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Traffic Density Detection and Signal Adjustment Using IR Sensor

Jeniffer Keerthana L[1], Kiruthiga M[2], Prasanna P[3], Sharmila A[4], Prof. A. Kannaki VasanthaAzhagu[5]
[1, 2, 3, 4]*Final year, Computer Science and Engineering*
[5]*Associative Professor & Head/CSE*
Achariya College of Engineering Technology

***Abstract:** The main issue in today's society is traffic congestion in urban areas. When the number of vehicles is increased quickly, both peak and off-peak hours experience traffic congestion. This results in less effective road traffic management. Systems for controlling traffic lights rely on the traffic signals' set time intervals. These time-based signals waste time for the side of a small number of vehicles on the road, which is greater than another road of vehicles at a high pace, and make them wait for a very long period. The advanced method focuses on the minimal amount of time that automobiles on a road waste. Therefore, it gives the density-detected lane extra time and gives the other lanes the same amount of time. The lane with low density. The IR sensor and the 8051 series AT89S52 microcontroller can be used to accomplish this.*
***Keywords:** IR sensor, KEIL software, power supply, LEDs, and vehicle density.*

I. INTRODUCTION

The project aims to build a dynamic traffic signal system based on traffic density, where the timing of the signal will alter automatically upon sensing the volume of traffic at any intersection. Heavy traffic jams are becoming increasingly common in large cities as a result of the number and variety of vehicles on the road. This generally occurs at intersections when people are travelling home from work throughout the day and in the evenings after work. The primary impact of this circumstance is an increase in time wasted by drivers. It is time to move away from more manual mode or fixed timer mode and towards an automated system with decision-making skills because traffic congestion is a serious issue in the majority of cities throughout the world. Present We have developed a framework for an intelligent and dynamic traffic control system to help solve this challenge. occasionally, there is more traffic on one side of the junction need more green time than the normal allocated period. As a result, we suggest a system in which the length of the green light is determined by the volume of traffic using that lane at the time. Infrared sensors (IR sensors) are used to do this.

The density of the vehicles that are fixed in the lanes within a set distance is measured using IR sensors. All of the sensors are connected to the microprocessor, which regulates the traffic signal system based on the density that the sensors detect. The AT89S52 microcontroller from the 8051 series is the one used in this application. The microcontroller is used to determine the green light glow time after the density calculation. The microcontroller will determine how long a flank will remain open or when to switch over the signal lights after the sensors on the side of the road identify the presence of vehicles and communicate the information to it. Following parts have more fully described the process. of this framework.

II. LITERATURE REVIEW

The control of traffic in complex settings has been suggested using a variety of study methods and methodologies. The best fixed-time signal plans should be found using transit traffic modelling software, and the best signal plans should be assessed using VISSIM micro-simulation software. Rongrong Tian and Xu Zhang [13] also recommended building an adaptive frame signal plan and refining and evaluating the plan using VISSIM with VS-PLUS emulator. It was demonstrated through microsimulation that the adaptive signal control's delay was considerably shorter than that of the fixed time control.

An innovative technique for area-wide traffic signal time optimisation under user equilibrium traffic was introduced by Jianhua Guo et al. [7]. The optimisation model was created as a multi-dimensional search problem with the goal of minimising the product of the variance in journey time per unit distance and the overall trip time connected with the urban street network. The model solution was created using a genetic algorithm. The logic frame and function module of the area-wide traffic signal control system are designed using a simulation control protocol that is included in the PARAMICS software tool and capable of conducting area-wide micro simulation. His findings demonstrate that after using the suggested model and the genetic algorithm to optimise area-wide signal timing, as measured by extended capacity ratio, mobility is improved.

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III. PROPOSED SYSTEM

The ideal answer to these problems is a traffic control system based on volume or density. IR sensors are used to determine the vehicle density. both the IR transmitter and receiver mounted on either side of the road that is used for detection of any vehicle on road. It is interfaced with the AT89S52 microcontroller that takes decision based on the input from IR sensors. In this very model, the system adjusts itself based on the amount of traffic on road.

METHODOLOGY

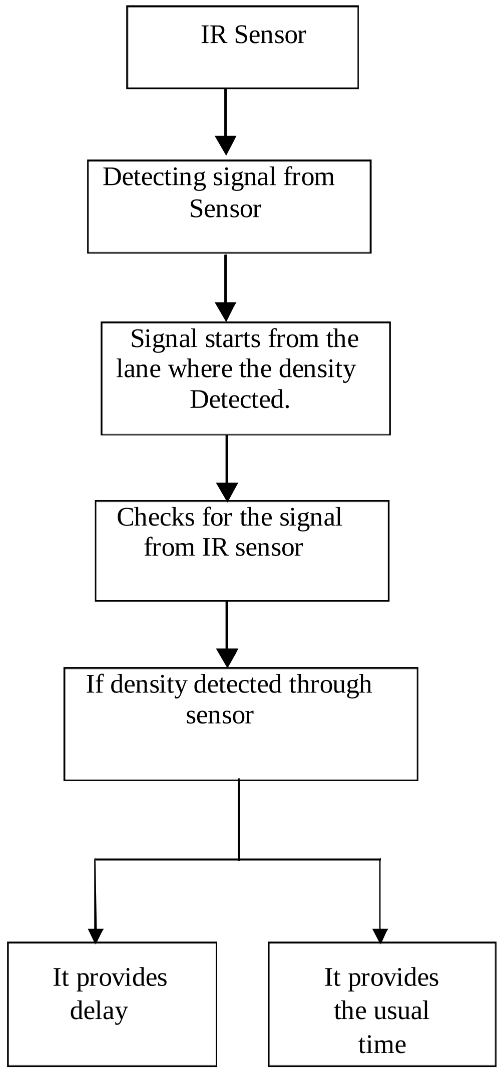

Figure 1: Architecture of the traffic signal control system

The dynamic traffic signal system that is density-based, where the timing of the signal changes automatically when the amount of traffic changes at any intersection.

Systems for controlling traffic lights rely on the traffic signals' set time intervals. These time-based signals waste time for the side of a small number of vehicles on the road, which is greater than another road of vehicles at a high pace, and make them wait for a very long period. In order to get around this, employing an IR sensor to monitor traffic intensity and modify the signal is more effective than utilizing other techniques.

In Fig. 2, the algorithm employed in this system is described. The algorithm's first phase is to take a picture of a roadless area covered in diamond-shaped patterns.

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IV. SOFTWARE IMPLEMENTATION

Implementing software entails setting up the microcontroller to do the required tasks. The project's software implementation is as follows.

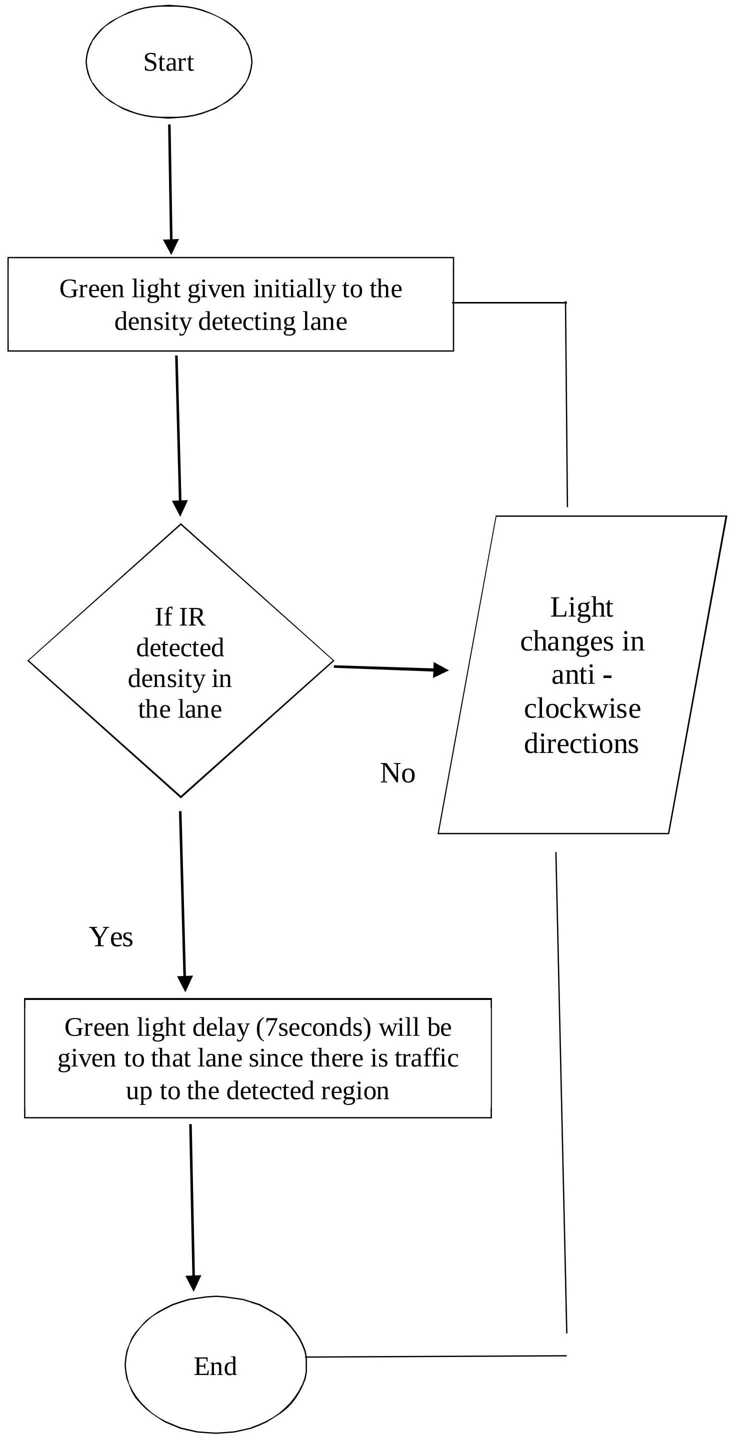

Figure 2: Flow Chart of software implementation

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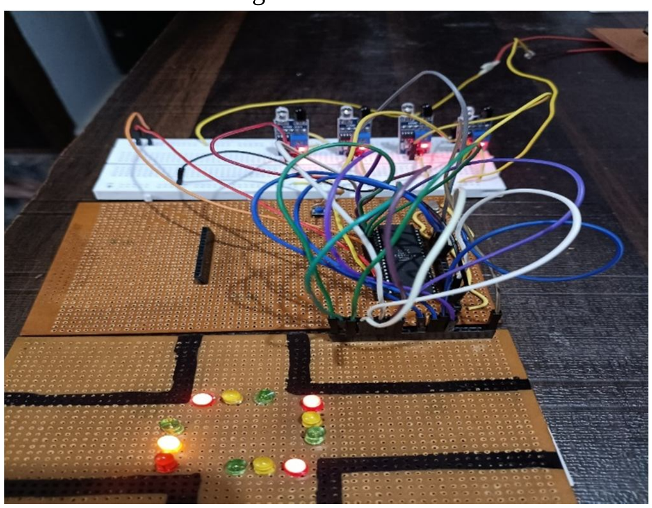
V. ALGORITHM

1) Step 1: launch the application
2) Step 2: Use sbit to declare the port's pins.
3) Step 3: Give the pins' used names meaningful variable names.
4) Step 4: Initialize the LED and IR sensor pins in step four.
5) Step 5: The control now enters a while loop that is always true.
6) Step 6: Make all other lanes' red lights glow, excluding lane 1.
7) Step 7: By default, the green light in Lane 1 remains on for 5 seconds.
8) Step 8: An additional 7 seconds of green light delay will be applied if Lane 1's IR sensor detects a vehicle.
9) Step 9: If not, the green light delay defaults.
10) Step 10: Lane 2 and the other lanes function similarly as traffic light switches that rotate anticlockwise.
11) Step 11: Because the code is in an always true while loop, this procedure is continuous looping.
12) Step 12: Stop the application.

VI. EXPERIMENTAL RESULTS

A. *Experimental Problem*

Figure 3: Model 1



B. *Experimental solution*

The suggested and advanced model will be created and will resemble the image below.

Figure 4: Model 2

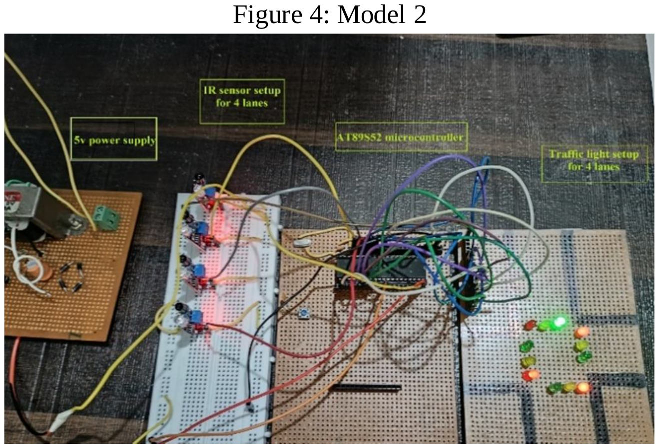


Figure 5: Model 3

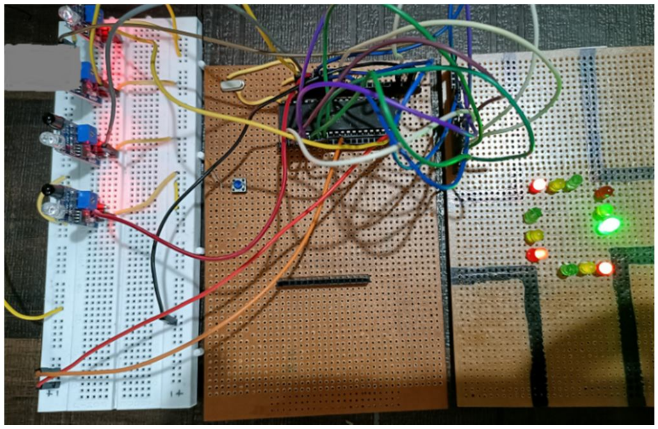
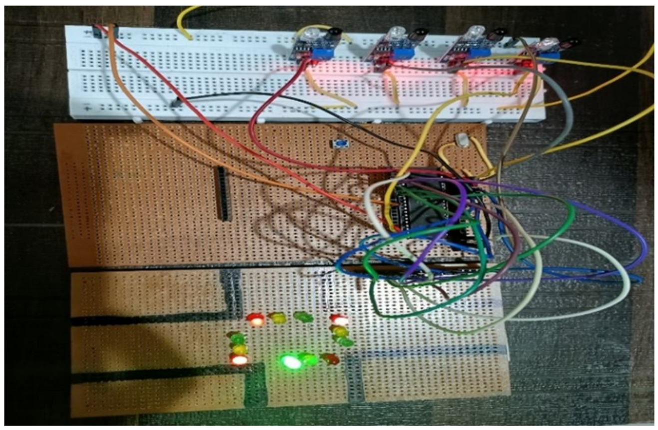


Figure 6: Model 4



VII. CONCLUSION

In conclusion, it was extremely nicely done to construct this density-based traffic management system employing an IR sensor. Since traffic density will always rise as the population grows, implementing this approach can reduce traffic congestion, especially during peak hours, and consequently, road accidents in the present and the future. The AT89S52 microcontroller, which is more affordable than other microcontrollers and is simple to modify to any potential in meeting future requirements hassle-free and quickly, contributes to a very acceptable model for implementing the embedded control system.

VIII. FUTURE SCOPE

1) In the future, improvements to this project's features may be made, such as switching the traffic light's power source from electricity to solar power panels to reduce the amount of electricity used and so support green energy.
2) Increasing the number of IR sensors along the route will improve the situation even further. For instance, we may place three IR sensors—low, medium, and high—on each route. We can determine the delay period based on that.
3) It is significant that we may incorporate emergency vehicle detection. For instance, if an ambulance is detected on any of the four routes, we may utilize the microcontroller's external interrupt to stop the background activity instantly and assign a green light for that.

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