A New Approach for Intelligent Traffic Control System using Raspberry pi

P. Nandini Kiran¹, Suraya Mubeen²

¹M.Tech student, Dept. of ECE, CMR Technical Campus, Hyderabad, Telangana, India
²Associate professor, Dept. of ECE, CMR Technical Campus, Hyderabad, Telangana, India

Abstract-This paper proposes an intelligent traffic control system to guarantee smooth flow of traffic. Vehicle is equipped with special Radio Frequency Identification (RFID) tag, placed such that it is intolerable to remove or destroy. We use RFID reader, system-on-chip to read the RFID tags attached to the vehicle and Raspberry-pi. It counts number of vehicles that passes on a specific path during a specified duration. It also regulates the network congestion, and hence the green light duration for that path. Density of the traffic will be decided with the help of IR sensors. And in order to give Green path (Zero traffic) for emergency vehicles RFID technology is used. Along with this RFID is used to trail stolen automobiles too. The paper proposes control of system in 2 modes i.e. 'automatic' without any human introversion and 'manual' with human introversion. The model was tested and the outcome of model is as expected.

Index Terms-Embedded Technologies, RFID, congestion control, traffic junction, ambulance vehicle.

I. INTRODUCTION

India is the second most populous country in the world and is a fast growing economy. Because of more population the growth in the number of vehicles is increasing exponentially day by day. But the infrastructure growth is slow due to space and cost constraints [1]. As a result, India is facing terrible road congestion problems in its cities. Also, Indian traffic is non-lane based and disordered. There are many issues related to increasing traffic such as accidents, numerous types of pollutions, time wastage and health related problems. The major reasons for traffic problems are increase in the number of vehicles, violation in the traffic rules, various construction works and increase in the number of accidents. This in turn has an adverse effect on the economy of the country as well as the loss of lives due to ambulances getting stuck in traffic jams. Due to all these problems the increase in the congestion level, especially at peak hours is one of the challenging works for the transportation specialists. But the existing methods for traffic management are not efficient in terms of the performance, cost and the effort needed for maintenance and support. To solve all the traffic related problems there is a need for efficient traffic management system. If a system for intelligent management of traffic flows is developed, the negative impact of traffic can be reduced to great extent. This includes technologies like ZigBee, RFID and GSM as they provide cost effective solutions. RFID is an emerging wireless technology that uses radio frequency electromagnetic energy to identify objects from a distance without requiring direct line of sight. A GSM modem is a highly flexible plug and play modem, which accepts a SIM card and operates just like a mobile phone controlled via AT commands. ZigBee is a transceiver module which operates at low power to transmit and receive data from any standard CMOS/TTL source.

This paper proposes a smart and fully automatic traffic control system that will detect and control the congestion in real time, detect a stolen vehicle and also passes emergency vehicles smoothly with the use of passive RFID devices.

II. BACKGROUND WORK

Traffic congestion is a major problem in cities of developing countries like India. Growth in urban population and the middle-class segment contribute significantly to the rising number of vehicles in the cities [2]. In [3], priority based traffic lights controller using wireless sensor networks was discussed which was used to provide clearance to any emergency vehicle by turning all the red lights to green in the path of the emergency vehicle depending on the priority assigned to them. The advantage of
the system is that it can control the traffic over multiple intersections but it has few drawbacks. Firstly, having sensors on all the roads is very costly especially when we are taking into consideration an economically poor country like India. Secondly, communication in wireless sensor network is still a research field and the data exchange between sensors is not reliable. Finally, the sensors need to be robust in order to survive in Indian weather.

In [4], traffic light control using image processing was proposed. This system used images to detect the vehicles. The image sequence captured by the camera is analyzed using digital image processing for vehicle detection, and according to traffic conditions on the road traffic light is controlled. This system showed that image processing is a better technique to control the state change of the traffic light and it is also more consistent in detecting the presence of the vehicle as it uses actual traffic images than those systems that used sensors. But there are many drawbacks such as installation problems and cost. Secondly, detecting congestion requires intelligent image processing techniques which in turn requires skilled personnel with adequate software background. And more importantly during bad weather conditions due to wind, rain, fog etc. the images captured by the camera is distorted by noise and it becomes difficult for the system to identify the vehicles. Hence, it can’t provide 24X7X365 days surveillance.

In [5], it proposed a RFID and GPS based automatic lane clearance system for ambulance. The main focus of this paper was to clear the lane in which the ambulance is travelling by communicating wirelessly with the nearest traffic signal, so that the green light is turned ON and hence the traffic is cleared. The communication between the ambulance and the traffic light controller is done using transceivers and GPS. Here, the use of RFID in the ambulances distinguishes between the emergency and non-emergency cases. The system is fully automated and can be implemented for the ambulances in service of hospitals but it has a drawback that it can’t be implemented for Government ambulances because the system needs all the information about the starting point and the end point of the travel. But the Government ambulances don’t have a particular place from which they regularly leave to pick up the patients. And also, the system may not work if in case the ambulance needs to take another route due to some reasons.

III. PROPOSED CONTROL SCHEME

The system consists of ARM11 Raspberry Pi device, RFID (RFID Reader and RFID Tag), IR Sensors and a Converter. RFID is connected to Raspberry Pi through USB module. Each vehicle is equipped with an RFID Tag and when the ambulance and stolen vehicle will come to the junction, where the reader will read and gives Green and Red light signal. IR Sensors are connected directly to the Raspberry Pi and are used when there is heavy traffic density.

![Fig.1 proposed system overview](image)

Raspberry Pi: UK was first to develop Raspberry Pi. It is a series of small single board computer. There are three generations in Raspberry Pi i.e. Raspberry Pi 1, 2 and 3. In this generation we can also find different models like model A, B. The basic Raspberry Pi did not have Wi-Fi and Bluetooth in it, later it was added. Raspberry Pi 3 is used in our proposed system. It has Broadcom SOC and GPU. CPU’s speed is 700MHz – 1.2GHz. RAM has 256MB – 1GB memory. SD card store OS in it. There are 4 USB slots. For camera to interface it has CSI. USB cable is used to power the raspberry pi. Raspberry Pi also have video or audio jack. And it has 40GPIOpins. For monitor connection it has HDMI port.

IR Sensor: Infrared Sensor is an electronic instrument which emits and/or detects Infrared radiations to sense its surroundings. The main areas are Sensing and Remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions. An IR sensor comprises of an emitter, indicator and related hardware. The circuit required to make an IR sensor comprises of two sections; the emitter circuit and the collector circuit.
An infrared sensor (IR sensor) is an electronic sensor that measures infrared (IR) light transmitting from items in its field of view. They are frequently utilized as a part of PIR-based movement detectors. IR Sensors work by utilizing a particular light sensor to identify a select light wavelength in the Infra-Red (IR) range. By utilizing a LED which creates light at an indistinguishable wavelength from what the sensor is searching for, you can take a gander at the force of the got light. At the point when a protest is near the sensor, the light from the LED ricochets off the question and into the light sensor. This outcomes in a substantial bounce in the force, which we definitely know can be distinguished utilizing a limit.

**Technical Specifications:**
- Operating voltage - +5V DC regulated
- Obstacle recognition: - Indicated by dynamic high yield
- Logic yield:- 1 or 0.
- Sensitivity:- up to 30Cm customizable.

**LCD 16 * 2 specification:** LCD remains for Liquid Crystal Display. LCD is finding far reaching use displacing LEDs (sevenportion LEDs or other multi fragment LEDs) on account of the accompanying reasons of the declining costs of LCDs, The capacity to show numbers, characters and illustrations. This is as opposed to LEDs, which are constrained to numbers and a couple characters. Fuse of an invigorating controller into the LCD, along these lines soothing the CPU of the undertakings of reviving the LCD. Conversely, the LED must be invigorated by the CPU to continue showing the information and Simplicity of programming for characters and design.

**Technical Specifications:**
- Show :- 16 Char* 2 Lines
- Controller:- LSI HD44780 IN BUILT
- Control Supply :- + 5V DC
- Show Color :- Gray
- Weight :- 35g

**RFID tag:** A radio-frequency identification framework utilizes labels, or names joined to the items to be recognized. Two-way radio transmitter-beneficiaries called crossexaminers or readers send a signal to the tag and reads its reaction. RFID labels can be active, passive or battery-assisted passive. An active tag has an on-board battery and occasionally transmits its ID flag. Battery-assisted passive (BAP) has a little battery on-board and is initiated when within the sight of a RFID reader. An inactive tag is less expensive and littler in light of the fact that it has no battery; rather, the label utilizes the radio vitality transmitted by the reader. Bet as that it may, to work an inactive label, it must beenlightened with a power level around a thousand times more grounded than for signal transmission. That has any kind of effect in obstruction and in presentation to radiation.

**RFID reader:** RFID frameworks can be arranged by the sort of tag and reader. A Passive Reader Active Tag (PRAT) framework has a detached reader which just gets radiosigns from active tags (battery worked, transmit as it). The gathering scope of a PRAT framework reader can be balanced from 1–2,000feet (0–600m), permitting adaptability in applications, for example, resources security and supervision. An Active Reader Passive Tag (ARPT) framework has an active reader, which transmits investigative signals furthermore gets validation answers from uninolved labels. AnActive Reader Active Tag (ARAT) framework utilizes active tags awoken with an investigator motion from the active reader.

A variety of this framework could likewise utilize a Battery-Assisted Passive (BAP) label which acts like a latent tag yet has a little battery to control the label’s arrival reporting signal. Repaired readers are set to make a particular cross examination zone which can be firmly controlled. This permits an exceedingly characterized perusing territory for when labels go all through the cross examination zone. Versatile readers might be hand-held or mounted on trucks or vehicles.

**Technical Specifications:**
- Operating Voltage – 5V
- Current-<50mA
- Read separate- 10Cm
- Operating frequency- 125KHz

**IV. SIMULATION RESULTS**

![Fig .2 Kit without and with all connections and power supply](image-url)
The above pictures show the working of the project kit. The adapter is connected to Raspberry Pi and LAN cable is connected to Ethernet port. After switching the power supply, all the LEDs will glow. The output pictures of the three functions are given below:

- When the Ambulance comes at Junction

![Fig.3 Ambulance comes at Junction](image)

![Fig.4 Change in Signals when Ambulance enters](image)

- When the Stolen Vehicle comes at the Junction:

![Fig.5 Stolen Vehicle comes at Junction](image)

- When there is Heavy Traffic Density:

![Fig.6 Stolen Vehicle founded](image)

Fig.6 Stolen Vehicle founded
When there is Heavy Traffic Density :

![Fig.7 Vehicles at Junction](image)

![Fig.8 Traffic Jam in Lane-1](image)

V. CONCLUSION

With the implementation of this system the manual effort and the time on the part of the traffic policeman...
is saved. As the whole system works automatically, it requires very less human intervention. The entire system is automated so the involvement of human is very less. If Ambulance will spend a lot of time in traffic jams and if there is the high density of traffic then the traffic signal will turn to Green. The signal turns to Red only after the clearance of traffic density and ambulance. If the stolen vehicle will pass through the signal, then the signal turns to Red. It is implemented by considering only one road of the traffic junction. This system is further can be implemented with the number plate recognition to reduce the implementation cost and also gets more accurate information about the vehicle.

REFERENCES


BIO-DATA

Author 1

P. Nandini Kiran currently pursuing her M.Tech (Embedded systems) in CMR Technical Campus, Department of Electronics and Communication Engineering at CMRTC, Hyderabad, India.

Author 2

Suraya Mubeen is currently working as an Associate Professor in the Department of Electronics and Communication Engineering at CMRTC, Hyderabad, India. She had submitted her Ph.D in Microwave Antennas in February 2017 and awaiting for report. She has total of 9 years of teaching experience, published 10 International Journals under her research and attended 16 international Conferences and published papers in it. She has attended 20 workshops and participated in FDP's and seminars. She is the reviewer of several international journals
and editorial board member also. She is a life member of IETE and ISTE. She is M.Tech Coordinator, NIRF Coordinator. Currently, she is Research and Development Coordinator ECE.