IOT BASED TRAFFIC SEMAFOR

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***Abstract*:** In order to ensure the safe movement of emergency vehicles, an intelligent traffic control system is proposed. Every vehicle is fitted with a special radio frequency identification (RFID) tag (positioned at a strategic location) that makes it difficult to disable or damage the RFID reader and uses the PIC16F877. The RFID tag reader is connected to the car. It counts the number of vehicles that travel through a particular path during the specified period. It also defines the network congestion and, hence, the length of the green light for that route. Whether the RFID-tag-read belongs to the stolen car, a GSM alert will be sent to the police control room. In addition, as the ambulance is entering the intersection, it must talk to the traffic controller at the intersection to turn the green light on. This module uses the Wi-Fi modules and the PIC16F877A on-chip system for wireless communication between the ambulance and the traffic controller. The prototype was tested under different input combinations and the results were reported as anticipated.

Keywords: WIFI module, GSM, PIC16F877A, ambulance vehicle, stolen vehicle, congestion control, traffic junction.

I. INTRODUCTION

India is the second most populated nation in the world with a fast-growing economy experiencing severe road congestion problems in its cities. Infrastructure development is slow compared to growth in the number of vehicles due to space constraints and cost constraints [1]. Also, Indian traffic is non-lane dependent and chaotic. It requires traffic management systems that are different from developed countries. Intelligent traffic flow control can reduce the negative effects of congestion. In recent years, wireless networks have been commonly used in road transport because they offer more cost-effective options [2]. Technologies such as ZigBee, RFID and GSM can be used in traffic management to provide cost-effective solutions. RFID is a wireless technology that uses radio frequency electromagnetic energy to relay information between the RFID tag and the RFID reader. Some RFID systems can only operate within a range of inches or centimeters, while others can operate within 100 meters (300 feet) or more. A GSM modem is a specialized modem type that accepts a SIM card and operates through a mobile operator subscription, much like a cell phone. An AT order is used to power modems. These commands come from the Hayes commands used by the Hayes smart modems. ZigBee works at low power and can be used to perform predefined tasks at all stages of job configurations. This operates in ISM bands (868 MHz in Europe, 915 MHz in the USA and Australia, and 2.4 GHz in the rest of the world). Data transmission speeds range from 20 kilobits per second in the 868 MHz frequency band to 250 kilobits per second in the 2.4 GHz frequency band [3, 4]. ZigBee uses 11 channels for 868/915 MHz radio frequency and 16 channels for 2.4 GHz radio frequency. This also uses 2 channel combinations, CSMA / CA and CSMA / CA slot [5].

Traffic congestion is a big issue in cities in developing countries such as India. Growth in urban and middle-class population significantly contributes to the rise in the number of vehicles in cities [6]. Congestion on the highways eventually results in slow-moving traffic, which decreases travel time, and therefore stands out as one of the major problems in metropolitan cities. The Green Wave System is used to provide clearance for any emergency vehicle by changing all red lights to green on the emergency vehicle route, thereby providing a full green wave to the appropriate vehicle [7]. The 'white wave' synchronizes the white process of traffic signals. With the 'black wave' system, the vehicle going through the green signal continues to receive green signals as it moves down the lane. The device as it passes through a traffic light can track a stolen vehicle. The benefit of the device is that the GPS inside the vehicle does not require additional power. The greatest downside of green waves is that, when the wave is interrupted, the disruption can cause traffic issues that can be compounded by synchronization.

In these situations, the queue of vehicles in the green wave increases in size until it is too wide and some of the vehicles are unable to hit the green lights in time and must wait. This is called oversaturation [12, 13].

The use of RFID traffic control to avoid problems that typically occur with traditional traffic control systems, in particular those related to image

processing and beam interference techniques, is discussed in [8]. This RFID strategy deals with multi-vehicle, multi-lane, multi-road junction areas. This allows for an effective time management system, in which a complex time schedule for the movement of each traffic column is drawn up in real time. The real-time function of the network is emulated by the decision of a traffic police officer on duty. The number of vehicles in each column and the routing is the property on which the estimates and decisions are made. The downside of this work is that it does not address the approaches used to communicate between the emergency vehicle and the traffic signal controller. RFID and GPS are proposed on the basis of an automated emergency lane clearing system [9]. The purpose of this work is to reduce the delay in the arrival of the ambulance to the hospital by automatically clearing the lane in which the ambulance moves before it reaches the traffic signal. This can be done by changing the traffic signal in the ambulance route to green when the ambulance is at a certain distance from the traffic junction. The use of RFID distinguishes between emergency and non-emergency situations, thereby preventing excessive traffic congestion. Communication between the ambulance and the traffic signal is rendered via the transceivers and the GPS. The system is fully automated and does not require human intervention at traffic junctions. The downside of this method is that it requires all the information on the starting point, the end point of the journey. It does not operate if the ambulance has to take another path for some reason or if the starting point is not established beforehand.

Some of the major problems are the handling of more than 36,000 cars, an annual rise of 7–10 per cent in traffic, roads running at a higher capacity of between 1 and 4, travel speeds of less than 10 km / hr in some central areas during peak hours, inadequate or no parking space for cars, restricted number of police officers[10]. A video traffic control and monitoring network is currently in operation in Bangalore Town[11]. It includes a manual review of the traffic control team's data to assess the length of the traffic light at each intersection. The same shall be reported to the local police officers for the appropriate action.

II. TRAFFIC SEMAFOR SYSTEM

For automatic signal control based on the traffic density of the road, manual effort is provided by the traffic police. As the entire system is automated, far less human interaction is needed. If a stolen car is identified, the signal will immediately turn red so that the police officer can take appropriate action if he or she is present at the intersection. SMS will also be submitted so that they can plan to intercept the stolen car at the next possible intersection.

With the emergency vehicle clearance, the traffic signal will turn green as long as the emergency vehicle is waiting at the traffic junction. The signal turns to abuse, just after the emergency vehicle has gone through. The system can be further improved by comparing it with long-range RFID readers. The GPS can be called to the stolen vehicle tracking module, so that the precise location of the stolen vehicle is identified.

A. Automatic Signal Control System

In this module, we used passive RFID tags and 125 KHz frequency RFID reader for experimental purposes. The RFID tag will relay the specific RFID to the reader when the vehicle comes within the range of the receiver. The microcontroller connected to the RFID reader will count the RFID read tags in a span of 2 minutes. For measuring purposes, if the count is greater than 10, the duration of the green light is set to 30 seconds, if the count is between 5 and 9, the duration of the green light is set to 20 seconds. If the count is less than 5, the period of the green light is set to 10 seconds. The red light duration will be 10 seconds and the orange light period will be 2 seconds, as seen in Fig: 1.

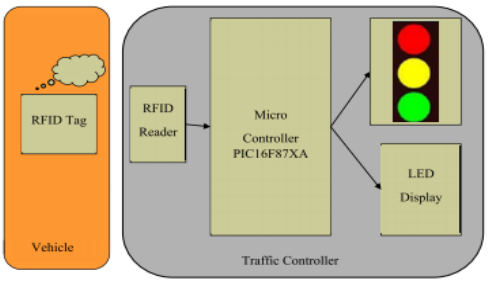

Fig: 1 Traffic semafor system

B. STOLEN VEHICLE DETECTION

For testing purposes, this module compares the specific RFID tag read by the RFID reader to the stolen RFIDs stored in the device. When a match is made, the traffic signal is automatically turned red for a period of 30 seconds. You must also send an SMS indicating the RFID number using the SIM300 GSM module. The LCD monitor shows that the stolen vehicle is present as seen in Fig: 2.

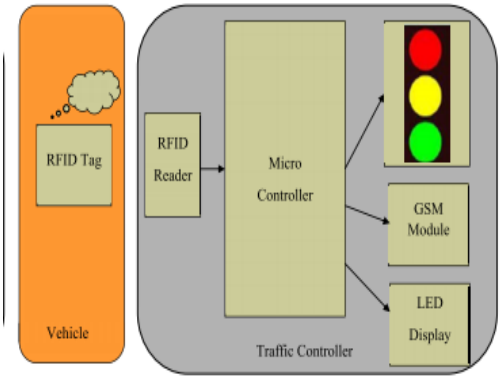

Fig: 2 Stolen vehicle system

C. Emergency Vehicle Clearance System

There are 2 sections in this package, the first part of which is a GSM transmitter is mounted in an emergency vehicle. The signal will be transmitted when the switch is pressed. The signal has a specific ID and security code. The transmitter comprises the microcontroller PIC16F877A and the GSM module. The microcontroller transmits commands and data to the GSM through serial communication. The second element is the receiver, which is positioned at the traffic pole. It also includes a PIC16F877A microcontroller and a GSM board. The receiver compares the provided security code to the security code in its database. If it matches, the green light will turn on. We used a short range RFID reader in our prototype for testing purposes. The receiver portion is turned on first. The red and green lights will be on for 10 seconds and the orange light will be on for 2 seconds, one after the other. Second, we put the RFID of the stolen vehicle into the range of the RFID operator. Then the signal will turn red for 30 seconds and the SMS will be sent. Fourth, we put 12 RFIDs into the range of the RFID reader, and then the length of the green light increases to 30 seconds. Fourthly, we put the emergency vehicle carrying the GSM transmitter into the range of the GSM receiver, and then the traffic light must turn green before the receiver receives the GSM receiver as shown in Fig: 3.

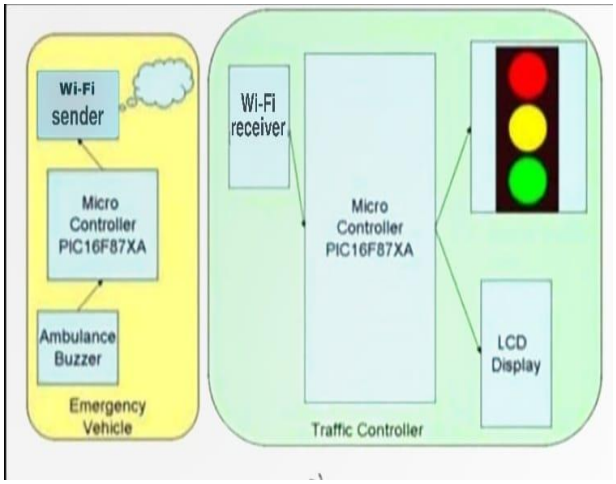

Fig: 3 Automatic Signal Control System

III. OVERALL CIRCUIT

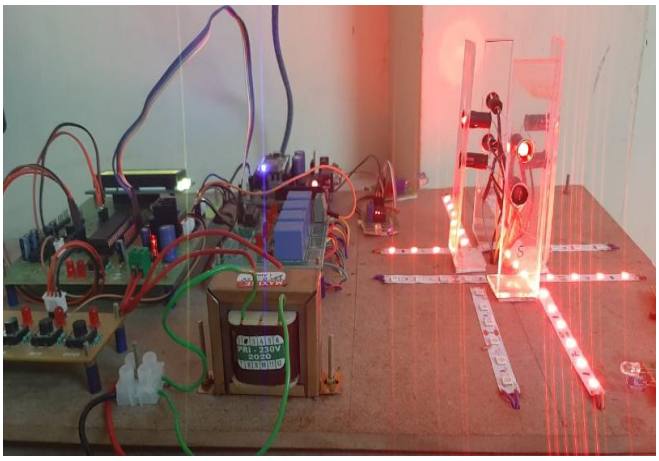

Fig: 4 Overall Circuit

IV. BLOCK DIAGRAM

Four IR sensors are used to measure traffic density. The keypad menu is programmed to monitor the timing of the IR sensor and the signal. The IoT module receives analog information from the IR sensors and generates an output of four LED controlled signals. The PIC controller receives the feedback of the IR sensor. Then receives the command from the IoT module and transfers it to the output channel.

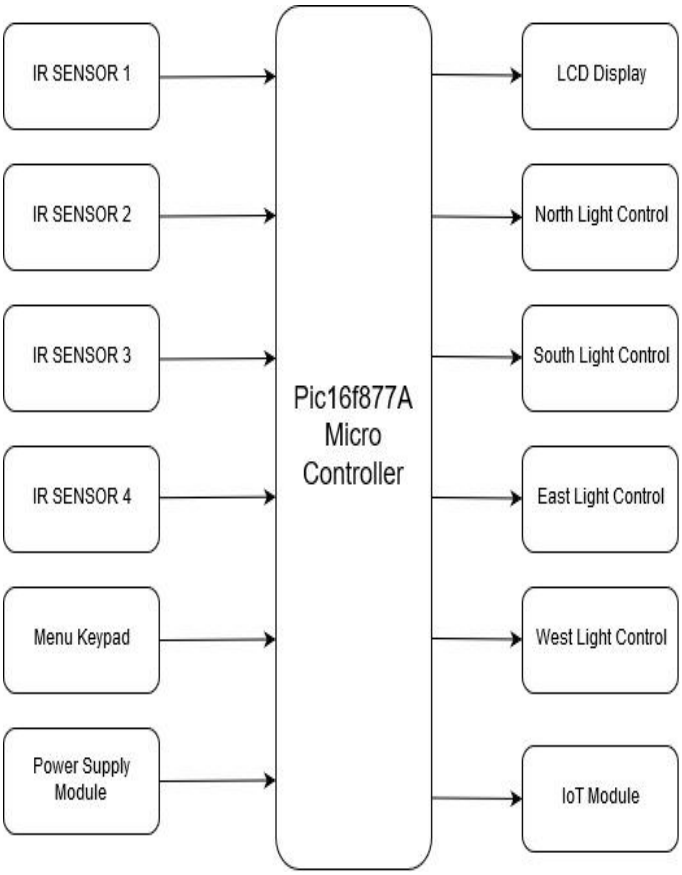

Fig: 5 Block Diagram

V. SIMULATION AND RESULTS

INPUT	OUTPUT
RFID TAGS AND READERS	TO LOCATE THE TARGET VEHICLES AND STOLEN VEHICLES
GSM MODULE	TO CLEAR THE TRAFFIC AT EMERGENCY SITUATIONS
IR SENSORS	TO CONTROL AND REGULATE TRAFFIC IN ALL DIRECTIONS
Node Mcu	PROCESS IS MADE FASTER AND MORE EFFICIENT

VI. OUTPUT

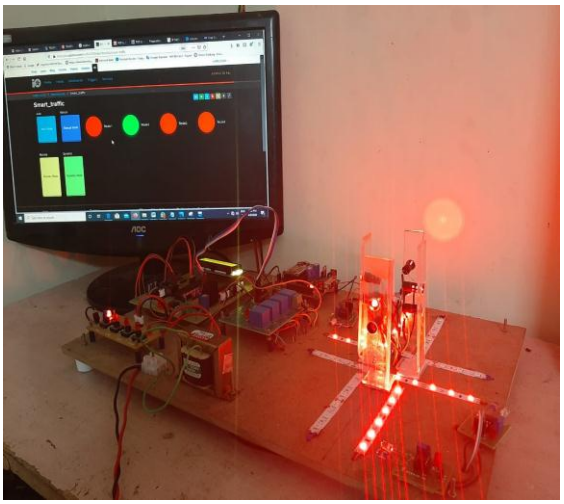

Fig: 7 Working Model

VII. CONCLUSION AND FUTURE WORK

Manual effort on the part of the traffic police is saved for automatic traffic signal control based on the traffic density of the lane. Since the entire system is automated, far less human intervention is required. When a stolen car is detected, the light will automatically turn red so that the police officer can take appropriate action when he/she is at the intersection. SMS will also be sent to prepare to stop the stolen car at the next practicable intersection. Emergency vehicles, such as ambulances, fire trucks, need to reach their destinations as soon as possible. When they spend a lot of time in traffic delays, other people's precious lives may be at risk. For the emergency vehicle clearance, the traffic signal should be green as long as the emergency vehicle is waiting at the road junction. The light turns red just after the emergency vehicle has gone through. More changes to the system can be made by comparing it with longer-range RFID readers. GPS can also be installed in the stolen vehicle tracking module to determine the precise location of the stolen car. The system is actually being applied by considering a single road

intersection. It can be improved by applying it to all roads at a multi-road junction.

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