iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** V **Month of publication:** May 2022

DOI: https://doi.org/10.22214/ijraset.2022.43350

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue V May 2022- Available at www.ijraset.com

Study and Research Analysis of Automatic Traffic Signal with Hydraulic System

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Abstract: ***The overall objective of our project is to grasp the role of traffic system and its management. To avoid the traffic issues we are suggesting an idea of automatic hydraulic barrier system.Apart from offering other advantages features of automatic hydraulic barriers are first choice if heavy loads must be moved , lifted or controlled. This technique hydraulic barrier operated by PLC programming for controlling traffic in step with change the signal will decided by calculating no. of vehicles passes through.Some research papers proposed earlier regarding barriers and hydraulic actuators, but they need research gap which one we are visiting to fulfill the one among the newest technology is Automatic Hydraulic Barrier. This project Automatic Hydraulic barrier on the state highways to control the traffic irregularities and accidents. The material required for automatic traffic control is Hydraulic barrier, webcam, varieties of sensors, manual switch, relay ,piston. When the lights on traffic signals on the hydraulic actuators starts lifting and its is at upward until the green lights activate. When the red light are on the those that need to cross the road they'll cross easily with safety and no vehicles move forward until the green light are on. This manner we will control the traffic irregularities and reduce the numbers of accidents.***
Keywords: Traffic signal control, Hydraulic system, Signal timing , Automatic traffic control,Passenger safety etc.

I. INTRODUCTION

Road safety is one among the important factors for those peoples who are crossing the roads. Numerous peoples are crossing the roads at the time of vehicles going and there's no red light. It should cause accidents. Folks that want to save lots of your time and crossed the road when it's busy may result in death. If a family head is cause to death in an exceedingly road accidents their family should suffer lifetime or any permanent body disability may change their whole life, and it can't be like earlier. During a research 53 road accidents in an exceeding hour and one death in every four minutes .The traffic police is fully accountable for smooth run of vehicles . In a very report of Hindustan Times the 33% traffic policeman in capital show the signs of asthma, lung congestion throat irritation and thick sputum. And 23% of the traffic policemen were diagnosed with stress and hypertension.

In India the transportation sector is growing very fast at the starting of the 21st century. The highway has record of 14,500 accidents resulting in 1,400 deaths since its establishment. Behind, accidents caused to traffic jams occurring in an overall later journey, denial the essential purpose of being of such highways . So , road safety and management of the highways has inevitably become a problem national concern. Improvement in behavioral safety and vehicle safety could be very while concern for any growing country. Traffic accidents is also occurring in various ways ,therefore the threat of traffic accidents to human life can't be fully eliminated . Within the 20th century, 25.85 million people died in traffic accidents worldwide, which exceeds the account of deaths in war .In line with the statistics of the Roadside Safety Research Program of the Federal Highway Administration (FHWA) (2018), roadside accidents accounted over 50% of all traffic fatalities.Consistent with China's Road Traffic Accident Statistical Annual Report (2018), roadside accidents account for about 8% of the annual total number of crashes but cause 13% of the death rate. According to China's Road Traffic Accident Statistical Annual Report (2018), roadside accidents account for approximately 8% of the annual total number of crashes but cause 13% of the death rate.

II. PROBLEM IDENTIFICATION

1) Increasing the numbers of accidents day by day in uncontrolled manner.
2) Wastage of fuel and pollution.
3) It increases the strain and frustration among passengers and also at traffic policeman.
4) Traffic jam may also have a negative impact on the mind of someone.
5) People experiences delay for his/her work.
6) So many peoples aren't following the traffic rules which can cause accidents.

III. CURRENT SCENARIO OF TRAFFIC IN INDIA

1) Most of the people not obeying the traffic rules due to they don't have any fear .
2) Due to the not good control at any traffic signal peoples are crossing the roads without caring of traffic signal .
3) At Highway, time of crime ,any criminals not following any traffic rules, It causes so In our country one death in Road Accidents per minutes.
4) 53 Road Accidents in every single hours

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IV. RESEARCH GAP

As of now we studied the previous research papers which was proposed we analyzed that someone used the image processing technique which helps to search out the density . During a research cable barrier is employed to manage the traffic but the upkeep of soil, foundation breaks, repair costs more.

A pursuit paper which suggests and devises flexible median divider using suitable polymer material, so on reduce the chance level during median divider accidents, but it takes more cost and more flexible. After the study and analysis of these research we are going to suggest the study of Automatic Traffic Barrier with Hydraulic barriers . It'll be connected with the traffic signals and webcam .For an emergency purpose we'll use manual switch for ambulance .

When the signal lights turn red it's automatically lift upward and when lights turns to green it'll be at its original position. It'll help to manage the traffic and reduce the numbers of accidents and also helpful for those one that are crossing the road at the time of red signal.

V. METHODOLOGY

1) Input data of traffic volume and elegance.
2) Signal cycle system
3) Computerized program of signal design
4) Connectivity of Automatic Hydraulic Barrier with algorithm
5) Automatic hydraulic barrier working and installation

A. *Traffic Survey*

Method used for traffic survey count

1) Manual Method: The fields' data sheet are often prepared to the particular requirement at any intersection At a four arm intersection the count At each arm of the traffic entering the intersection is also counteracted into three categories, via left turning, right turning, straight ahead traffic then take a reading during an information sheet.
2) *Combination of Manual and Mechanical Method:* An example of a combination of manual and method is that the multiple pen recorders. A chart moves continuously at the speed of clock. Different pens record the occurrence of assorted event on the chart. The actuation of the event recorder pen by pressing the switch associated with each pen recorder.
3) *Video Photography:* Video photography gives a permanent record of volume count. Its analysis are typically done conveniently within the office by replying the cassette on a TV monitors.
4) *Photographic Method:* Time–lapse camera photography has been accustomed successfully to figure out the speed of vehicles accurately in crowded streets. per this method, photographs are taken as fixed intervals of sometime on a special camera‟s by projecting the film on a screen, the passage of any vehicle are often traced with relevancy time, and video camera can also be used.

B. *Passenger Car Unit*

1) Common practice to contemplate the coach because the standard vehicle unit to convert the choice vehicle unit is additionally called railway car unit or PCU.
2) The PCU could even be considered as a measure of the relative space requirement of a vehicle class compared of that of a railcar under a specified set of roadway, traffic, and other conditions.
3) The PCU value of a vehicle class could even be considered because the ratio of capacity of a roadway where there are passengers cars only to the capacity of the identical roadway when there are vehicles of that class only.

The Indian Roads Congress has given set of tentative PCU values or equivalent factors for rural road

a) Passenger car, tempo, autorickshaw, agricultural factor : **1.0**
b) Bus, Truck, agricultural tractor- trailer unit : **3.0**
c) Motorcycle, scooter, and pedal cycle : **0.50**
d) Velocipede : **1.50**
e) Horse – drawn vehicles : **4.0**
f) Small Bullock cart and handcart : **6.0**
g) Large Bullock cart : **8.0**

C. Components Used

1) *Hydraulic Actuator:* Hydraulic actuators are elements converting the energy of the working fluid into the energy associated with the reciprocating motion. The foremost frequently applied materials utilized in power hydraulics are described, and various surface modifications of the discussed elements, which are aimed at improving the operating parameters of actuators, are presented. The foremost frequently used materials for actuators elements are iron alloys. A characteristic feature of single-acting actuators is that the presence of 1 working chamber and therefore the possibility of executive (active) movement only in one direction. The return movement will be allotted by an external force or a spring force. Double-acting actuators, in turn, are characterized by a working stroke in both direction.

Fig. 1 Hydraulic Actuator

2) *Servo Motor:* A servo motor may be a variety of motor which can rotate with great precision. Normally this kind of motor consists of a sway circuit that gives feedback on this position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you wish to rotate an object at some specific angles or distance, then you utilize a servo motor. it's just made from a straightforward motor which runs through a servo mechanism. If motor is powered by a DC power supply then it's called DC servo motor, and if it's AC-powered motor then it's called AC servo motor. A servo motor may be a variety of motor that may rotate with great precision. If you wish to rotate an object at some specific angles or distance, then you utilize a servo motor. it's just made from a straightforward motor which runs through a servo mechanism. If motor is powered by a DC power supply then it's called DC servo motor, and if it's AC-powered motor then it's called AC servo motor. Servo Motor helps to lift the hydraulic actuator at the varied lane as per the timing set by cycle diagram.

Fig. 2 Servo Motor

3) *Photoresistors (LDR):* The most common light sensor type that's employed in a light-weight sensor circuit are photoresistors, also called a light-dependent resistor (LDR). Photoresistors are accustomed simply detect whether a lightweight is on or off and compare relative light levels throughout each day.

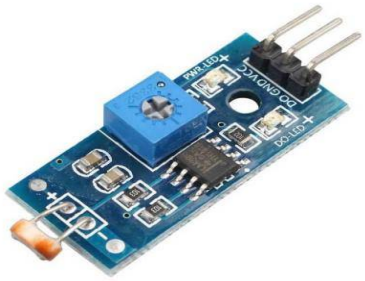


Fig.3 Photoresistors (LDR)

4) *Switch:* A manual switch is precisely what it seems like manual.It has very low cost , quick building and installations . during this method the switch is employed for a emergency like ambulance passing or the other purpose.

Fig. 4 Manual Switch

5) *Audrino Board*

a) The Arduino Uno may be a microcontroller board supported the Atmel's ATmega328

b) It has 14 digital input output pins of which 6 are often used as PWM outputs and 6 analog inputs

c) The Arduino Uno will be powered via USB connection or with an external power supply

d) The Arduino Uno original contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable.

Fig. 5 Audrino Board

D. Cycle Daigram for 2 Phase Signal by Webster Method

For designing a 2 phase stoplight A, B, C and D we are going to asuume the conventional flow is 700,800,1200 and 1400 vehicles / sec. For design a 2 phase intersection the intergreen period for one approach is 5 sec(all red amber time for one approach is 2 sec and for one more approach is 3 sec).

Formula Used :

$S = 3600/h$ sec.

$Y = q/s$ sec.

$\sum Yi = Y1+Y2+Y3+Y4$

$CO = 1.5L+5/(1-\sum Yi)$

$Y = t_r + V/2a+2gG$

Sol.

1) Calculation of Delay (L)= 2n+R

=2*2 + 4=9 sec.

2) Calculation of Saturation Flow

Assume $h_A = 1.9$ sec, $h_B = 1.6$sec , $h_C = 0.9$ sec , $h_D = 0.9$sec.

Then $S_A = 3600/h_A = 3600/1.9 = 1895$ /sec.

$S_B = 3600/h_B = 3600/1.6 = 2250$ /sec.

$S_C = 3600/h_C = 3600/0.99 = 3636$ /sec

$S_D = 3600/h_D = 3600/0.99 = 3636$/sec.

3) Calculation Of Y at each phase

Table 2 for calculation of Saturation flow and $\sum Y_i$

Particulars	Phase AB	Phase CD
q in (vps)	600	1200
S in /sec.	1895	3636
Y = q/s	0.36	0.34
Max Y_i	0.7	

4) Optimum cycle length $CO = 1.5L+5/(1-\sum Y_i)$

$= 1.5*9 +5/ (1-0.7)$

$= 61.6$ sec. Take 62 seconds.

5) Calculation of green time

$G_{AB} = Y_{AB} * (CO-L)/\sum Y_i = 0.36(62-9)/0.7 = 27.2$ sec.

$G_{CD} = Y_{AB} * (CO-L)/\sum Y_i = 0.34(62-9)/0.7 = 25.7$ sec.

6) Calculation of change and clearance interval.

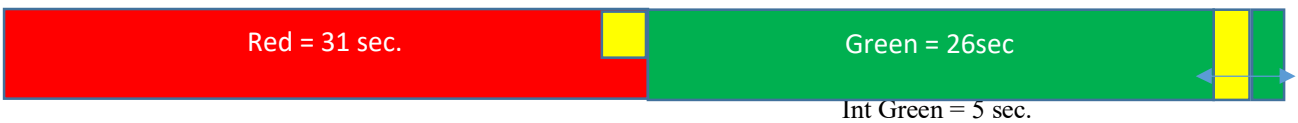
$Y = t_r + V/2a+2gG = 10+35*1.47/2*10 = 3.6$ sec.

Take 4 seconds.

CYCLE DIAGRAM FOR 2 PHASE SIGNAL

Red Amber time = 2 sec.

Red Amber time = 3 sec.



Int Green = 5 sec.

E. Cycle Diagram For 4 Phase Traffic Signal By Webster Method

Let us assume Red Amber time for one approach is 2 sec. and for another is 3 sec. We will take the normal flow for A,B,C and D is 2550,1920,2150 and 1990.

1) Calculation of total delay= 2n+R
= 2*4+5
= 13sec.

2) Calculation of saturation flow and $\sum Y_i$ is:

Table 2 for calculation of Saturation flow and $\sum Y_i$

Particulars	Phase A	Phase B	Phase C	Phase D
q in vps	2550	1920	2150	1990
S in per sec.	$S=3600/h_A$ =10285	$S= 3600/h_B$ = 9000	$S= 3600/h_C$ =10910	$S= 3600/h_D$ = 9230
Y =q/s	0.24	0.21	0.19	0.21
$\sum Y_i$	0.85			

3) Optimum cycle length = $1.5L + 5 /(1-\sum Y_i)$
= 1.5*13 + 5 / (1-0.85)
= 163.3 sec.
Take 163 seconds.

4) Calculation of Green time .

$G_A = Y_A *(CO-L)/\sum Y_i$
= 0.24*(163-13)/0.85
= 42.3 sec.

$G_B = Y_B *(CO-L)/\sum Y_i$
= 0.21*(163-13)/0.85
= 37 sec.

$G_C = Y_C *(CO-L)/\sum Y_i$
= 0.19*(163-13)/ 0.85
= 33.5sec.

$G_D = Y_D *(CO-L)/\sum Y_i$
= 0.21*(163-13)/0.85
= 37 sec.

F. Model Diagram Of Traffic Signal With Hydraulic Actuator

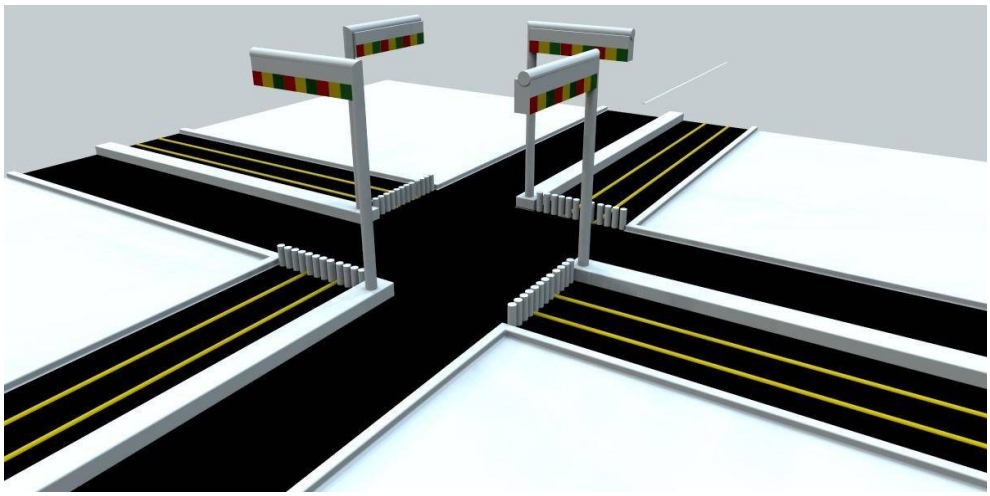


Fig .7 Model Layout

VI. CONCLUSION

The implementation of the automatic movable road barrier describes a simple method, which uses computer vision to target a roadway in order to control traffic. Using a camera or suitable IoT device, it identifies the number of vehicles moving on each lane and decides the position and dynamic status of the road barrier. This process reduces the traffic congestion caused due to skewed or excess of traffic density during peak hours of the day. The current study is used to identify only car densities, however, this could be further extended to identify all types of vehicle moving on a roadway and control the traffic. A algorithm is written for the working of automatic hydraulic barriers as per signal time design. A working model is designed to reflect the real life situation for traffic flow on different approaches. Hydraulic barrier can be useful for strictly control of the traffic rules. Therefore the designed project will be helpful at the intersections where frequent accidents occur.

VII. ACKNOWLEDGEMENT

This paper become a reality with the kind support and help of many individuals, we would like to extend our sincere thanks to all of them. First and foremost, we want to offer this endeavour to our GOD Almighty for the wisdom he bestowed upon us, the strength, peace of mind and good health in order to finish this research. We would like to express our gratitude towards our family for the encouragement which helped us in completion of this paper. We are highly indebted to Excel Engineering College, Department of Mechanical Engineering and Head of the Department along with the faculty members for their guidance and constant supervision as well as for providing necessary information regarding this research & also for their support in completing this endeavor. We would like to express our special gratitude and thanks to our adviser, Udaykumar for imparting his knowledge and expertise in this study. We would like to thank and appreciate our colleague Rakesh kumar shah, Pradeep Kandel, Ajay Kumar Yadav, Sumit Pandit and people who have willingly helped us out with their abilities.

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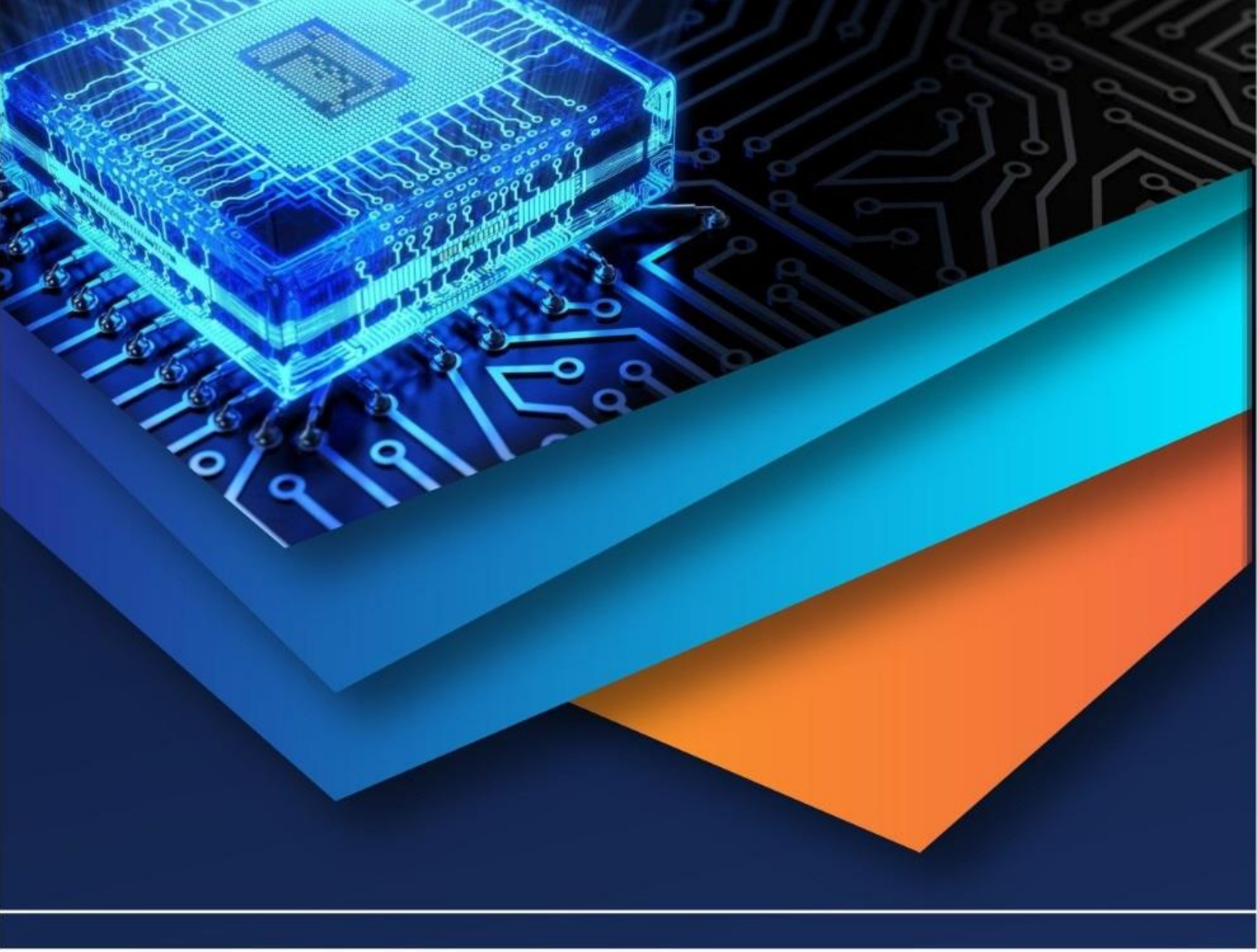

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