

Intelligent Traffic System

KEYWORDS: RTIS, AMBULANCE, ARDUINO, ULTRASONIC, AND PUSH BUTTON





Menna Thabet

Tasneem Hesham

PURPOSE

Traffic jam is a the most circulating problem in all modern countries in the world which began to develop over time. It is caused by the increasing number of vehicles on the road resulting in congestion, leading to waste of time. It causes many accidents on the road or disruption of the movement of rescue vehicles resulting in many hazards. The shortest way to reduce traffic jam thus reduce the greenhouse gases emissions and maintain a sustainable environment is improving the system of traffic lights and making it smarter.

Intelligent traffic is a system which depends on counting the number of cars on each road, regulating traffic in all road junctions by providing traffic lights with opening times relevant to cars number in these roads. Also, opening the traffic lights in each road whenever ar emergency vehicle is found nearby.

Background Research

Traffic congestion is a serious problem with large and adverse effects on both the quality of life and the economy. In addition to the time wasted standing still in traffic, time that could be put to more productive uses, congestion results in unnecessary fuel consumption, causes additional wear and tear on vehicles, increases harmful emissions lowering air quality, and increases the costs of transport for business.

We found in our research information about the traffic system which we have in our country, its purpose is to facilitate the safe movement of cars, avoiding collisions.

This system uses a sensor loop embedded in the pavement that detects weak magnetic fields such as the metallic parts of cars.

But this system has many advantages, such as:

- Some drivers disobey these signals.
- Increasing traffic congestion, air pollution, and fuel consumption.
- Increase in use of less-adequate roads to avoid traffic signs.
- Excessive delay due to time allocated by the traffic signals.

HYPOTHESIS

gases, it will also reduce the timed

of waiting for emergency

vehicles.

In this scientific research we are providing that our intelligent traffic system will reduce traffic jam and the related road traffic injures (RTIs) in streets thus reduce the emissions of harmful

PROCEDURE

The construction of prototype was made of by specific steps as follows:

- ✓ First, Ultrasonic sensors were connected to Arduino uno to detect the passing cars in the both intersected roads (fi
- ✓ **Second,** the breadboard was connected to the Arduino uno by the jumper wires.
- ✓ Third, the bush button was fixed on the side of each road.
- ✓ Fourth, the light led and push button were connected by wires to the breadboard.
- ✓ **Fifth,** the system was coded on Arduino uno to light the green light led.

The project has specific design requirements as shown in fig (2), which manage three things; the ability of the ultrasonic sensors to detect a maximum number of cars on the two intersected roads, reducing the response time of the traffic light to turn into green color for any ambulance vehicle, and the low cost of the prototype was accomplished.

Then, the prototype was tested as the following:

The First Test:

The four ultrasonic sensors were tested on the two roads to detect the number of cars, as shown in fig (3), before the cycle of duration start and then choose the right road to turn its led into green color.

The Second Test:

The efficiency of the protype was measured by comparing our system with the ordinary system according to reducing the response time of the green light to open for the ambulance vehicle. It shown that the ordinary system had greater red-light duration.

The Third Test:

The all materials that were used were listed with cost and the whole budget was calculated which the prototype cost was low.

DATA

Third trail

The useful and important data while researching were collected to serve us for prove our solution. Just as traffic lights cause many serious problems, the most important of which is the increase in the number of road accidents.

 90 ± 0.1

According to the Global Status Report on Road Safety, current estimate for Egypt show a road traffic fatality rate of 42 deaths per 100,000 Population fig (4) which is one of the highest in the middle east.

 30 ± 0.1

After testing our prototype, the change at the time the green signal continued turning on the two roads was clear and was estimated

as shown in table (1):				
	Number of cars in road x	Number of cars in road y	Green light duration in road x	Green light duration in road y
First trail	1	2	50 ± 0.1	70 ± 0.1
Second trail	2	3	54 ± 0.1	66 ± 0.1

In each trail, the green light duration was longer for the road that had a greater number of cars.

RESULTS

As represented in the previous data and graphs, tests were conducted, and results recorded as the following: ☐ The first test was succeeded by the ability of ultrasonic sensors to report all cars on the intersected roads. As each cycle of duration was 120 seconds. Then, in each trail the road that had more cars, had longer green light

t(x) = (x/x+y+0.01)*60+30

As in the First trail, the detected cars in road x were 1 car and road y were 2 cars. Then the green light duration calculated by:

t(x)=1/1+2*60+30=50 st(y)= 120-50= 70 s

the detected cars in road x were 2 car and road y were 3 cars. t(x)= 2/2+3*60+30 = 54 s

duration. The green light duration was calculated by the equation:

t(y) = 120-54 = 66 s

the detected cars in road x were 3 car and road y were 0 cars.

t(x)=3/3+0*60+30=90 s

t(y) = 120-90 = 30 s

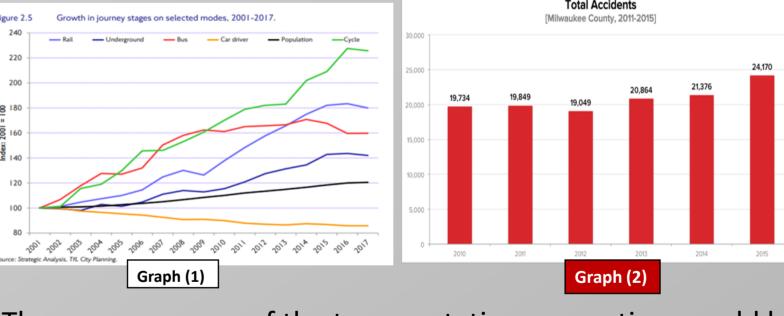
- ☐ The second test showed that the project achieved high efficiency by saving the response time of the traffic light to turn into green while the ambulance vehicle passed. As it was compared with the ordinary system, when the saved time by ours was 30 s, the ordinary system saved zero s. The red-light duration in the ordinary system
- ☐ The third test was succeeded to achieve less cost as the materials cost was calculated and the prototype could only cost 350 L.E.



After testing and analyzing the solution, it was concluded that the project succeeded in reducing the emergency vehicles response

time and limiting the cost to 350 L.E. The project managed to reduce the response time of emergency vehicles by 90 seconds at best situations. In addition to that, based on our research about the prior solutions it was proven that most of the current solutions acting on reducing the road accidents fatal consequences, for instance, causing wounds and injuries which would eventually lead to the need of urgent emergency care. Those findings served as an advantage to the proposed solution which has proved its capability of providing the least response time of emergency vehicles. Thus, the system didn't only solve a major public health issue but also reduced Road traffic injuries (RTIs), urban congestion and air pollution in Egypt.

1) shows the growth in the transportation congestions in the world from 2001 to 2017. This ensure that the problem of traffic signals crowding is getting worse.



☐ The consequences of the transportation congestions could be represented in increasing the number of accidents on the roads related to road traffic injuries (RTIs), this leads to many death cases. As shown in graph (2), the increasing in the tota number of accidents from 2010 to 2015

In order to implement this system on the ground, as it does not require much effort and money, a traffic signal road will be built by adding the sensors on the sides of the roads in addition to fix the push buttons for detecting the ambulance vehicles. However, engineers should take care of coding these modern traffic lights systems and avoid any error. If the system was applied on roads and replaced with ordinary traffic system as shown in

of increasing the number of car accidents and the number of deaths in Egypt and the whole world.

It will also reduce road congestion and air pollution

associated with car exhaust.

I. Facts and information about the general problem of traffic congestion roads

Article Title: The Causes of Traffic and Congestion. Publication date: October 4, 2018

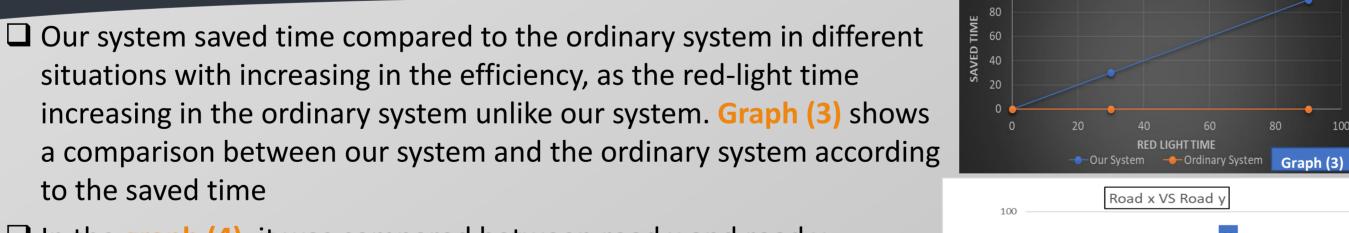
II. Raised the congestion problem associated with the risk of road traffic injuries

Article Title: Road traffic injuries_ World Health Organization. Publication date: March 10, 2013 III. Increasing the percentage of car accidents on the roads

Article Title: Common causes of car accidents, Smith Magram Michaud Colonna, P.C. Publication date: January 10, 2020

IIII. The mechanism of ultrasonic sensors and coding in Arduino.

Complete Guide for Ultrasonic Sensor HC-SR04 with Arduino. Publication date: April 2, 2019





situations with increasing in the efficiency, as the red-light time increasing in the ordinary system unlike our system. Graph (3) shows a comparison between our system and the ordinary system according to the saved time ☐ In the graph (4), it was compared between road x and road y

according to the green light duration in the three trails. The the denser road has the longer green light duration.

> The First Part: Ultrasonic sensors were used to detect the number of cars passing the street in a specific time, they emit short, high-frequency sound pulses at regular intervals, If they strike a moving car, then they are reflected back as echo signals to the sensor so it can count it (fig.5). This equation detects the number of seconds the green light opens for one of the two intersected roads.

t(x) = (x/x+y+0.01)*60+30

t(x): Number of seconds the green light opens for one of the two intersected roads, x: Number of cars in that road, and y: Number of cars in the other road. The equation has a maximum duration of 90 seconds and a minimum duration of 30 seconds to maintain balance between the two roads. So the sum of the interval will be 120 seconds, after this seconds passes, the number of cars on each road will be counted again. These values are obtained at the greatest difference between the number of cars in the two roads.

So, when the value of the cars in road x is maximum and road y doesn't have any cars, the green light will open for 90 seconds on road x. The jumper wires were also used to connect the sensor to the breadboard and then to the Arduino.

The Second Part:

A push button was used, so when an emergency vehicle is passing the street, the button will be on one side of the road, it is used as changer for the traffic lights so it can pass easily as lights on other roads will turn into red and on the road which the car is passing the traffic lights will be green.

We also used Arduino UNO as it is an open-source prototyping platform, where we could write and upload the computer code to the physical board

UNO **JUMPER** WIRES LED LIGHTS FLAT WOOD BOARD **BREADBOARD** ULTRASONI **PUSH** SENSOR **BUTTON**

