DESIGN AND IMPLEMEMTATION OF TRAFFIC LIGHT CONTROLLER WITH IR SENSOR INPUTS USING VERILOG

[1]K.RAJESH, [2]D.JEEVITHA, [3]LAKSHMIKANTHAPPA GARI KALPANA, [4]CHEPURI RAJABABESWARACHARI, [5]D.DURGA BHAVANI, [6]A.NAGARJUNA

[1]ASSOCIATE PROFESSOR, DEPT OF ECE, Dr.SAMUEL GEORGE INSTITUTE OF ENGINEERING AND TECHNOLOGY, MARKAPUR

[2,3,4,5,6]U.G STUDENT, DEPT OF ECE, Dr.SAMUEL GEORGE INSTITUTE OF ENGINEERING AND TECHNOLOGY, MARKAPUR

ABSTRACT

The traffic light control system aims to reduce vehicle congestion at intersections and ensure safer pedestrian crossings. Various technologies have been implemented worldwide for traffic light management, but in densely populated countries like India, upgrading to a new system and implementing it universally is a challenging task. This proposal introduces a Traffic Light Controller using IR sensors, designed to enhance traffic flow and prevent pedestrian accidents. The system operates effectively at a maximum frequency of 50 MHz, with the coding developed in Verilog, offering a time-efficient and safer solution for traffic management.

INTRODUCTION

Traffic lights, also known as traffic signals, stoplights, or robots, are signaling devices used at pedestrian crossings, road intersections, and other locations to regulate traffic flow. Installed worldwide, they control competing traffic flows by assigning right-of-way through a universal color code (Red, Yellow, Green) to manage the movement of vehicles and pedestrians. At busy intersections, they help distribute delays more evenly, reducing congestion. However, many cities, like Dhaka, suffer from inefficient traffic signal management, leading to accidents and severe traffic jams. Rather than building new infrastructure, a more effective solution involves improving existing systems. Traffic light controllers play a crucial role in optimizing traffic flow, improving road safety, and reducing environmental impact. The goal of such systems is to enhance safety, minimize travel time, and increase infrastructure capacity, thereby benefiting public health, the economy, and the environment. This project aims to develop a traffic light controller for a four-way intersection with a focus on optimization, improved safety, and smoother traffic movement.

LITERATURE SURVEY

In recent years, numerous studies have focused on addressing traffic congestion. One such system, introduced by Ganiyu R. in 2014, used a microcontroller to manage traffic light control through pressure switches that sensed vehicle weight, adding time to the green light when a car passed, and triggering an LED to indicate the time delay. Similarly, in 2013, Sachin Jaiswal employed a microcontroller with

IR sensors to sense traffic density and utilized RF transmitters and receivers to adjust the traffic lights according to high, medium, and low density levels. Rashid Hussain's 2013 research used wireless sensor networks (WSN) along with microcontrollers to route vehicles based on traffic density sensed by nodes. Further advancements in 2014 led to a dynamic traffic signal system using Raspberry Pi, adjusting signal timings based on real-time traffic data. By 2017, a camera-based system controlled traffic using a KL25Z microcontroller, FRDM board, sound sensors, and LEDs. The current paper proposes an efficient and safe traffic control system using Arduino connected to four IR sensors at junctions to measure vehicle flow. Vehicles are given a 3-second time interval, and the system processes delays based on density. The green light duration increases at busier junctions, ensuring more effective traffic management by adjusting the flow based on real-time density rather than fixed time intervals.

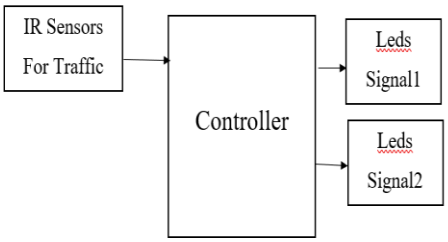
EXISTING SYSTEM

Managing traffic manually involves deploying personnel, signage, and physical measures to control vehicle flow at intersections and on roads. Traffic officers direct traffic by signaling when vehicles should stop, go, or turn based on real-time conditions, using standardized hand signals that are easily recognized by drivers. Additionally, clear and visible road signs provide essential information, such as speed limits, lane changes, and upcoming intersections, ensuring smooth and safe movement for all road users.

PROPOSED SYSTEM

Traffic light control systems are essential for regulating vehicle flow at road junctions, ensuring smooth traffic movement along transportation routes. These systems use three colored lights: red, yellow, and green. A red light signals drivers to stop, a green light indicates that drivers can either start or continue driving, and a yellow light warns drivers to prepare to stop, as the light is about to turn red. The goal is to maintain an organized flow of traffic, minimizing congestion and enhancing road safety.

BLOCK DIAGRAM



FUTURE SCOPE

The future scope of designing and implementing a traffic light controller with IR sensor inputs using Verilog is highly promising, as it can be expanded to develop smart and adaptive traffic management systems for smart cities. With further advancements, the system can be integrated with wireless sensor networks, IoT platforms, and real-time data analytics to optimize traffic flow dynamically across larger city areas. Machine learning algorithms could be incorporated to predict traffic patterns and adjust signal timings more intelligently. Additionally, the system can be scaled to include emergency vehicle detection, pedestrian crossing management, and vehicle-to-infrastructure (V2I) communication, making it a crucial

component in the evolution toward fully automated, efficient, and safer transportation networks.

CONCLUSION

In today's world, which is increasingly driven by automation, manually controlling traffic signals in heavy traffic areas can lead to significant problems, especially with the potential for human error. This project aims to introduce a fully autonomous traffic signal system that reduces reliance on manual control, minimizes traffic jams, and prevents accidents by operating in a sequential, automated process. The system's simple design, low cost, and easy maintenance make it an ideal solution for modern cities. Instead of traditional manual traffic signals, an autonomous traffic light simulator can be implemented, where each intersection's controller determines the light duration based on real-time traffic data. This dynamic system ensures that green lights are given only when needed, enhancing efficiency and providing valuable insights for analysis and optimization.

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