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Density-Based Traffic Control and Ambulance Prioritization

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ABSTRACT: The current traffic signalling system is inefficient, as it operates based on fixed timings and doesn't consider traffic density or approaching ambulances. This system aims to prioritize ambulances and clear overcrowded roads first, irrespective of normal signals. An RF-based data transmitting card is installed in the ambulance, allowing the driver to send a signal to the main control circuit. The system can sense all four sides of the X roads and allows clearing traffic with grace time when traffic is more than normal. Four sets of optical sensors detect traffic density, and a microcontroller chip generates logic pulses for each passing vehicle. The system contains four signal posts with three indicators: red, green, and yellow. The demo module is marked with a small circle, and all four signal posts are arranged within the circle.

KEYWORDS: 89C52 Microcontroller chip, detecting circuits built with IC567 and IR sensors, RF transmitter, RF receiver, 89c2051 controller chip, Power supply unit.

I.INTRODUCTION

Traffic congestion is a significant issue in large cities worldwide, particularly in developing countries where population growth is faster than in developed countries. This increases traffic congestion, making it difficult to reach nearby areas and potentially causing death for emergency vehicles. To address this, a wireless communication system has been installed in ambulances, allowing drivers to activate corresponding keys based on approaching traffic signals. Traffic control systems currently follow a timer system, but this may not always clear traffic. A project has been designed to control traffic based on density at signal junctions using four IR sensors. The controller estimates traffic density in each direction and allows vehicles with higher density to receive extended green signals. The project also prioritizes vehicles with higher density and clears traffic. Automotive technologies are increasingly being used in modern road traffic control systems due to the growing number of vehicles and passengers.

The project focuses on developing intelligent control structures for urban traffic and motorway systems to avoid traffic jams, accidents, and environmental costs. It uses communication networks, sensor networks, and sophisticated algorithms to set traffic lights and minimize waiting times. The research aims to address traffic clearance in dense urban networks and future extensions of the project. Intelligent Traffic Control combines traffic engineering, system analysis, control theory, and optimization to manage vehicle movements efficiently and effectively.

Traffic control strategies are based on predefined plans and traffic-actuated strategies. Predefined plans use historical data to define regulation plans, while traffic-actuated strategies consider current traffic flows or vehicle numbers. Logic programming is a recent application of this method, which can be applied to urban intersections with high traffic levels. This method offers simplicity and flexibility in designing traffic control strategies.

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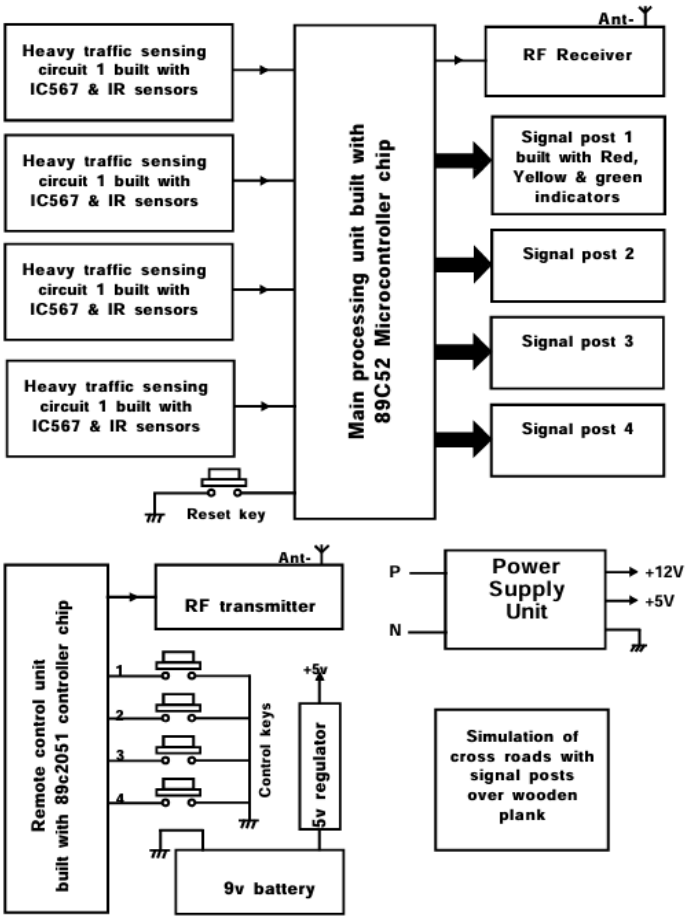
BLOCK DIAGRAM:



II.RELATED WORK

Several research studies and projects have focused on developing smart traffic light control systems using microcontrollers. These systems use sensors to detect vehicle density at intersections and dynamically adjust traffic signal timings to optimize traffic flow. By integrating microcontrollers with sensors, these systems effectively manage traffic based on real-time data.

Many cities have implemented ambulance priority systems that utilize microcontrollers and GPS technology. These systems enable ambulances to send signals to traffic lights, triggering them to change in favor of the ambulance's route. Microcontrollers play a crucial role in processing these signals and coordinating with traffic lights to ensure smooth passage for emergency vehicles.

Some research efforts have focused on developing energy-efficient traffic control systems using microcontrollers. These systems aim to minimize energy consumption by optimizing traffic signal timings based on vehicle density patterns, thus reducing idling time and fuel wastage.

Density-based traffic control and ambulance prioritization using microcontrollers showcases a diverse range of innovations aimed at improving traffic management, emergency response, and overall urban mobility. These efforts demonstrate the potential of microcontroller-based systems in creating smarter and more sustainable transportation infrastructure.

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III.METHODOLOGY

The project involves the practical construction of a Density based traffic control and ambulance prioritization, requiring the integration of various electronic and electrical components. Key active components include the 89C52 Controller chip, Voltage regulator ,89c2051 controller chip, LM567 IC, IR sensors.

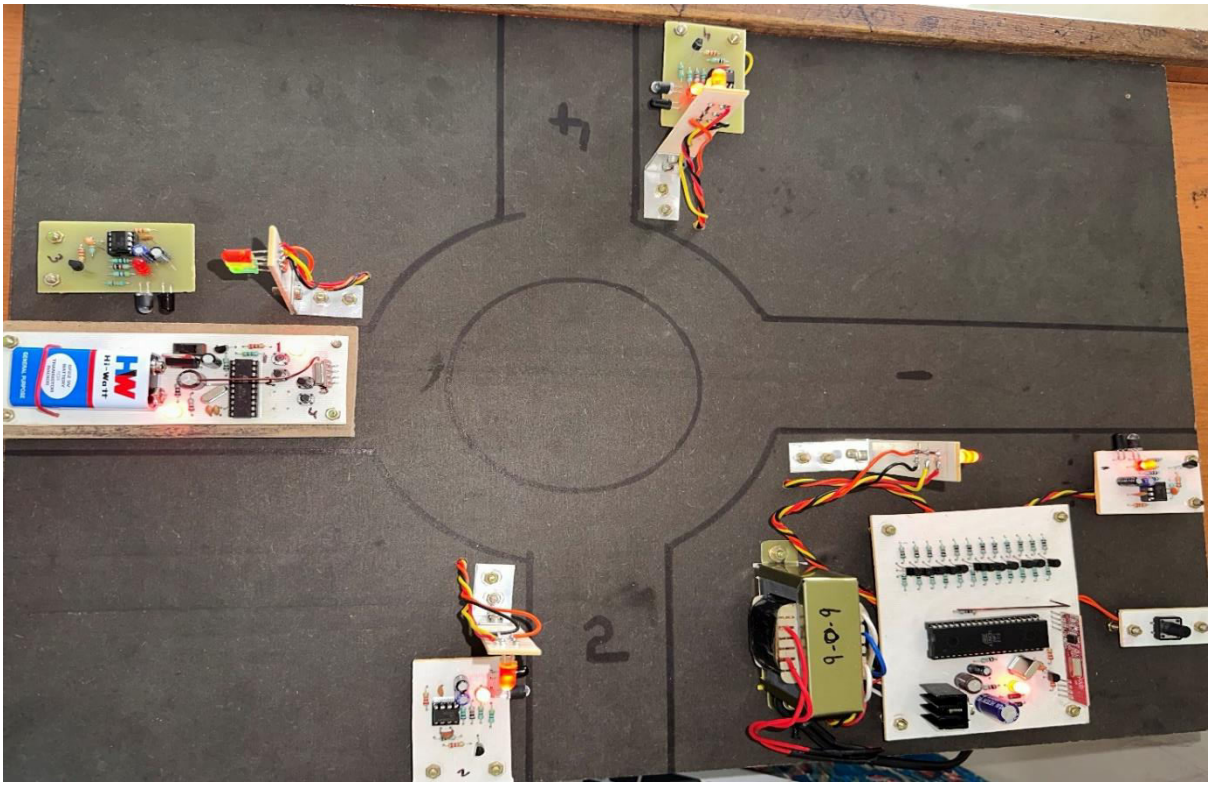
The methodology begins with the procurement and assembly of the necessary hardware components. The 89C52 main processor serves as the central control unit, coordinating system operations. A voltage regulator ensures stable power supply to the components, while the LM567 IC to count the number of vehicles in four directions and two IR leds, IR signal transmitting LED and IR signal receiving LED.

Hardware works together with firmware and software to make a system function. Software is a collection of code installed into the microcontroller chip to control the traffic and ambulance unit.

Overall, the methodology involves the careful selection, integration, and testing of electronic hardware components to realize the practical implementation of the project concept.

IV.EXPERIMENTAL RESULTS

The experimental results demonstrate the successful implementation and functionality of the density-based traffic control and ambulance prioritization.



• Reduces Congestion: Dynamic adjustment of traffic signal timings based on real-time vehicle density data alleviates congestion, leading to smoother traffic flow and reduced travel times.

• Optimizes Traffic Flow: Prioritizes green signals for lanes with higher vehicle density, allowing a balanced traffic distribution and minimizing bottlenecks.

• Improves Air Quality: Reduced congestion and smoother traffic flow result in lower idling times, reducing emissions of pollutants.

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• Enhances Safety: Prioritizes ambulance routes, improving emergency response times.

• Enables Real-time Adaptability: Enables instant adaptation to changing traffic conditions, ensuring optimal traffic management.

• Reduces Fuel Consumption: Smoother traffic flow and reduced congestion lead to lower fuel consumption, contributing to energy conservation.

• Enhances Public Transport Efficiency: Can be integrated with public transport networks to prioritize buses or other mass transit vehicles.

Overall, density-based traffic control and ambulance prioritization using microcontrollers offer a holistic approach to addressing traffic management challenges, promoting sustainable mobility, and enhancing the resilience and responsiveness of urban transportation systems.

V.CONCLUSION

The project "Density based traffic control and ambulance prioritization" successfully developed a prototype module for demonstration purposes. The module is arranged over a wooden plank, simulated with crossroads circles and required devices like signal posts and traffic density sensors. The results are satisfactory, and a 2 square feet plank is selected to demonstrate the basic signal control system with 4 signal posts. Four double lane roads are simulated and marked with circles. Signal posts with 3 different coloured light indicators are arranged near the circle, and traffic sensing boards with IR LEDs are arranged just before the posts. The system is designed to allow more traffic through overcrowded roads by sensing traffic density and also taking care of ambulance. If any side road is crowded with more vehicles than the other three, the green indicator will glow for more time to clear traffic.

REFERENCES

While designing and fabricating this project work, we studied a lot of material gathered from websites. Regarding micro controllers, plenty of books are available, the following are the references made during design, development, and fabrication of the project work.

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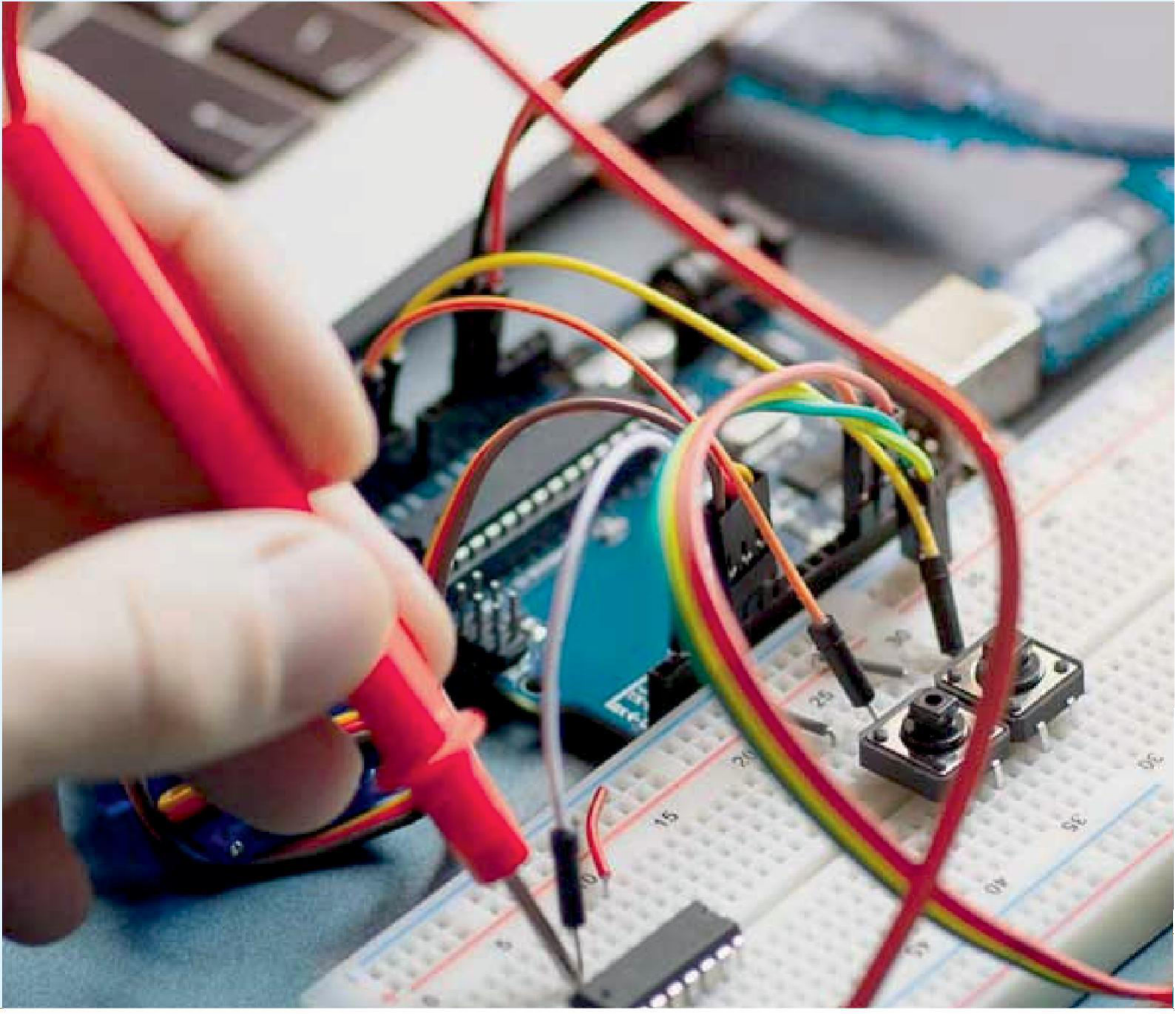

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