International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 02 | Feb -2017 www.irjet.net p-ISSN: 2395-0072

INTELLIGENT TRAFFIC LIGHT CONTROLLER USING EMBEDDED SYSTEM

Sayali Ambekar[1], Shraddha Jawalkar[2], Anagha Patil[3], Shweta Patil[4]

[1] *Student, Dept. of Computer Engineering, Sinhgad College of Engineering, Maharashtra, India*
[2] *Student, Dept. of Computer Engineering, Sinhgad College of Engineering, Maharashtra, India*
[3] *Student, Dept. of Computer Engineering, Sinhgad College of Engineering, Maharashtra, India*
[4] *Student, Dept. of Computer Engineering, Sinhgad College of Engineering, Maharashtra, India*

Abstract - *Present Traffic Light Controllers (TLC) based on microcontroller and microprocessor. These TLC have limitations because it is functioning according to the program that does not have the flexibility of modification on real time basis. Due to the fixed time intervals of green, orange and red signals the waiting time is more and car uses more fuel. To make traffic light controlling more efficient, there is a new technique called as "Intelligent traffic light controller". This new technique makes the use of Sensor Networks along with embedded technology. The timings of Red, Green lights at each crossing of road will be intelligently decided based on the total traffic on all adjacent roads. Thus, optimization of traffic light switching increases road capacity and traffic flow, and can prevent traffic congestions.*

***Key Words*: IR sensors, microcontroller, k-means algorithms, MAX-232**

1. INTRODUCTION

This system is developed using embedded system. It is used for controlling the traffic signal that is why it is used with roads, bikes and traffic. For this we are creating a hardware kit and server. In this project we are using clustering algorithm that is K-Mean algorithm. We can also maintain the database using MySQL. With the help of IR sensors we are going to take vehicle count as input to system. According to vehicle count, we are decided the time ranges for all signals. For implementing this system we are using hardwares like 4 IR sensors, ADC, atmega8 microcontroller etc. and softwares like NetBeans, java language, MySQL database and glassfish server.

2. MANUSCRIPTS

2.1 Motivation

The motivations for using intelligent traffic light controllers are to implement hardware which is suitable for real life implementations. They include minimizing the delay or waiting time on road, design of safe and efficient traffic flow, assigning the right way and avoiding the overhead of traffic police. The traffic jam will be reduced by increasing the green signal time on heavy road and decrease the red signal time in non-heavy road.

2.2 Organization of report

The report is divided into three chapters. Chapter 2 discusses about literature review that covers fundamentals of topic, existing method, its merits and demerits, algorithms and actual working of system. Chapter 3 discusses about result, conclusion and future work.

2.3 Literature Survey

In "Dynamic Traffic Signal Timing Optimization Strategy Incorporating Various Vehicle Fuel Consumption Characteristics" paper proposes a dynamic traffic signal timing optimization strategy (DTSTOS) based on various vehicle fuel consumption and dynamic characteristics to minimize the combined total energy consumption and traffic delay for vehicles passing through an intersection. The proposed timing plan was compared with consistent results were obtained [1].

In "SmartRoad: Smartphone-Based Crowd Sensing for Traffic Regulator Detection and Identification" article they present Smart Road, a crowd-sourced road sensing system that detects and identifies traffic regulators, traffic lights, and stop signs. The resulting traffic regulator information can be used for many assisted-driving or navigation systems but limitation is the mobile crowdsensing paradigm is quickly raising interests and funds [2].

In "Optimizing Traffic Signal Settings in Smart Cities" proposes a bi-level optimization framework to settle the optimal traffic signal setting problem. The upper-level problem determines the traffic signal settings to minimize the driver average travel time, while the lower-level problem aims for achieving the network equilibrium using the settings calculated at the upper level. The Dynamic Traffic Assignment (DTA) to decouple the complex bi-level problem into tractable single-level problems which are solved sequentially. The bi-level problem can be expressed as a mathematical program converting the lower-level problem as a set of additional constraints of the upper-level problem. [3].

The "Real Time Vehicle Tracking System Based on ARM7 GPS and GSM Technology" paper has described the designed and development of the system in real time successfully. The system provides positioning and navigational information in terms of number of parameters. Also if we want then information regarding the satellites which are being tracked by the system is also displayed. The developed system is compact, low cost and reliable. Since this system can be used anywhere on the planet provided that signals from at least four satellites are received. Furthermore, the implementation is low-cost. [4].

The "Design and Implementation of Vehicle Tracking System Using GPS/GSM/GPRS Technology and Smartphone Application" paper has described the design and implementation of our vehicle tracking system. An in-vehicle device, a server and a Smartphone application are used for the vehicle tracking system. In this work, the in-vehicle device is composed of a microcontroller and GPS/GSM/GPRS module to acquire the vehicle's location information and transmit it to a server through GSM/GPRS network. [5]

2.4 Merits of Intelligent traffic light controller using embedded system:

- Control the traffic.
- We can analyze the whole day traffic using log system.
- To reduce possibilities of accidents.
- To reduce waiting time.
- To reduce overhead of traffic police.

Demerits of Intelligent traffic light controller using embedded system:

- We have to choose proper position for sensors otherwise it will count any object as vehicle.
- Cost effective.
- Ineffective during heavy rain.

2.5 Fundamentals

There are different fundamentals used in intelligent traffic light controller using embedded system, they are:

1. IR-Sensor:

IR sensor uses the infrared light to sense object in front of them & gauge their distance. Our hardware kit is consists of 4 IR sensors, atmega8, microcontroller, 4 traffic lights.IR transmitter looks like an LED. This IR transmitter always emits IR rays from it. The operating voltage of this IR transmitter is 2 to 3v.These IR (infra-red) rays are invisible to human eye. But we can view these IR rays through camera. IR receiver receives IR rays that are transmitted by IR transmitter. Normally IR receiver has high resistance in order of mega ohms, when it is receiving IR rays the Resistance is very low. The operating voltage of IR Receiver is also 2 to 3V.

Fig -1: IR Sensor [6]

2. ADC:

ADC stands for Analog to digital convertor. In our system IR sensor take vehicle count from real world which is in the form of analog. From this we can say that ADC takes analog data as input and it converts that analog data into digital data without any data loss. ADC gives us digital output .And this digital data is forward to system for algorithm implementation.

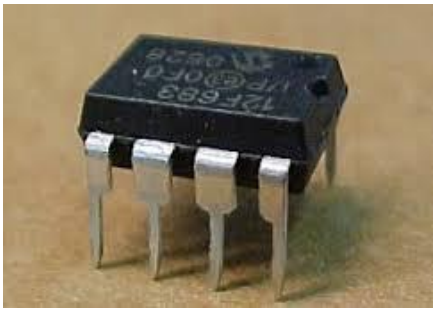

Fig -2: ADC [6]

3. Microcontroller:

Here we are going to use atmega8 microcontroller. There many microcontroller families like ARM, AVR, etc. This atmega8 is belongs to AVR microcontroller family. Here atmega8 takes the input from ADC which is in the form of digital.

Fig -3: atmega8 [6]

4. System Database:

We are going to use MySQL database. Here the count of vehicle and its timer this all things present in database as log. So at the end of data if we want to check total vehicles or traffic on street with the help of these logs we can check data from database. And suppose we want to provide that data to user using android app then with the help of this data user can see the traffic of signal.

Fig -4: MySQL Database [6]

5. MAX-232:

The MAX-232 IC is an integrated circuit which consists of 16 pins and it is a resourceful IC mostly used in the voltage level signal problems. Generally, the MAX-232 IC is used in the RS232 communication system for the conversion of voltage levels on TTL devices that are interfaced with the PC serial port and the Microcontroller. This IC is used as a hardware layer converter like to communicate two systems simultaneously. The image of MAX232 is shown below.

Fig -5: MAX-232 [6]

2.6 Related Work

In this section we are going to see the actual working flow of our project. Here any object like demo vehicles place between IR sensor's transmitter and receiver. These objects are counting by using IR sensors. In this system, initially sensors are work. Sensors take count of objects i.e. vehicle count and send it to microcontroller. This count is in the form of analog data. But microcontroller understands digital data not the analog data. So there is need of converting analog data into digital data. For this purpose ADC is used into the system which is placed between IR sensors and microcontroller. Here our microcontroller is atmega8 from AVR microcontroller family.

The microcontroller takes digital data as input and passes it to server i.e. PC. To connect both PC and microcontroller together we require mediator for translation process and this can be done by using MAX-232 IC as bridge between them. The MAX232 is a dual transmitter / dual receiver that typically are used to convert the signals. The MAX232 IC is used to convert the TTL logic levels to RS232 logic levels during serial communication of microcontrollers with PC. So the digital data is send to the server through MAX-232 IC.

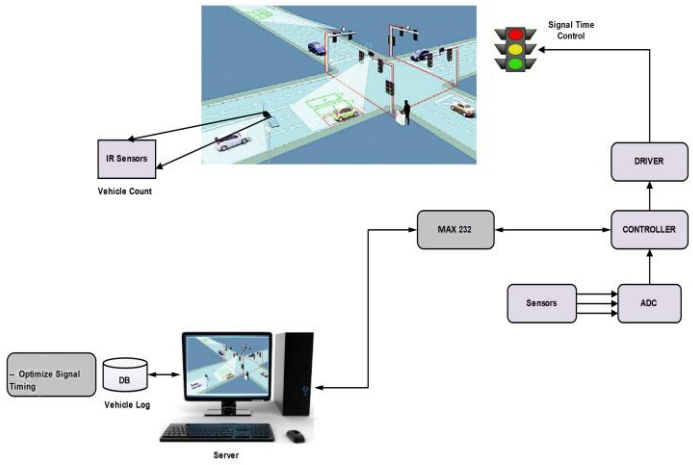

Fig -6: Working of Intelligent System

On the server side, K-Mean algorithm is implemented for calculate the timings to each traffic signals on road. After calculating time, they are sending to traffic signal through microcontroller using driver. The signal timings can be optimized on server side only. After sending calculated time to signals, it will glow LED lights on traffic signals according to calculated timings. All the information like vehicle count, traffic signal and related timings are stored into database using MySQL. The system will performed actions by using this entire process.

2.7 Algorithm of Intelligent Traffic Light Controller Using Embedded System

K-Mean algorithm is clustering algorithm. To get the count of vehicles from different area it is necessary to use cluster algorithm. So we are using K-Mean algorithm here.

K-Mean Algorithm:-

Step 1:

Begin with a decision on the value of k = No of clusters.

Step 2:

Put any initial partition that classifies the data into k clusters. You may assign the training samples randomly, or systematically as the following:

1. Take the first k training sample as single-element clusters.

2. Assign each of the remaining (N-k) training samples to the cluster with the nearest centroid. After each assignment, re compute the centroid of the gaining cluster.

Step 3:

Take each sample in sequence and compute its distance from the centroid of each of the clusters. If a sample is not currently in the cluster with the closest centroid, switch this sample to that cluster and update the centroid of the cluster gaining the new sample and the cluster losing the sample.

Step 4:

Repeat step 3 until convergence is achieved, that is until a pass through the training sample causes no new assignments.

3. CONCLUSIONS

It is observed that the proposed Intelligent Traffic Light Controller is more efficient than the conventional controller in respect of less waiting time, an efficient operation in emergency mode. Moreover, the system has simple architecture, fast response time, user friendliness and scope for further expansion.

ACKNOWLEDGEMENT

Every work is source which requires support from many people and areas. It gives me proud privilege to complete the seminar on "INTELLIGENT TRAFFIC LIGHT CONTROLLER USING EMBEDDED SYSTEM" under valuable guidance and encouragement of my guide Prof. D. P. Salapurkar. I am also extremely grateful to our respected H.O.D. Prof. Dr. P. R. Wankhede for providing all facilities and every help for smooth progress of seminar. I would also like to thank all the Staff Member of Computer Engineering Department for timely help and inspiration for completion of the seminar. At last I would like to thank all the unseen authors of various articles on the internet, helping me become aware of the research currently ongoing in this field and all my colleagues for providing help and support in my work.

REFERENCES

[1] Junfeng Zhao,Wan Li, Junmin Wang, Xuegang Ban "Dynamic Traffic Signal Timing Optimization Strategy Incorporating Various Vehicle Fuel Consumption Characteristics" June 2016, IEEE.

[2] SHAOHAN HU, LU SU, HENGCHANG LIU, HONGYAN WANG and TAREK F. ABDELZAHER "SmartRoad: Smartphone-Based Crowd Sensing for Traffic Regulator Detection and Identification" ACM Transactions on Sensor Networks, Vol. 11, No. 4, Article 55, Publication date: July 2015.

[3] Zhiyi Li, Mohammad Shahidehpour, Shay Bahramirad, Amin Khodaei "Optimizing Traffic Signal Settings in Smart Cities" 2015 IEEE.

[4] Pradip V Mistary, R H Chile "Real Time Vehicle Tracking System Based On ARM7 GPS And GSM Technology" 2015 IEEE.

[5] SeokJu Lee, Girma Tewolde, Jaerock Kwon "Design and Implementation of Vehicle Tracking System Using GPS/GSM/GPRS Technology and Smartphone Application", Electrical and Computer Engineering Kettering University Flint, MI, USA, 2014 IEEE.

[6] Courtesy: Google images or information.

[7] P. Pyyknen*, J. Laitinen, J. Viitanen "Finland IoT for Intelligent Traffic System" VTT Technical Research Centre of Finland Tampere, Finland, 2013 IEEE.

[8] Muhammad Hassam Malhi, Muhammad Hassan Aslam, Faisal Saeed, Owais Javed, Muhammad Fraz "Vision Based Intelligent Traffic Management System", 2011 IEEE.