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Smart Traffic Control System using PLC and Raspberry Pi

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ABSTRACT: Studies show that all over the world, there has been a rapid increase in the number of vehicles. The latest statistics show that there are approximately 53,700 vehicles being registered every year in India. As a result traffic problems have increased in the last few years and the present traffic light controllers have limitations because it uses hardware that does not have the flexibility of modification on real time basis. The fixed time interval of green and red signals has increased the overall waiting time. To make the present traffic controller more efficient we come up with a new technique called as “Smart Traffic Control System”. This makes use of IR sensors along with a programmable logic controller to vary the timings of the green signal based on density of the road .The timings of the green signal is smartly decided based on the traffic on the roads. As compared to traditional traffic control system this new system is more efficient and flexible. It also has an intelligent traffic control system to pass the emergency vehicles such as ambulance, fire brigade etc. using RFID and also detect signal jumpers with image processing and notify the penalty message through GSM module.

KEYWORDS: Smart Traffic Controller; GSM; Programmable Logic Controller (PLC); Raspberry Pi 3; RFID

I. INTRODUCTION

Traffic management has become the key and most important aspect today because of the growth of industrialization and population there has been a tremendous growth in the traffic. With the increase in traffic there arises problems such as heavy traffic jams, violation of traffic rules etc. Traffic congestion also results in long waiting times, wastage of fuel and reduced productivity at work place. Therefore it is necessary to have an efficient traffic control system for socio-economic benefits. One way to improve traffic flow and safety is to replace the conventional traffic controller.

The problems faced due to traditional traffic light Controller are as mentioned

A. Traffic Congestion

Traffic Congestion has increased due to increase in the number of vehicles on road. Traffic jams usually occur at peak hours. The main effect of traffic jams is people wasting time on the road which in turn reduces the productivity at work place. The solution for this problem is to program the controller to provide different time delay settings for green signals based on the density of traffic present. The delay for roads that have high volume of traffic should be set longer than the delay for the road that has low traffic.

B. Need to wait even if there is no traffic

Even if there is no traffic or very less traffic, people have to wait because the traffic light remains red for the preset time period, the road users should wait until the light turns green. The solution to this problem is again obtained by determining the density of traffic on each of the lanes and providing minimum delay of green signal for the roads having no traffic.

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C. **Emergency vehicle getting stuck in traffic jam**
Delay due to traffic jams pose major threat to the life of patient in an emergency vehicle. It may not always be possible to give way to the ambulance or to clear way for emergency vehicle. This problem can be solved by detecting the emergency vehicles well ahead of the signal and turn on the green signal of that particular road to allow free movement of traffic on the road in which emergency vehicle is present.

II. RELATED WORK

In [1] authors used RFID reader, NSK EDK125TTL and PIC16F877A SoC(System on Chip) to read the RFID tag riveted to the vehicle. It was used to count the number of vehicles that move on a particular path during a described duration and also determined the network traffic, and hence the green light duration of that path. They used ZigBee modules on CC2500 and PIC16F877A SoC for wireless communications between the ambulance and traffic controller to turn the green light on. In [2] author proposed the concept of intelligent traffic routing using wireless sensor networks. The primary elements of this system were sensor nodes consisting of sensors and a transmitter. This system consisted of 4 x 2 arrays of sensor nodes in each road. The sensors used were ultrasonic or Infrared based optical sensors which transmitted status based on presence of vehicle near it. The sensor nodes transmitted signal at described time intervals via ZigBee protocol to the central controller placed at every crossing. The controller received the signal and figure out which road and which lane has to be given the green signal based on the traffic density. Traffic Light Controllers (TLC) problems based on microcontroller and microprocessor were cleared using a model proposed by Shilpa Chavan and R. Deshpande [3]. This technique had used sensor networks along with embedded system. The Infrared Sensors were tested to detect the vehicles on road. The signals from sensor assembly obtained were digital signals which accord to presence or absence of a vehicle. These digital signals from each lane were given to the input port of microcontroller which determined the length of traffic on each lane. This information was the input to the microcontroller to determine various timing signals. These signals were applied to two relay drivers. The output of relay driver was applied to Red, Green and Orange LED at each junction. IC 24C61 was used for I2C interface. In [4] the author presents a novel intelligent traffic administration system, based on Internet of Things, which is featured by low cost, high scalability, high compatibility, easy to upgrade, to replace traditional traffic management system. In [5] authors used image processing for detection of denseness of vehicles on the roads. They measured traffic density at signals and accordingly changed the time delays of traffic lights based on the density. In [6] author made use of an RF transmitter-receiver module and a Zigbee transmitter-receiver along with Atmega 328 ICs to demonstrate the concept of the system that empowers Emergency vehicles (e.g. Fire-trucks, Police Cars, Ambulances) to override the current traffic sequence and reach its destination uninterrupted.

III. PROPOSED METHODOLOGY

To subdue the complications of the existing traffic control system we have approached a more appropriate methodology which is more fortunate. A diagram showing the interconnection between the components of the system is as shown in the Figure1.This system focuses on implementing the following features

A. **Density Based Traffic Control**- The density of vehicles on each of the roads is determined using sensors placed along each road and based on the density the delay for the green signal is provided. The roads with greater densityare provided with greater delay of green signal compared to the roads with lesser density of vehicles.

B. Prioritizing Emergency vehicles using RFID- Here we detect the emergency vehicle on a particular road well ahead of the traffic signal and send a signal to the controller to turn on the green signal of that particular road and make the other signals red so that the emergency vehicle is free to move without getting stuck in traffic jams.

C. Notifying Penalty for Signal Jumping through SMS- We use sensors to detect if any vehicle is crossing the signal after the signal turns red, determine the registered vehicle number of the vehicle crossing the signal and

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notify the driver by sending an SMS to the mobile number corresponding to the vehicle number through GSM module.

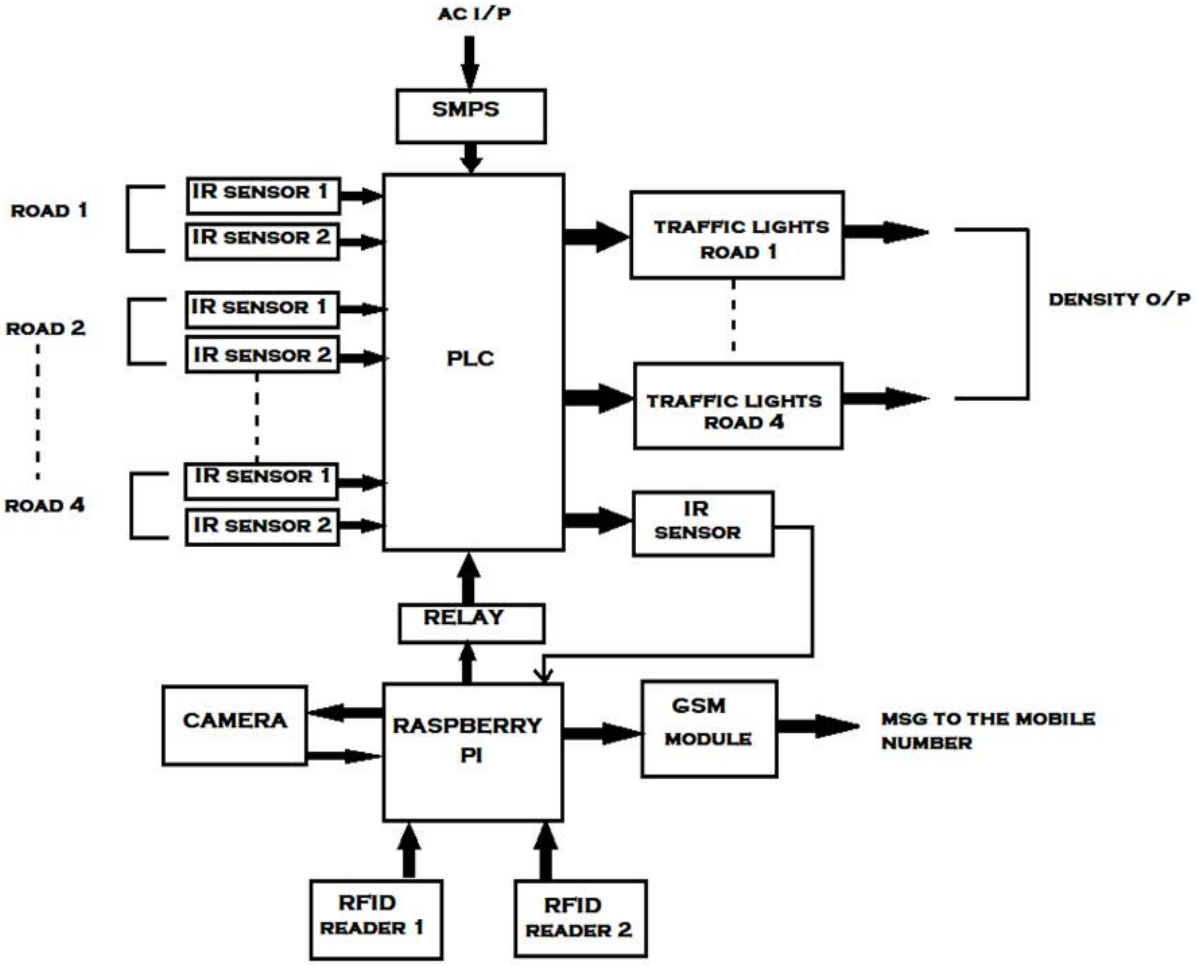

Figure1. Smart Traffic Control System

A. Density based traffic control

- Display Unit: It is the basic traffic signal display which is visible to the vehicle driver. It is an arrangement of LED's.
- Detector Unit: Consists of a proximity IR sensor which recognises the presence of the vehicles and sends information to the controller for being processed. Two IR sensors are placed along each of the roads to determine the density of vehicles.
- Control Unit: It is the unit which analysis the detector output which gives an indication of the presence of vehicles, makes calculation of the traffic density and accordingly controls the display unit. Here we use a PLC (Programmable Logic Controller) as a control unit. PLC is programmed in such a way that if the second sensor senses a vehicle implying that the traffic is dense the green signal is turned on for a longer time compared to the first sensor sensing or none of the sensors sensing the vehicle.

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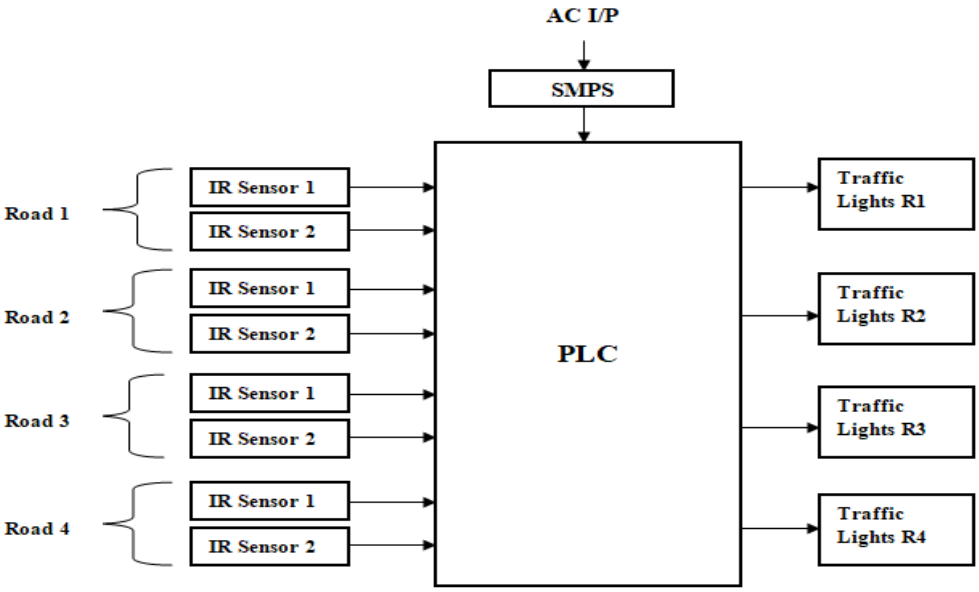

Figure2. Density Based Traffic Control System

B. Detecting and giving priority to emergency vehicles

- Detector Unit: RFID Cards and RFID Readers (EM-18) are used to detect the presence of emergency vehicle.
- Display Unit: It is the basic traffic signal display which is visible to the vehicle driver. It is an arrangement of LED's.
- Processing Unit: Raspberry Pi 3 is used for processing the signals received from the detector unit, determines if it is an emergency vehicle and in turn sends signals to the control unit i.e. the PLC.
- Control Unit: This unit receives output from the processors (Raspberry Pi 3) which gives an indication of the presence of an emergency vehicle and thereby glows green LED on that particular road. Here we use a PLC (Programmable Logic Controller) as a control unit.

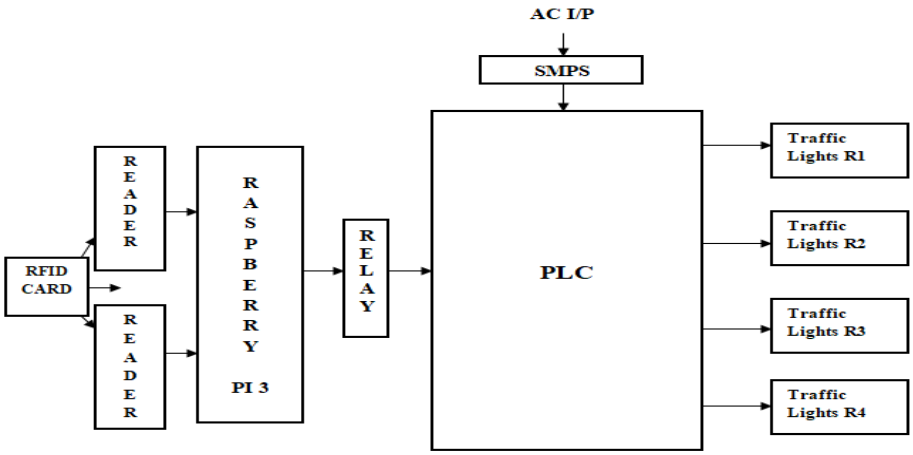

Figure3. Prioritizing Emergency Vehicles

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C. Notifying penalty for signal jumping through SMS

- Control Unit: PLC controls the signals at each of the road depending on density. When the signal is read PLC activates the detector unit i.e. it activates an IR sensor.
- The Detector Unit:It has an IR Sensor to detect if the vehicle is crossing the signal and a Raspberry Pi Camera to capture the vehicles image.
- Processing Unit: Raspberry Pi 3 is used for processing the image, to get the registered license number through python coding and to send message to corresponding mobile number using GSM module (SIM800).

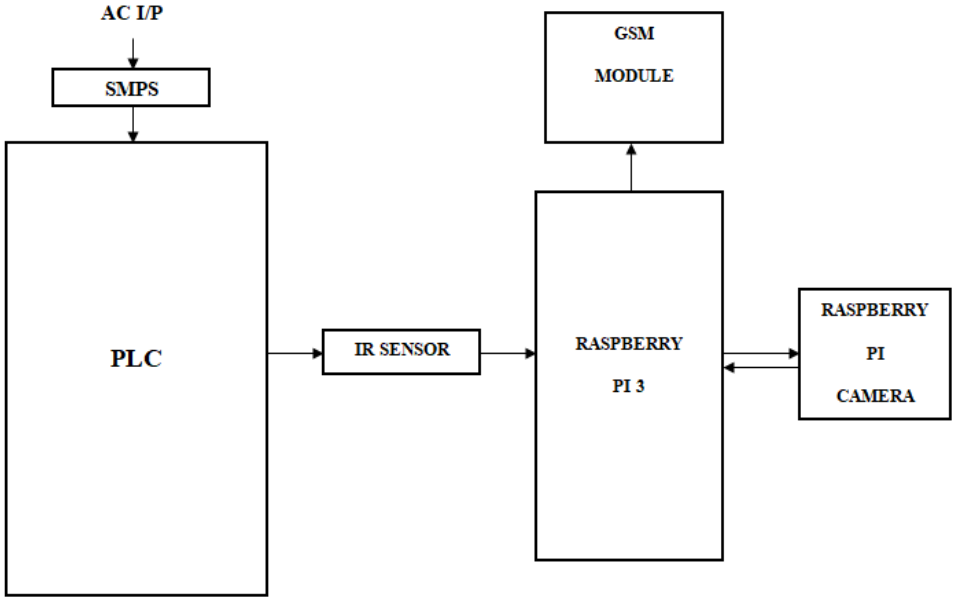

Figure4. System for sending penalty message to signal jumpers using SIM800

IV. EXPERIMENTAL RESULTS

Traffic signals are controlled using PLC. The timings of the traffic signals are adapted according to the density of the vehicles. Higher the density of the vehicles longer is the turn on time of the green signal. Lower the density of the traffic the turn on time of green signal is lesser. Emergency vehicles such as ambulances, fire engines etc. aredetected using RFID and the controller switches on the green signal as soon as the emergency vehicle is detected. Signal jumpers are detected, their vehicle numbers are obtained through image processing and penalty message is sent to their mobile numbers via GSM module.

V. CONCLUSION AND FUTURE WORK

Hence the three features which constitute a smart traffic control system were successfully implemented and were verifiedfor various input conditions. This system can be implemented to avoid road problems such as traffic jams and emergency vehicles getting stuck in traffic. We can further display the speed limit that a vehicle should maintain to allow the vehicle to skip the next signal i.e. coordination between the signals so that further traffic congestion at the signal can be reduced.

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REFERENCES

[1]. Rajeshwari Sundar, Santhoshs Hebbar and Varaprasad Golla," Implementing Intelligent Traffic Control System", Sensor Journal, IEEE (Volume:15,Issue:2).
[2]. V. Vishwanathan and V. Santhanam,"Intelligent Traffic Signal Control Using Wireless Sensor Network", Proceeding of 2nd International Conference on Advances in Electrical and Electronics Engineering, pp.165-169, 2013.
[3]. Shilpa S. Chavan (Walke), Dr. R. S. Deshpande, J. G. Rana," Design of Intelligent Traffic Light controller using Embedded System", International Conference on Emerging Trends in Engg. & Tech., ICETET-09.
[4]. Hasan Omar Al-Sakran,"Intelligent Traffic Information System Based on Integration of Internet of Things and Agent Technology", (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 6, No. 2, 2015.
[5]. Parichita Basak, Ramandeep Kaur," Intelligent Traffic Control System using Image Processing", International Journal of Science and Research (IJSR), 2015.
[6]. Karthik Chaganty, Tanmay Karadar and Dr. Rajani Mangala,"Traffic signal preemption for emergency vehicles", International Journal of Electronics and Communication Engineering and Technology (IJECET) Volume 7, Issue 4, July-August 2016.
[7]. Ms. Sarika B. Kale and Prof. Gajanan P. Dhok "Design of intelligent traffic light controller using embedded system" Second International Conference on Emerging Trends in Engineering and Technology, ICETET-09.
[8]. Xia and Shao, "Modelling of traffic flow and air pollutionsion with application to Hong Kong Island", Journal ofEnvironmental Modelling & Software. Vol. 20, 2005. pp 1175-1188. [4] G.Sathya, Fathima Shameema S, Jyothi MolSebastian, Jemsya K S"Automatic Rescue System for Ambulance and Authoritative Vehicles, Vol.2 -Issue 4 April.
[9].G. Salvi "An Automated Vehicle Counting System Based on Blob Analysis for Traffic Surveillance" Department of Economics Studies, University of Naples "Parthenope", Naples, Italy [10].R. Cucchiara, M. Piccardi, and P. Mello, "Image analysis and rule based reasoning for a traffic monitoring system," IEEE Trans. Intell. Transport. Syst., vol. 1, no. 2, pp. 119-130, June 2002.
[11].L. Li, W. Huang, I. Y. Gu, and Q. Tian, "Foreground object detection from videos containing complex background", Proc. of the Eleventh ACM international Conference on Multimedia, Berkeley, CA, USA, November 02 08, 2003.
[12].Er. Kavneet Kaur, Vijay Kumar Banga "Number Plate Recognition Using OCR Technique" IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 pISSN: 2321-7308 Volume: 02 Issue: 09 Sep-2013.
[13].VismayPandit, JineshDoshi, Dhruv Mehta, AshayMhatre and AbhilashJanardhan"Smart Traffic Control System Using Image Processing" International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)Volume 3, Issue 1, January – February 2014 ISSN 2278-6856.