ABSTRACT

This paper deals with traffic congestions of different sizes at intersections and specifically intersections that have traffic lights. This paper provides many suggestions and appropriate solutions that can be implemented in order to facilitate the transit of various types of emergency vehicles across intersections. This paper also provides individual solutions about emergency vehicles (special vehicles) and to make proposals for them, these depend on the technology system and the Internet of things which most of the world's population exploits.

General Terms: Wireless Sensor Network, GPS and Radio waves.

Keywords: Traffic light, emergency.

1. INTRODUCTION

The problem of traffic congestion around the world is one of the main and main problems and there are always difficulties in emergency situations and facilitating access to the goal, but with the development and growth of technology we can benefit from those industries and work to link with the road sector where the topic of this paper was linked with the smart transportation system Technology.

This paper reviews several suggestions for solving this problem, which will be explained in detail in the summary and to identify its pros and cons, as follows:

1) Use of radio wave technology.

2) Use of Internet technology (Wi-Fi + GPS).

3) Create a special smart application for emergency vehicles (private cars).

These suggestions are trying to reduce as much as possible the presence of vehicles at the intersections and the main goal that I am looking for through this paper is to reduce the largest possible number of vehicles at the intersections and work to facilitate the arrival of the emergency vehicle during its passage to the intersection and to maintain the safety and security of citizens.

An example (study model) was taken, which is in Tulkarm, Palestine, and we will get acquainted with the possibility of applying it in that city. The Synchro program has been used to study the traffic situation, the time for traffic lights, and the possibility of applying the idea in the city.

2 .USE OF RADIO WAVES.

Since its discovery, the radio waves changed the face of the world. For the first time, people experienced direct communication across long distances and between countries wirelessly, and the innovations and inventions that use the range of (radio waves) in modern technology such as mobile phones and others came. Radio waves are one of the basic tools that transformed the world into a village Small.

One of the techniques proposed in this paper is the use of the principle of radio waves in determining the presence of the emergency vehicle at intersections.

The principle of this technique:

This technology is based on several pillars such as the traffic control unit, the emergency vehicle (ambulance, police and firefighters), so that each emergency vehicle has an electronic piece in it and when a notification about the presence of an injured or a specific target is reached, this piece will be operated upon reaching the same intersection that also contains On an electronic piece fixed at the same signal, so that this mobile wave is captured by the emergency vehicle and works to change its

programming either to be automatic or through the traffic control unit responsible for remote control of signals, so it gives the green light to this vehicle to work on crossing the intersection and continue In reading until crossed met Obey and then turns it off by the driver so that the signal returns to program itself to return to normal.

It can be used as an electronic piece which called (programmable integrated circuit) and denoted as (PIC), it is a microcontroller manufactured by (Microchip) and is one of the most famous types of programmable microcontrollers such as the picture shown below.[1]

Figure 2.1 Electronic piece (PCI).

Advantages of using this technology:

1. The speed of radio waves is almost the same as the speed of light.
2. Easy to use and does not need complication.
3. The electronic piece is small in size and can be carried in the palm of your hand.
4. This electronic widget is easily programmable in almost any flash.

The disadvantages of this technique:

1. It may take a lot of time to get rid of the obstacle vehicle on the intersection.
2. You need periodic maintenance, such as wiping it from the dust on the signal itself, in order for the signal to pick up waves.
3. Several vehicles may drive while the emergency vehicle is passing and this creates problems at intersections.

3. DEPENDENCE ON WI-FI AND INTERNET OF THINGS.

Internet of things is a newly emerging term and means the new generation of the Internet (the network), which allows understanding between devices connected to each other (via the Internet Protocol) These devices include tools, sensors, sensors and various artificial intelligence tools and others.

In this technique I focused on several things, including the type of intersections and work to impose several directions to which the emergency vehicle is heading, and also work on an analysis (cycle length) expected to occur at the intersection when the vehicle passes.

In this part of the technology I aim to control the traffic volume during the launch of the vehicle and not during its arrival at the intersection in order to get rid of the existing lines and all obstacles on the road.

The factors I studied and considered in this technique are:

1. The distance the emergency vehicle needs before reaching the intersection.
2. Speed of the emergency vehicle before reaching the intersection (speed since the start of the launch)
3. The number of vehicles or an approximate traffic volume traveling in the same direction as the emergency vehicle.
4. The expected time for the emergency vehicle to reach the intersection.
5. The number of access point present on the same road as the emergency vehicle traveling before reaching the intersection, because it is working to generate different traffic volumes so that I have conflict point , and this affects the speed of the emergency vehicle and the time required to reach the target.
6. Traffic volume on the intersection before the emergency vehicle arrives.

Also in this technique, there are several questions that I have asked

First: While the emergency vehicle reaches the intersection, will the rest of the vehicles in the same direction be allowed to pass?

Second: When the emergency vehicle reaches the intersection, all directions are marked in red? So, the emergency vehicle will pass by the red signal on its own?

In my opinion, the first question is, if I wanted to allow the passage of the same vehicles that are in the same direction as the emergency vehicle, perhaps when the emergency vehicle passes, I will form overflows after the intersection stage by the same vehicles that are going in the same direction and thus reduce the speed of the emergency vehicle and work to form another traffic volume If we pass on another intersection, perhaps I can allow the second question and work to operate the signal a few seconds after the emergency vehicle passes towards its target in order not to have any obstruction from the back, but also may form a new queue and delay when the vehicles that remained on the red signal awaiting crossing The emergency vehicle.

The principle of using Wi-Fi and Internet of things.

This technology depends mainly on the Internet and GPS, and the principle of this technique is that the traffic control unit is notified by the driver of the emergency vehicle to start towards the departure of the emergency vehicle to the specified target and therefore falls on the obstacle of the traffic center unit through the cameras located at the intersections working to identify the nearest A line or path of an emergency vehicle to reach towards the target and thus work to know the traffic volume on the road as a whole and also at the intersections, therefore the traffic control unit works by changing cycle length or the length of the red and green light period so that it aims to pass the largest possible number of vehicles to the intersections before voting Vehicle of emergency in order to facilitate the process of reaching the right time, and get the lowest possible number of queuing delays are likely to occur and be tracking continuous process through the GPS system and also know the speed of the vehicle and the expected arrival time.

Figure 3.1 Example of a tracking system.

One of the problems that I encounter is the type of traffic light on the intersection, such as Pretimed and Actuated, as the type of this signal helps me reduce traffic volumes at intersections, for example Actuated and semi actuated mainly depends on the presence of detectors , which works on reading vehicles when passing at a specific point, and this helps me Significantly to get rid of these traffic volumes, but at the same time if we want to implement them at the intersections in order to control the emergency vehicle, it is considered a high cost and also needs drilling operations in the pavements in order to put detectors and therefore in cases of damage may be the cost of maintenance is high, in On the other hand, if I had full actuated, I would have require costly equipment's such as detectors and if I had semi actuated I will be high traffic accident in times of light traffic , and the most important advantages is its ability to control of cycle length and work to be programmed in by mechanical traffic

systems center so that the adjustment at all intersections from the moment of the launch of emergency vehicles.

After reviewing everything that was mentioned above, it is now possible to find out the positive and negative effects of using this technique, which aimed at reducing as much time as possible and the rapid ability to respond.

Advantages of using this technology:

1. Preserving human lives.
2. Arrive at the right time.
3. Feeling satisfied and trusted by citizens.

Disadvantages of using this technology:

1. You need a strong communications structure.
2. Fear of interruptions in the internet or sometimes unresponsiveness.
3. You may need regular maintenance.

One of the expected problems is the presence of several emergency situations, for example I have a four-way intersection and I happen to see that two emergency vehicles will pass on the intersection from two different directions, so what can be done in this case?

When sending the signal from the basis, some preliminary information must be sent, for example, description of cases (serious, medium, and weak) and the direction of the target, and therefore the responsibility lies with the traffic control unit that takes these data into consideration and works to give priority to the severity of the situation and the proximity of the situation.

Also from the real problems is the presence of intersections classified as (Unsignalize intersection) and therefore here the severity of the situation is high and to solve this problem it is possible through the traffic control unit to choose a path that suits the emergency vehicle so that it is as far as possible to get away from such intersections, but basically when these intersections are classified by Traffic engineer should not have high traffic volume in these areas.

4. CASE STUDY (Tulkarm - Palestine).

I want to take the Tulkarm city area in Palestine as an example so that we work to implement such a technique where I will review two examples the first is an intersection in the form of (T intersection) and also another intersection consisting of four directions and in each intersection the type of signal I have is (pretimed signals) and therefore I will review the possibility of changing the cycle length in the event that my emergency vehicle passes, assuming the speed of the vehicles is 75 km / h.

The first intersection

Figure 4.1 Irrigated sizes on the intersection.

Through the above figure, I have a traffic intersection with certain traffic volumes, and by using the Synchro program, I had hypothetical results in the absence of an emergency vehicle as follows:

Yellow = 3.5 Seconds

All red = 1 Second

Green = 22.5 Seconds

Effective green time = 18 Seconds

Phases	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Control delay	9.3	11.3	3.1	10.4	14.5	9	3.3
Que length	14	90	20	36	152	30	17

Table 4.1: Results of the first intersection in the normal position.

I did several different studies and assumed that the emergency vehicle was in different directions. Cycle length = 45 seconds. I tried to change the period of the yellow color and work to reduce it in the event of an emergency vehicle on the road. The results were as follows:

Yellow = 2 Seconds

All red = 1 Second

Phases	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Control delay	7.2	8.6	2.1	8.1	10.3	13.3	4.3
Que length	13	7	18	34	146	41	22

Table 4.2: Results of the first intersection in the emergency vehicle situation.

The cycle length became equal to 60 seconds. The directions improved and the possibility of minimizing all directions. However, I have a problem in the northern direction, where we notice that the values here have increased in value and therefore if the emergency vehicle is on the northern direction, the traffic control unit will be responsible for facilitating programming.

The second intersection:

This intersection consists of four different directions.

Figure 4.2 Irrigated sizes on the intersection.

Phases	SBL	SBR	SBR2	SEL	SET	SER	NWL	NWT	NWR	NEL2	NEL	NER
Control delay	9.4	13.9	-	12.1	12.6	-	-	200.9	15.8	11.4	-	0.2
Que length	40	130	-	47	124	-	176	173	45	-		0

Table 4.3: Traffic results on an intersection with four directions in the normal position in the same city.

5. USE OF SMARTPHONE APPLICATIONS FOR EMERGENCY VEHICLES (PRIVATE CARS).

In this part also depends on the second part, which is the use of Wi-Fi and 3G technology and GBC, and the idea of this application is the same idea of the previous parts but for private cars, which is loaded for emergency situations where I can work to link this application with the traffic control unit, the police and the hospital so that when there is An emergency situation we are working to record preliminary data, and then the departure journey begins. The traffic control unit works to facilitate the road and track the vehicle via the GPS system, and the police also, and monitors whether the vehicle reached the target (hospital) or not, in order to avoid deception in such matters Imposing fines or penalties against the Violating.

Some countries have installed sound sensors for the emergency vehicle so that it works to open the road or the signal in front of it, but I think these have its drawbacks, such as it may need a longer time for the vehicle to pass, by getting rid of some of the vehicles on the intersection.

6. CONCLUSION

This paper touched on key point to give a clear way to emergency purpose vehicles on road so that they can reach to their destination in least time by not stopping at the traffic intersections. Traffic intersections will be smart enough to take care for flow of traffic if there is any emergency purpose vehicle need to pass on and in normal condition, traffic intersection will work normally as discussed in earlier paper. But a practical implementation of this paper need to grass root level and then optimization can be done accordingly.

7. REFERENCES

[1] Microchip Technology: Smart.