Intelligent Traffic Signaling System Based on an IoT Approach: Managing traffic efficiently is a major challenge in cities. This study focuses on smart traffic signals that adjust automatically based on live traffic conditions. The system uses sensors and microcontrollers to detect the number of vehicles on the road and adjust signal timings automatically. This research is useful for a0 Portable Traffic Signal Project because it shows how IoT technology can improve traffic control without human intervention. The system's ability to collect and analyze traffic data in real-time makes it efficient and responsive, reducing congestion. Although this study focuses on fixed traffic signals, the concept can be applied to portable traffic lights, making them more intelligent and adaptable.

Smart Traffic Light Management Through IOT. Deep Reinforcement Learning

This paper talks about making traffic lights smarter using IoT (Internet of Things) and machine learning. The system uses sensors to collect traffic data in real time and learns how to adjust signal timings automatically to reduce traffic jams. For a Portable Traffic Signal Project, this is helpful because it shows how to make traffic signals more intelligent. Even though it focuses on permanent signals, the same idea can work for portable signals. By using IoT and smart technology, portable traffic signals can respond to traffic changes and work more efficiently.

Portable Smart Traffic Signaling System With Cloud- AI Enablement. Portable smart traffic signaling system focuses on designing and developing a portable smart traffic signaling system. That leverages cloud computing. And artificial intelligence is used to improve traffic flow instantly as conditions change. This system is intended to be easily deployable, making it suitable for temporary traffic control Situation such as road construction, accident sites. Or emergency scenarios .smart portable traffic signaling system using IoT and artificial intelligence. It is designed for smaller traffic junctions that experience congestion at specific times but do not have permanent traffic signals. The system uses an ESP32 microcontroller and can work with or without internet connectivity. Edge ML Technique for Smart Traffic Management in Intelligent Transportation System. This project focuses on implementing Edge ML techniques in smart Traffic Management to improve urban mobility, reduce congestion, and enhance rood safety by leveraging edge computing. Real time At models, and IOT-based sensing, the system can analyze traffic patterns, optimize signal timings, and detect incidents instantly.

Compared to traditional cloud-based traffic management Edge ML ensures low latency, efficient bandwidth & real-time adaptive control, making cities. Smart & more responsive to traffic conditions .This system aims to make city roads smarter, foster and safer.

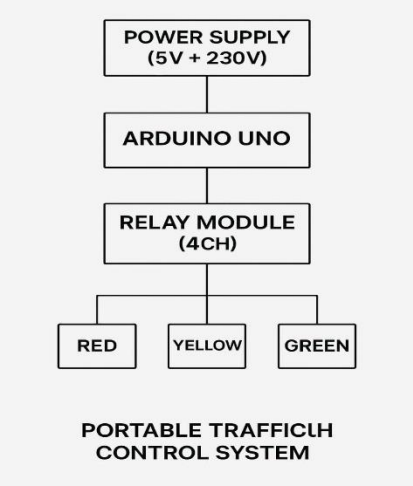
2. A Deep Q Learning Network for Traffic Lights Cycle Control In Vehicular Network. This paper explores how Artificial Intelligence (AI) can improve traffic light control using Deep Reinforcement Learning (DRL). Traditional traffic lights operate on fixed schedules, which often lead to congestion, long delays, and inefficient traffic flow. To address this, the study proposes a Deep Q-Learning Network (DQN) that dynamically adjusts the duration of traffic light cycles based on real-time data collected from sensors and vehicles. By dividing intersections into grids and using Convolutional Neural Networks (CNNs), the model learns the best timing strategy to optimize traffic movement. Advanced techniques such as Double Q-learning, Dueling Networks, and Prioritized Experience Replay further enhance decision-making. The system was tested using the SUMO traffic simulator, and the results showed that AI-powered traffic lights significantly reduced waiting times and improved overall traffic flow. This research highlights how intelligent traffic management can make urban road networks more efficient and responsive to real-world conditions. The Traffic Signal Control Problem For Intersections This paper provides a detailed review of the Intersection Traffic Signal Control Problem (ITSCP), which deals with optimizing traffic light schedules to reduce congestion and improve traffic flow. The study highlights the complexity of ITSCP due to unpredictable traffic patterns, vehicle interactions, and real-time decision-making challenges. It reviews different approaches used over the years, including fixed-time, actuated, and adaptive traffic signal control methods. The paper also explores various optimization techniques, such as mathematical models, heuristic algorithms, reinforcement learning (RL), and multi-agent systems (MAS). It discusses the impact of new technologies like connected and autonomous vehicles, advanced vehicle detection systems, and artificial intelligence on traffic management. The review identifies gaps in current research and suggests future directions, such as considering real-world traffic complexities, expanding to larger networks, and integrating emerging technologies for smarter traffic signal control.

Simulation And study of a smart traffic light system for urban areas. This project focuses on developing an intelligent traffic light control system that can adjust signal timings based on real- time traffic conditions. Traditional traffic lights operate on fixed timers, which often lead to unnecessary congestion. To solve this, the system uses an AT89C51 microcontroller (MCU) to detect traffic flow and dynamically change the duration of red, yellow, and green lights. The system consists of a control module, traffic flow detection module, time display module, and signal conversion module. The researchers tested their design using

3. PROTUS simulation software, which showed that the system can improve traffic flow, reduce congestion, and provide more efficient signal control. The project is cost- effective, reliable, and practical for urban traffic management Design And Implementation Of Portable Traffic Light Control System The paper "Design and Implementation of Portable Traffic Light Control System" presents a smart traffic light system that adjusts signal timings based on traffic density. Unlike traditional fixed-time traffic signals, this system can switch between automatic and manual modes, allowing traffic police to control light durations during congestion or emergencies. It is designed to be cost-effective, portable, and easy to implement, making it a practical solution for cities with unplanned road networks. The system uses a microcontroller to manage signal timings and prioritizes emergency vehicles. The main goal is to ease traffic jams and make roads more efficient. Application Of Traffic Light Control In Oversaturated Urban Network Using Multi-Agent Deep Reinforcement Learning This project focuses on improving traffic light control in highly congested urban areas using Multi-Agent Deep Reinforcement Learning (MARL). Traditional traffic lights follow fixed schedules, which often lead to traffic jams. This study proposes an AI-based adaptive traffic signal system that uses Deep Q-Networks (DQN) to adjust signal timings dynamically based on real-time traffic conditions. The system collects traffic data from multiple intersections and trains AI agents to make smarter traffic control decisions. Simulations using the SUMO traffic simulator show that this approach reduces congestion, increases vehicle flow, and improves overall traffic efficiency. The study highlights how AI can make city traffic management smarter and more responsive.

2.Methdology

2.1 Research Design



First point Fig.1.Portable Traffic Control

The core design is based on Arduino Uno as the controller unit programmed to operate relay outputs. These relays are connected to 230V AC bulbs representing red, yellow, and green signals. The use of voltage regulators like 7805 and 7812 ensures stable voltage levels for the components.

Diodes are added across relay coils to prevent back EMF.

2.2 Data Collection

Component	**Quantity**
Arduino Uno	1
2-Channel or 4-Channel Relay Module	1
AC Bulbs (Red, Yellow, Green)	3
10k Potentiometer	1
Breadboard & Jumper Wires	As required
220V Power Supply with proper safety measures	1
Resistors (for potentiometer input filtering)	As needed
Bulb Holders	3
Arduino USB Cable	1

Table1. Required Components

Observations were made on bulb timing cycles, transition accuracy, and the responsiveness of relays. System behavior was logged over multiple on-off cycles for each signal to validate consistency.

2.3 Data Analysis

Recorded data indicated consistent timing of red, yellow, and green signals. Relays triggered within expected thresholds, showing the design's stability. No noise-induced false switching or AC failure occurred. Circuit remained stable under extended usage.

3.Result

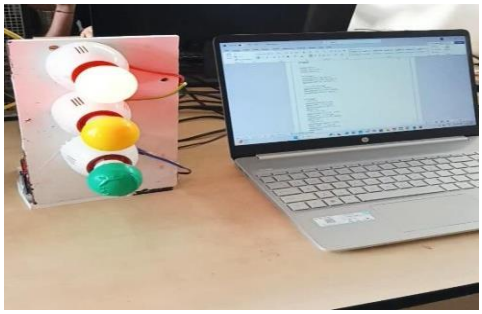


Fig.2.Stop Signal

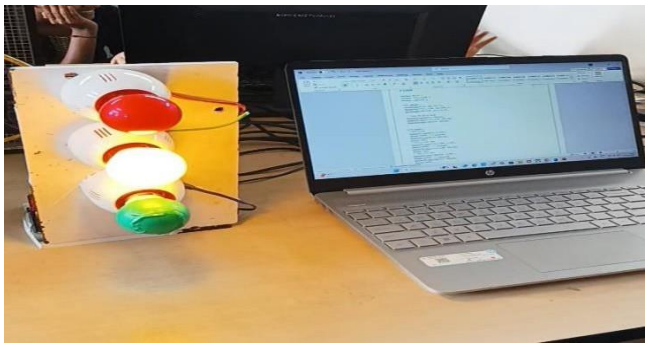


Fig.3.Slow Down

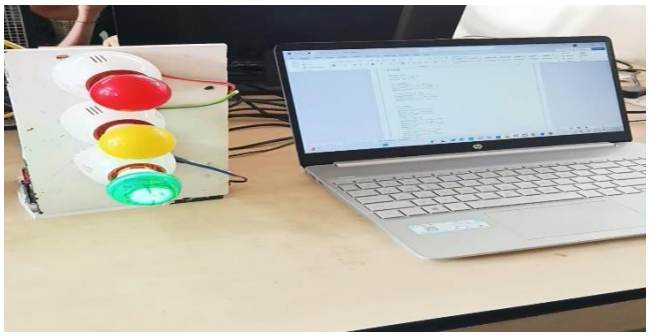


Fig.3.Go signal

3.Disscusion

The prototype operated successfully under continuous test conditions. The relay modules effectively handled AC signal switching based on logic from Arduino Uno. No delay or electrical noise issues were observed. By maintaining isolation between the AC and control sides, the system ensured both functional safety and accuracy. Voltage regulators were used to protect the Arduino from power surges. The use of a physical signal bulb (instead of LEDs) provides a more realistic field simulation.[2],[3],[4].

Acknowledgements

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Conclusion

This portable traffic light control system delivers a robust and low-cost solution for real-time, temporary traffic management. Its simple construction and AC compatibility make it a practical alternative in places where permanent signals are unfeasible. The system's adaptability also allows for future enhancement, including integration with Bluetooth, LoRa, or wireless sensor input. Such systems can be especially useful in rural areas or during urban construction.[1],[4].

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