

Circulation of Emergency Vehicles: Installation of Smart Traffic Lights on Avenues

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Summary: In the city of Paraná, Entre Ríos, there is an inefficient circulation of emergency vehicles, mainly on the avenues. This is due to the lack of good planning and coordination between emergency services and traffic authorities, the lack of public awareness of the need to yield to emergency vehicles and the state of the streets. This project consists in the analysis of the implementation of smart traffic lights on major avenues. These smart traffic lights can detect and give priority to emergency vehicles, which could significantly reduce response times. Although there are implementation and maintenance costs, the benefits make up for the investment. This solution aims to improve the safety and efficiency of emergency vehicle circulation in Paraná.

Keywords: smart traffic lights, emergency vehicles circulation, traffic congestion.

Resumen: En la ciudad de Paraná, Entre Ríos, existe una ineficiente circulación de vehículos de emergencia, principalmente en las avenidas. Esto se debe a la falta de una buena planificación y coordinación entre los servicios de emergencia y las autoridades de tránsito, a la falta de conciencia ciudadana sobre la necesidad de ceder el paso a los vehículos de emergencia y al estado de las calles. Este proyecto analiza la implementación de semáforos inteligentes en las grandes avenidas. Estos semáforos pueden detectar y dar prioridad a los vehículos de emergencia, lo que podría reducir significativamente los tiempos de respuesta. A pesar de los costos de implementación y mantenimiento, los beneficios compensan con creces la inversión. Esta solución pretende mejorar la seguridad y la eficiencia de la circulación de vehículos de emergencia en Paraná.

Palabras clave: semáforos inteligentes, circulación de vehículos de emergencia, congestión de tráfico

I. INTRODUCTION

This work focuses on the city of Paraná, which is the capital of the province of Entre Ríos. In Paraná there are about 340,861 inhabitants. There is also an average of one vehicle every 3.5 inhabitants. Therefore, there are about 100,000 vehicles [1]. This causes a high volume of traffic on

the avenues, so emergency vehicles take a long time to reach their destinations and that is a problem to be addressed.

The purpose of this presentation is to discuss the problem of inefficient circulation of emergency vehicles on avenues. We are also going to present an idea of how to address it by means of smart traffic lights on avenues.

To achieve this purpose, this presentation is organized as follows. First, the problem of inefficient circulation of emergency vehicles is going to be described, contextualizing the geographical area. Then the causes and consequences of this problem are going to be analysed. Secondly, the project idea about how to address it by means of smart traffic lights on avenues, with its strengths and weaknesses is going to be described.

A. Description of the Context

The city of Paraná has four hospitals and twenty-three health centers, two fire stations, and many police stations. Fig. 1. shows the busiest points of our city. Also, these are the main routes of emergency vehicles. The main streets highlighted are Almafuerter Av., Francisco Ramirez Av., Churruarin Av., Gualeguaychú, Enrique Carbo, among others.

The highlighted buildings are the state-run hospitals called *Hospital de la Baxada*, *Hospital San Martin*, *Hospital San Roque* and the private institution called *Clinica Modelo S.A.*. Other important places include the military hospital, the fire station and the volunteer Fire Department headquarters, and the 911 central office, as shown in Fig. 1.

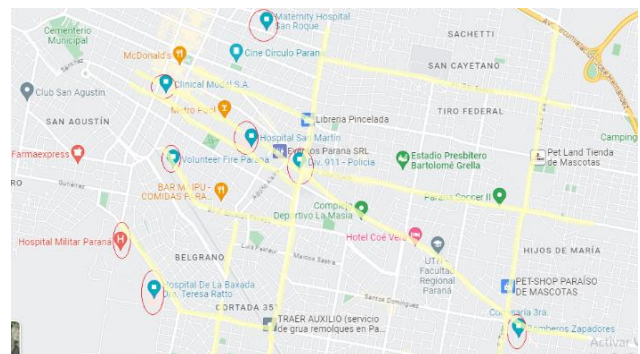


Fig. 1. Map of a part of the city of Paraná showing locations and main routes of emergency services. [2]

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All these places are located on the main avenues or close to them. Fig. 2 is a satellite photo showing the location of the intersection known as 5 Esquinas (5 corners) and its surroundings. This point is crucial since it connects all the main avenues of Paraná, so it is always very congested.



Fig. 2. Satellite view of the 5 Esquinas intersection. [3]

B. Problem Statement

As Paraná is a large city, there are many vehicles. This means that its streets are always very congested, especially the avenues. It is important for emergency vehicles to move quickly because, if they do not reach their destination in time, there may be serious consequences. People in need of urgent medical or attention or under dangerous situations can be seriously injured or even die by the inefficient circulation of emergency vehicles.

C. Description of Scenes that Help Picture the Problematic Situation

Fig. 3 shows a picture taken from the Aldefonso Av. sidewalk. This photo shows an ambulance circulating along Aldefonso Av., arriving at Rondeau Street. In the foreground there is a blue and white ambulance. This one circulates quickly; it may be because there is an emergency. It also shows the problem. This occurs when the ambulance must stop because the vehicles do not give way to it.



Fig. 3. Photo of Aldefonso Av. S

Fig. 4 shows a photo taken from the sidewalk of Aldefonso Av. This photo shows cars circulating along Aldefonso Av. and its intersection with Las Lechiguas Street. In the middle is a white and green ambulance. It has its sirens on. The ambulance must manoeuvre dangerously to overtake the vehicles. This could cause an accident.



Fig. 4. Photo of Aldefonso Av.

These images clearly show the problem of circulation of emergency vehicle in Paraná. It is now necessary to analyse the causes and consequences of this issue.

D. Identification and analysis of causes or factors that give rise to the problem:

There are many factors that give rise to the problem of circulation of emergency vehicles in Paraná. One of these is lack of proper planning and coordination between emergency services and traffic management authorities.

A further cause is related to the lack of awareness of how to act when an emergency vehicle has its sirens on. People do not have the awareness of the traffic laws in emergencies.

The poor condition of the roads is another cause we can mention. In some cases, roads may be in such poor conditions that emergency vehicles cannot pass through them, which can lead to delayed care for patients.

E. Identification and Description of the Consequences

There are many consequences resulting from the problem of emergency vehicle traffic in Paraná. One of them is that it can cause delays in response times, which can be critical in emergency situations, which can negatively affect their chances of recovery.

Another consequence has to do with the fact that in fire situations, inefficient circulation can lead to the spread of fire to nearby structures, increasing public safety risks. A rapid response by fire trucks is essential to control and extinguish the fire.

One further consequence is related to the risk to emergency workers traveling at high speed to reach the scene. If they are unable to move efficiently due to traffic congestion or lack of clear lanes, the likelihood of accidents on the road increases.

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II. THE WAY FORWARD

A. Problem approach

Our project consists in the implementation of intelligent traffic lights connected to emergency services to improve their circulation. This system leverages technology and real-time communication to ensure a faster response in critical situations.

To achieve this, it would require the installation of advanced sensors on emergency vehicles, such as ambulances or fire trucks, as well as at traffic lights along designated routes. These sensors would allow detection of the proximity of emergency vehicles at approximately 300 to 500 meters.

When an emergency vehicle approaches the traffic light, a two-way communication between the vehicle and the traffic light would be automatically activated. The traffic light would receive information about the location and speed of the emergency vehicle.

With this information, the traffic light could calculate the optimal time to change to green before the emergency vehicle reaches the intersection. This will ensure that the road is clear and that the vehicle can pass unimpeded.

This approach not only improves the safety of emergency crews and affected persons in critical situations. It also optimizes traffic flow by minimizing unnecessary waiting times.

This seems to be an innovative and effective solution. However, it has its advantages and disadvantages.

B. Strengths and Weaknesses of the Proposal

The main disadvantage of implementing intelligent traffic lights is the significant cost of installing advanced sensors and setting the communication network between them.

In addition, periodic maintenance and technology upgrades would be required. This could increase long-term operating costs.

Smart traffic lights have many advantages. Not only would it improve the safety of emergency crews and response to critical situations, but it would also optimize traffic flow, reducing congestion and emissions.

In addition, the benefits in terms of lives saved and minimized damage in emergencies amply justify the costs involved. This demonstrates its long-term value to the community.

III. CONCLUSION

In conclusion, the city of Paraná faces major challenges in the circulation of emergency vehicles due to traffic congestion, poor road conditions, among others. These problems cause delays in emergency response times, which can affect people in need of help.

Our project proposes a solution to improve emergency response times and traffic flow by implementing smart traffic lights connected to emergency services to improve their circulation. Advanced sensors installed on emergency vehicles and traffic lights enable real-time communication,

allowing traffic lights to detect approaching emergency vehicles and adjust signals accordingly. This system would improve safety and optimize traffic flow.

However, this solution is not without its difficulties. The significant upfront cost of installing advanced sensors and establishing a communication network is a considerable hurdle. In addition, the system would require regular maintenance and technology upgrades, which would increase operational costs in the long term.

ACKNOWLEDGMENT

The authors would like to thank María Laura Sollier for her collaboration in the writing of this project.

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The present project is a skills integration activity in Inglés I at Universidad Tecnológica Nacional, Facultad Regional Paraná, carried out by EFL engineering students. The yearlong project requires students to delve into a problem in the city where they live and to address it by means of a simple project in English. Should the reader have any questions regarding this work, please contact Graciela Yugdar Tófaló, Senior Lecturer, at gyugdar@frp.utn.edu.ar.