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ABSTRACT. Traffic congestion is a significant problem in many cities in India, along with other countries. Failure of signals, poor law enforcement, and bad traffic management have led to traffic congestion. One of the major problems with Indian cities is that the existing infrastructure cannot be expanded more, and thus the only option available is better management of the traffic. Traffic congestion has a negative impact on the economy, the environment, and the overall quality of life. Hence, it is high time we effectively managed the traffic congestion problem. There are various methods available for traffic management, such as video data analysis, infrared sensors, inductive loop detection, wireless sensor networks, etc. All these methods are effective methods of intelligent traffic management. However, the problem with these systems is that the installation time and the cost incurred for installing and maintaining the system are very high. Hence, a new technology called Radio Frequency Identification (RFID) is introduced, which can be coupled with the existing signaling system and act as a key to smart traffic management in real-time. This new technology will require less time for installation and will have fewer costs compared to other methods of traffic congestion management. The use of this new technology will lead to reduced traffic congestion. Bottlenecks will be detected early, so early preventive measures can be taken, thus saving the driver time and money.

JEL Classification: J60, J64, J68

Keywords: Smart Traffic, RFID, GSM, Traffic congestion, Urban Planning

Introduction

Urbanization in cities around the world brings many comforts and assets to the daily life of residents but the damage is also hugely worrying. One easily detectable effect is traffic congestion, which affects our daily activities. Traffic congestion comes with other problems that people have to deal with, such as fuel burning, waste of time, exhaust smoke, etc., which directly affect the costs of the population in general through measurements (Schrank, Lomax, and Ezel, 2011). It also reduces the movement of vehicle users. From available traffic delay measurements to impressionistic guides in almost every major city in developing and developed countries, congestion is increasingly hindering the movement of personal vehicle users. Traffic
decreases further for the public transport user. This is largely because transport routes can generally coincide with the higher-flowing arteries, which are the arteries most affected by congestion. Moreover, public transport networks are mostly radial and do not allow to avoid congestion when crossing the city. Finally, public transport users cannot follow travel destinations that are located outside the most accessible locations on the periphery because the public transport system does not provide the specified service. A traffic light system can greatly affect the results of traffic jams as well. With currently active fixed time traffic signals, traffic patterns can certainly be disrupted in busy hours or events. Adaptive traffic control represents a clear advantage over traditional control and appears to be the next promising solution to the congestion problem (Cai, et al., 2009).

1. Traffic congestion

Traffic congestion on road networks is nothing but slower speeds, increased journey time and increased parking of vehicles. When the number of vehicles exceeds the road capacity, traffic congestion occurs. Traffic congestion is a major problem in major cities in India. Traffic congestion occurs when demand exceeds the available road capacity. Individual accidents such as accidents or sudden braking of the vehicle in the smooth flow of heavy traffic have undulating effects and cause traffic jams [William Beaty, 1998]. There are even serious security problems in the traffic system due to antisocial elements which also lead to traffic stagnation in one place. In a country like India, there is an annual loss of Rs 60,000 crore due to congestion (including waste of fuel). Congestion in India has also slowed down the speed of freight vehicles, increasing waiting time at checkpoints and public squares. The average speed of vehicles in major corridors such as Mumbai, Chennai, Delhi and Chennai is less than 20 kilometers per hour while it does not exceed 21.35 kilometers per hour along Delhi and Mumbai. According to Transport Corporation of India and IIM India's freight volume is increasing annually by 9.08% and vehicles by 10.76%, but road freight volume is only 4.01%. This has reduced the road area according to the total number of vehicles [Dipak K Dash, 2012].

Average The fuel mileage in India is only 3.96 km. The main reason for this is traffic congestion. India ranked second in population after China in Asia, and thus as the population increased, the number of vehicles also increased. Economic growth has certainly had an impact on urban traffic. With rising incomes, more and more people began to go to cars instead of two-wheelers. It has a great impact in curbing traffic congestion of ROR vehicles.

2. Radio-frequency identification

Radio frequency identification is a technique used to identify elements in a unique way by means of radio waves, capable of capturing hundreds of objects at the same time. Unlike other systems such as barcodes or QR codes, which use images for identification, RFID uses radio waves to capture information from RFID tags, with the property that direct line of sight is not necessary, which means that the only requirement is that the RFID tag has to be within the reading range of the RFID reader or antenna. (Azeem, 2009)

3. Global System for Mobile Communication

It is a digital cellular technology used to transmit voice and mobile data services. Important facts about GSM are listed below:
1. The GSM concept of a cell-based portable radio system emerged in Bell Labs in the early seventies.

2. GSM is the name of a standardization group founded in 1982 to create a common European standard for mobile telephony.

3. GSM is the most accepted standard in the field of communications and is implemented globally.

4. GSM is a circuit-switching system that divides each 200 kHz channel into eight 25 kHz time slots.

5. The GSM system operates on the 900 MHz and 1800 MHz mobile communication bands in most parts of the world.

6. The GSM system operates in the 850 MHz and 1900 MHz bands.

7. GSM has a market share of more than 70 percent of the world’s digital cellular subscribers.

8. GSM uses narrowband time division multiple access (TDMA) technology to transmit signals.

9. GSM was developed using digital technology. Has the ability to transfer data rates from 64 kbps to 120 Mbps.

10. GSM currently supports more than one billion mobile subscribers in more than 210 countries worldwide.

11. GSM provides basic and advanced voice and data services, including roaming. Roaming is the ability to use your GSM phone number in another GSM network.

12. GSM digitizes and compresses data, then sends it down through a channel with two more streams of user data, each in its time interval. (FHWA-HRT.2006)

4. Study area

The city of Diwaniyah is one of the cities of southern Iraq and the Middle Euphrates region, which is the administrative, economic and political center of the province of Diwaniyah, where there are all administrative and governmental institutions passing through a branch of the Euphrates River known as Shatt Diwaniyah, about 180 km from the capital, Baghdad, and the area of the judiciary center is 319 km.

4.1. Location of Diwaniyah City

Diwaniyah Governorate is located in the center of southern Iraq and is one of the provinces of the Middle Euphrates, which includes the Iraq Sedimentary Flood Sedimentary Plain. The astronomical position of the province is determined between latitudes (31° 17’ and 24° 32’) north and longitudes (24° 44’ and 49° 45’) east. Qadisiyah is directly bordered by
Babylon Governorate from the north, Wasit Governorate from the northeast, Dhi Qar from the southeast, Muthanna from the south and Najaf Al-Ashraf from the west. It is about 180 km from the capital Baghdad and is a link between the province of Najaf and the rest of the southern provinces. The area of Diwaniyah is about (425.8 km²) constituting 9.1% of the country area as in Map No. (1) and here it must be noted that the link of the importance of the city It is the importance of the site changing from one stage to another.

The geographical location of the city of Diwaniyah is almost ideal, as it represents an administrative center for four districts: (Diwaniyah - Shamiya - Hamza - and Afaak) as in map No. (2).

The city of Diwaniyah is located in the central part of southern Iraq on the Euphrates River and about 180 km south of Baghdad and about 320 km north of the city of Basra and on the eastern branch of the Euphrates River in Iraq, where the sedimentary plain begins from the north of Baghdad and extends to the Arabian Gulf and the city of Diwaniyah is located within the sedimentary plain and delta area and consists of agricultural land mixed with orchards, which start from the north and continue towards the east, especially in the district of Sumer and the center of the district of Afak The elevations of the earth's surface range between (13-23) meters above sea level (Husseini, Baghdad 2012).

Map No. (1) showing the geographical location of Diwaniyah Governorate in relation to Iraq

Source/Ministry of Water Resources, General Authority for Survey Unpublished data, Planning Information Systems Department
4.2 Location of Diwaniyah City

The city of Diwaniyah is bordered to the north by the Daghara district, to the east by the Afak district, to the south by the Sudair district, and to the west by the Shafi'i district. The area of (404) square kilometers. The city consists of (62) residential neighborhoods. The area of the center of the Diwaniyah district is (361) square kilometers.

5. Inductive loop detection

Inductive loop detection works on the principle of placing one or more turns of insulated wire in a shallow hole in the road, and a wire in the wire extends from the roadside pull box to the control unit and to the electronic unit located in the controller cabinet. When a car passes over the loop or stops, the induction of the wire is changed. Due to the change in inductance, there is a change in frequency. This change in frequency causes the electronic unit to send a signal to the control unit; indicating the presence of the vehicle. Induction loop detection is useful in knowing vehicle presence, traffic, occupancy, and even the number of vehicles passing through a given area [Ali, S.S.2011]. But there are few problems with this system. These include poor reliability due to incorrect connections made in the tow boxes and
due to the application of sealant to road interruptions. If this system is implemented in poor pavement or where road potholes are frequent, the reliability problem is exacerbated.

5.1 Video analysis

Video analysis consists of a placed intelligent camera and sensors, a processing unit and a communication unit. Traffic is continuously monitored using a smart camera. The captured video is then compressed to reduce transmission bandwidth. Video analysis extracts the description of the scene from the raw video data. This description is then used to calculate traffic statistics. This statistic includes vehicle frequency, average vehicle speed as well as lane occupancy [Bichlien.2012] Problems associated with video analysis are-(a) the total cost of the system is too high (b) the system is affected in case of fog or heavy rain (c) night monitoring requires proper street lighting

5.2 Infrared sensors

Infrared sensors are used to detect energy emitted by vehicles, road surfaces, and other objects. The energy captured by infrared sensors is concentrated on an infrared-sensitive material using an optical system that then converts energy into electrical signals. These signs are mounted above them to display traffic. Infrared sensors are used to control signals, detect pedestrians in footpaths and transmit traffic information. The primary disadvantages of infrared sensors are that the operation of the system may be affected by fog; the installation and maintenance of the system is tedious [Bing-Fei.2013].

6. Traffic Intersections in Diwaniyah City

Intersections are one of the important parts of the road network in the city as the element responsible for changing the direction of movement of vehicles from one road to another, which makes their design and choice of shape affected by several precise engineering considerations: such as traffic capacity, density and volume of traffic, and the speed of vehicles, and based on the traffic monitoring and engineering operations accomplished, the city of Diwaniyah contains (66) intersections, of which only six contain traffic signals, while the rest are not equipped with traffic signals.

The field survey was conducted for the six intersections that contain traffic signals. Table (2-4) below shows the traffic volume of some intersections that were representing the study sample, and the peak time was determined at two times, morning and evening, and the morning observation was: (7:30 to 9:30), evening observation (4:00 to 6:00) "as shown in Table (2-4) and Figure (2-7):

Table No. (2-4) Vehicles Passing Through Stations by Type / Time from 7:30 - 9:30 am
<table>
<thead>
<tr>
<th>Terminal</th>
<th>Distance from center</th>
<th>Private car</th>
<th>Taxi</th>
<th>Medium load</th>
<th>Light load</th>
<th>Bicycle</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orouba Intersection</td>
<td>595</td>
<td>1453</td>
<td>1624</td>
<td>37</td>
<td>95</td>
<td>404</td>
<td>3613</td>
</tr>
<tr>
<td>Governorate Intersection</td>
<td>646</td>
<td>1654</td>
<td>1431</td>
<td>28</td>
<td>54</td>
<td>356</td>
<td>3523</td>
</tr>
<tr>
<td>Municipality Intersection</td>
<td>652</td>
<td>1223</td>
<td>901</td>
<td>63</td>
<td>80</td>
<td>298</td>
<td>2565</td>
</tr>
<tr>
<td>Eagle Junction</td>
<td>256</td>
<td>2629</td>
<td>1823</td>
<td>192</td>
<td>527</td>
<td>640</td>
<td>5811</td>
</tr>
<tr>
<td>Intersection of Processions</td>
<td>620</td>
<td>1234</td>
<td>850</td>
<td>47</td>
<td>62</td>
<td>430</td>
<td>2623</td>
</tr>
<tr>
<td>Intersection Challenge</td>
<td>981</td>
<td>2212</td>
<td>1712</td>
<td>238</td>
<td>412</td>
<td>543</td>
<td>5117</td>
</tr>
<tr>
<td>Fountain Intersection</td>
<td>460</td>
<td>1134</td>
<td>760</td>
<td>7</td>
<td>51</td>
<td>274</td>
<td>2226</td>
</tr>
</tbody>
</table>

Source: The researchers worked based on the field study and as illustrated in Figures (B) in the appendix.

Source: The researchers based on Table (2-4).

We note from the figure that the highest percentage of vehicles is at the Eagle Intersection because this intersection passes through three neighborhoods, namely the Euphrates neighborhood, the Military neighborhood and the civilization, as well as the vehicles standing in terms of Al-Daghara, while the lowest percentage of vehicles passing through the fountain intersection, because this intersection is a secondary intersection in the city. As for the evening period, the number of vehicles passing through the survey stations varied from one intersection to another as shown in Table (2-5) and Figure (2-8).
Table No. (2-5) Vehicles Passing Through Stations by Type / Time from 4-6 PM

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Private car</th>
<th>Taxi</th>
<th>Medium load</th>
<th>Light load</th>
<th>Bicycle</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orouba Intersection</td>
<td>880</td>
<td>647</td>
<td>26</td>
<td>82</td>
<td>110</td>
<td>1745</td>
</tr>
<tr>
<td>Governorate Intersection</td>
<td>940</td>
<td>620</td>
<td>9</td>
<td>21</td>
<td>85</td>
<td>1675</td>
</tr>
<tr>
<td>Municipality Intersection</td>
<td>745</td>
<td>534</td>
<td>43</td>
<td>50</td>
<td>70</td>
<td>1442</td>
</tr>
<tr>
<td>Eagle Junction</td>
<td>1120</td>
<td>863</td>
<td>130</td>
<td>310</td>
<td>213</td>
<td>2636</td>
</tr>
<tr>
<td>Intersection of Processions</td>
<td>721</td>
<td>405</td>
<td>12</td>
<td>47</td>
<td>120</td>
<td>1305</td>
</tr>
<tr>
<td>Intersection Challenge</td>
<td>965</td>
<td>766</td>
<td>195</td>
<td>225</td>
<td>284</td>
<td>2435</td>
</tr>
<tr>
<td>Fountain Intersection</td>
<td>630</td>
<td>420</td>
<td>0</td>
<td>32</td>
<td>96</td>
<td>1178</td>
</tr>
</tbody>
</table>

Source: The researchers based on the field study

![Pie chart showing the percentage of vehicles passing intersections in the evening](image)

Source: The researchers worked based on Table (2-5).

We note from the figure that the eagle intersection also has the highest percentage of passing vehicles in this period, due to the traffic coming from three residential neighborhoods of the
Euphrates, civilization and military in addition to the Daghara hand, while the lowest intersection is the fountain intersection, because it is considered a secondary intersection in the city.

7. Proposed intelligent traffic management system

7.1. System components

The RFID system consists of an RFID controller and an RFID tag.

1) RFID controller: The RFID controller consists of an RFID investigator who uses this investigator to communicate with the RFID card and then the RFID controller obtains the signals/data received by the investigator. Message interference is used to send commands and data messages from controller components. The core of the controller is inside the RFID controller. The controller core listens to investigators depending on the configuration. The controller core can perform read/write operations on the RFID tag or it can do it. Both the hearings and the implementation [5]. The RFID controller can have a serial interface through which external GSM/GPRS devices can be connected with it to create a dual radio.

2) RFID tag: RFID tags are wireless devices that use radiofrequency electromagnetic fields to transmit data, which are used to identify and track objects. RFID tags are of two types: active and passive [12]. Active RFID has a battery installed, which passive RFID does not. Passive RFID must rely on an external source of work. Tag information can be stored in non-volatile memory. The tag consists of a radio frequency transmitter and receiver. Can be assigned a unique serial number per mark [13].

7.1. Related algorithm Insertion

Max_red refers to the maximum time a signal can take Be red. Max_green indicates the maximum time the signal takes They can be green. Min_freq_count indicates the minimum frequency of vehicles. Traffic per second = ∑ number of vehicles / second. Act_freq_count refers to the actual frequency of vehicles. Timer refers to the number of the actual timer.

Algorithm:

1. When the signal turns green.
   (Timer < Max_green and Timer ≠ 0) (Act_freq_count > Min_freq_count)
   Keep the green signal. Decrease the timer by 1.
   Otherwise if (Act_freq_count ≤ Min_freq_count)
   Go 2. The end
2. Make the signal red. Convert the adjacent signal to green. Go to 1. Desirable Output: Effective Congestion Management
8. System Overview

Each vehicle can be installed with an RFID tag. This RFID tag will store all vehicle-related information such as vehicle number etc. RFID tags can be used to uniquely identify each vehicle and also help the driver receive some traffic messages. The existing signaling system can be coupled with the RFID controller. As shown in Figure 1, each signal can contain information related to each vehicle it passes. Thus, when a vehicle passes a signal, the signal can automatically maintain the number of vehicles passing through it, and help detect traffic congestion. Each signal must be stored with a limit value that must be in red and green. Now depending on the frequency at which vehicles pass by signal per second, the timer can be controlled dynamically. Each controller must be stored in the signal with a minimum frequency value for vehicles passing through the signal. Once this minimum frequency is reached, the controller must send a command to the signal to turn red. The signal is thus dynamically controlled. For example, suppose for a signal, the maximum time a signal can be red is 30 seconds, and the maximum time a signal can be green is set to 20 seconds. The controller with a minimum value of the frequency of the vehicles it passes through per second is stored as 5. Now suppose the signal turns green, the timer starts with a maximum value of 20. At first, the frequency of vehicles passing the signal per second is 10, after 10 seconds, this frequency drops to 5, and then the RFID controller automatically sends a command to the signal to turn red. The signal thus turns red and the signal next to it at this intersection turns green. This process continues in cycle. Dynamic signal control thus helps reduce time waste. This also helps avoid congestion. Traffic where priority is given to a dense traffic road. This system helps detect traffic congestion. If the frequency of vehicles crossing the signal per second remains higher than the set value despite reaching the maximum timer value, congestion has occurred at that point. Once congestion is detected, the RFID controller can send a message to the previous signal controller informing it to pause traffic along this span. After receiving the message from its subsequent signal, the RFID controller will place the red signal for this extension towards the busy crossing point for a predetermined period of time. When congestion is released at the intersection, the controller with the respective signal will send another message to the previous controller indicating that the traffic flow has resumed again in this direction. When this message is accepted, the controller of the previous signal turns off the red light and the green signal in the on position and restarts the signal cycle as before.

9. Applications

9.1. Traffic congestion detection and management

In addition to the previous method of traffic congestion detection, another method can be used. The server that can receive some important data calculated by the signal controller can be maintained. The main objective is to implement a system that will track the travel time of individual cars as they pass through roadside controllers and calculate the average journey time using a rules-based system to challenge d. Whether the area is crowded or not crowded. If congestion is detected, the system will control traffic lights/generate automatic forwarding messages to selected approaching vehicles.

9.2. Automatic speed limit detection
Violation We can use this technique to calculate the speed of the motorist and detect if he violates the set / set speed limit. If the driver violates the rule, a warning message will be sent to the driver via the audio and/or video interface and the penalty will be calculated in the server and paid monthly to the car owner.

9.3 Automatic invoicing for the primary area/number

Fees Fees are also automatically collected and Base Area Charges groups using the same framework. The controller will be placed in a toll booth and along motorized roads around the primary area which will uniquely detect each individual vehicle within its area by capturing the identifiers of its devices and will keep records of the time those controllers were seen within its reading area, this information will be sent to a master server. Accordingly, the main server calculates fees and bills against vehicle identification numbers [14].

Conclusion and future work

The proposed work focuses on the intelligent traffic management system using RFID technology that will eliminate the disadvantages of the existing system such as high implementation cost, dependence on environmental conditions, etc. The proposed system aims at effective management of traffic congestion. It is also cost-effective than the current system. Moreover, the study presents the problems in urban areas around the world due to congestion and related sources. Congestion has evolved into a problem affecting economies around the world. Urban areas in particular are the hardest hit under these conditions. Bottlenecks have a negative impact on the financial situation of the country, on the environment and, accordingly, on the quality of life in general. The proposed system can be optimized using any robust communication network other than

References