**Visvesvaraya Technological University**

Belagavi, Karnataka- 590014

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## A Mini-Project Progress Report

## On

## “Solution to Traffic Problem in Congested Area”

## 

## Submitted in partial fulfillment of the requirements for the award of the Degree

## of

**BACHELOR OF ENGINEERING**

**INFORMATION SCIENCE AND ENGINEERING**

ACCREDITED BY NBA

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2022-2023

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

**DAYANANDA SAGAR COLLEGE OF ENGINEERING**

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(An Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE & ISO 9001:2008 Certified) Accredited by National Assessment & Accreditation Council (NAAC) with ‘A’ grade,

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2022-23

**CERTIFICATE**

This is to certify that the Mini Project work done on **“Solution to Traffic Problem”** is being submitted by **Anagha R (1DS22IS017), Suvan Banerjee (1DS22IS168), Vaibhav S Magdum (1DS22IS177), Vedant Rajendra Balpande (1DS22IS181)**, in the partial fulfillment of II semester of Bachelor of Engineering in Information Science & Engineering of the Visvesvaraya Technological University, Belagavi during the academic year 2022-2023. The Project progress report has been approved as it satisfies the academic requirements under the rules prescribed for the Bachelor of Engineering Degree.

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2.

**ABSTRACT**

This project aims to make an existing system of traffic lights better by applying methods discussed in the mentioned article1. The primary objective is to make traffic more streamline in urban areas, addressing a drawback associated with the classic traffic light system. The existing system is slow and doesn't consider a lot of factors and has timed signals which causes traffic congestion, which can cause delays in emergency services like ambulances and has a greater environmental impact2. By using our project we provide a better traffic flow and reduced waiting time. The results of this project will benefit the individuals and authorities.

1. Article refers to Sharon, G. (2021). Alleviating Road Traffic Congestion with Artificial Intelligence. In IJCAI (pp. 4965-4969).
2. Source : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4243514/

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**CHAPTER 1: INTRODUCTION**

The number of vehicles on the road are increasing day by day so it is important to manage the traffic flow efficiently in order to utilize the existing road capacity in the best way possible. Developing a smart traffic management system to optimize traffic flow, reduce congestion, while minimizing the travel time and maximizing mobility. Installation of traffic signals can actually cause a deterioration in overall safety of intersections. Time traffic signals can cause a situation of deadlock1. Metro cities and many majorly populated cities have traffic signals at very short distances which prevent the smooth flow of traffic. Severe traffic can cause phantom traffic jams2. The phantom jam begins when a car in dense traffic slows down even slightly, which causes the car behind that to slow even more and the slowing action spreads backward through the cane of traffic like a wave, getting worse the further it spreads. The present automated traffic control systems work on time-based algorithms. Each lane is allotted a fixed time for traffic to clear off, the times may be equal for all lanes or based on the average vehicle density.

**1.1 LITERATURE REVIEW**

* Traffic congestion is a pressing urban issue with negative economic, environmental, and societal impacts. This literature review aims to explore and evaluate diverse strategies to address traffic congestion.
* Causes and Effects: Traffic congestion stems from factors like population growth, limited road capacity, and car dependency.
* Traffic lights play a pivotal role in managing intersections and regulating traffic. They facilitate the orderly movement of vehicles, pedestrians, and cyclists by assigning right-of-way and controlling signal timing.
* Numerous cities have adopted adaptive signal control systems and coordinated signal timing strategies. Successful implementations have demonstrated reduced travel times, enhanced traffic flow, and minimized congestion.
* Benefits and Challenges: Benefits of traffic light solutions include improved traffic flow, reduced congestion, and potential fuel savings. However, challenges include initial implementation costs, maintenance, and potential disruptions during deployment.

1. Source: https://www.eg.bucknell.edu/~cs315/2013-fall/sec02/notes/13-Deadlock-Intro-print.pdf
2. Source: https://www.livescience.com/61862-why-phantom-traffic-jams-happen.html

**1.2 MOTIVATION**

* The motivation for undertaking a project focused on solutions for traffic congestion using traffic lights is driven by the critical need to address the pervasive problem of urban traffic congestion. Traffic congestion has far-reaching negative impacts on cities and their inhabitants, ranging from economic losses and increased travel times to environmental pollution and decreased quality of life.
* Societal Impact: Traffic congestion significantly affects the daily lives of people. By developing effective solutions using traffic lights, the project aims to enhance the well-being of citizens by making their daily journeys smoother and less stressful.
* Traffic Safety: Congested roads often lead to higher rates of accidents due to sudden stops, aggressive driving, and frustration. By implementing well-coordinated traffic light systems, the project can contribute to safer road conditions.
* Economic Considerations: Traffic congestion results in wasted time, increased fuel consumption, and higher transportation costs.
* Urban Planning and Design: Efficient traffic management is a crucial aspect of urban planning. The project aligns with the goals of creating more livable and sustainable cities by focusing on optimizing traffic light systems, which are integral components of urban infrastructure.

**1.3 PROBLEM DEFINITION**

Developing a smart traffic management system using AI to optimize traffic flow, reduce congestion, while minimizing the travel time and maximizing mobility. The problem at hand is to design and implement a solution that effectively reduces traffic congestion. The solution should focus on minimizing congestion-related delays, improving travel times, reducing environmental impact, and enhancing overall urban mobility.

**1.4 OBJECTIVES**

The main objective of this project is to design a traffic light controller based on Computer Vision that can adapt to the current traffic situation. Our proposed system aims to use live video feed from the CCTV cameras at traffic junctions for real- time traffic density calculation by detecting the vehicles at the signal and setting the green signal time accordingly.

It will enhance the efficiency of the transportation system by optimizing traffic management, reducing bottlenecks, and ensuring smoother coordination between various transportation modes.

Increases the safety for pedestrians, cyclists, and drivers by implementing measures that reduce accidents, improve visibility and prioritize pedestrian-friendly infrastructure.

**1.5 EXPECTED OUTCOMES**

* Engaging in a project focused on solutions for traffic congestion using traffic lights can yield a range of expected outcomes.
* Improved Traffic Flow: Implementation of optimized traffic light strategies can lead to smoother traffic flow, reduced stop-and-go patterns, and decreased congestion at intersections.
* Reduced Travel Time: By minimizing waiting times at traffic lights, commuters experience reduced travel time, leading to enhanced efficiency in daily transportation.
* Enhanced Safety: Well-coordinated traffic lights contribute to safer road conditions by reducing abrupt stops and minimizing the risk of collisions at intersections.
* Technological Innovation: Implementing adaptive traffic signal control and intelligent transportation systems showcases the practical application of cutting-edge technologies.
* In summary, the expected outcomes of a solutions-focused traffic light project encompass improved traffic conditions, economic savings, environmental benefits, and positive impacts on urban mobility and quality of life.

**CHAPTER 2: PROPOSED METHODOLOGY**

* The traffic flow has no specific pattern that is followed, and the static signal timers pose a huge problem to the already critical problem of congestion.
* Therefore, implementing a system which aims to reduce chances of such scenarios by automatically computing the optimal green signal time based on the current traffic at the signal will ensure that the direction with more traffic is allotted a green signal for a longer duration of time as compared to the direction with lesser traffic.
* This system can override the older system of hard coded lights which cause unwanted delays, reducing congestion and waiting time which will reduce the number of accidents and fuel consumption which in turn will help in controlling the air pollution.
* Our proposed system will pass a snapshot from the CCTV cameras at traffic junctions for real-time traffic density calculation using Image Processing and Computer Vision.

**2.1 ALGORITHMS**

Algorithm Name: Object Tracking with YOLO and Tracker

Input: Video Feed

Output: Traffic Signal Control

1. [START] Import required libraries

- Import cv2 (OpenCV)

- Import pandas as pd

- Import YOLO from ultralytics

- Import Tracker class

2. Load YOLO model

- Initialize YOLO model using 'yolov8s.pt'

3. Define RGB Event Handler Function

- Define function RGB(event, x, y, flags, param)

- Capture mouse movement events

- Update colorsBGR with [x, y] coordinates

4. Create Video Capture Object

- Open video capture object for 'veh2.mp4'

5. Read Class List from File

- Read 'coco.txt' file

- Split data into class\_list using newline as delimiter

6. Initialize Count and Tracker

- Initialize count as 0

- Initialize Tracker object

7. Set Constants

- Set cy1 to 322

- Set cy2 to 368

- Set offset to 6

8. Start Loop

- Read frame from video capture

- If frame read fails, break loop

- Increment count by 1

- If count is not divisible by 3, continue to the next iteration

- Resize frame to (1020, 500)

- Perform YOLO prediction on the frame:

- Get prediction results

- Extract bounding box data and class indices

- Filter out boxes corresponding to 'car' class

- Update Tracker with the list of bounding box coordinates

- For each tracked bounding box:

- Calculate center coordinates (cx, cy)

- Draw circle at (cx, cy) on the frame

- Display ID next to the circle

- Display frame with tracking information

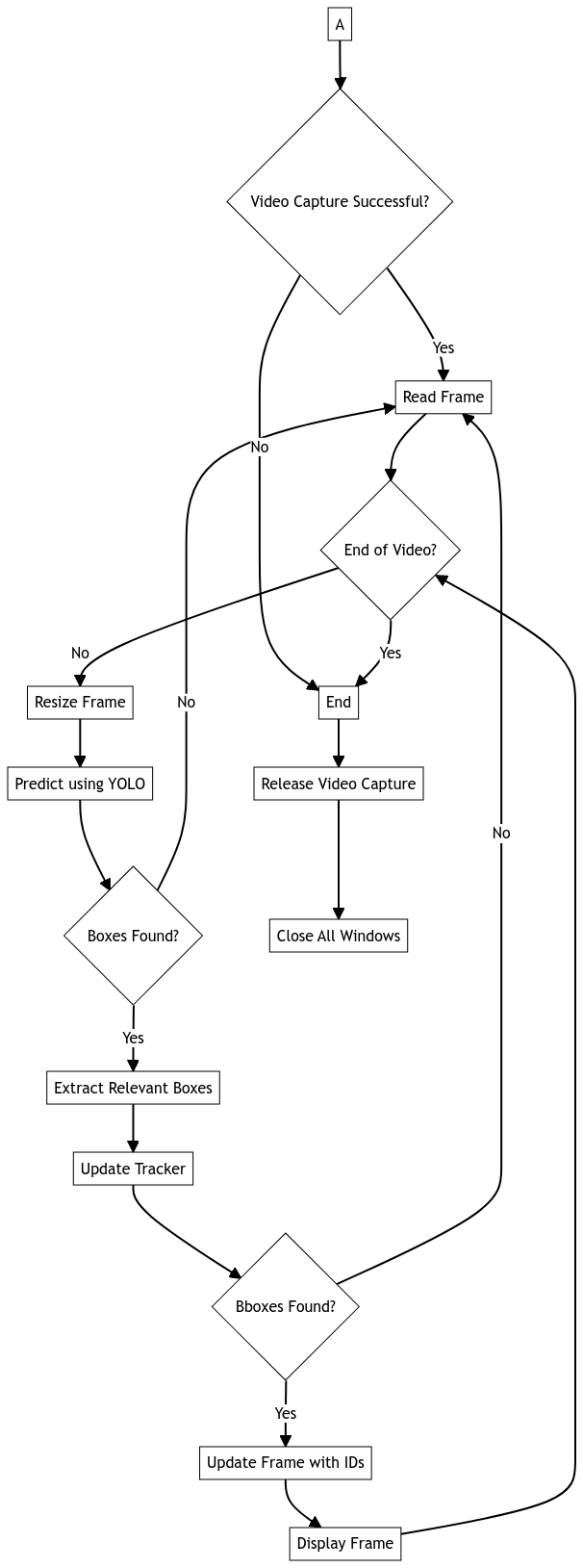
- If 'Esc' key is pressed, break the loop

9. Release Resources

- Release video capture

- Close all OpenCV windows

10. Exit Program [END]

**2.2 FLOW CHART**

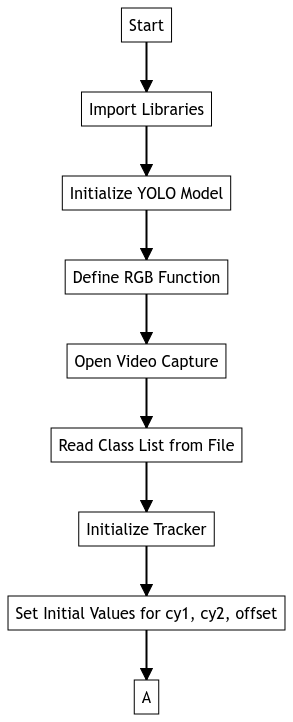


Fig (a). Flow Chart

**2.3 IMPLEMENTATION**

**2.3.1 Detection Code**

import cv2

import pandas as pd

from ultralytics import YOLO

from tracker import\*

model=YOLO('yolov8s.pt')

def RGB(event, x, y, flags, param):

    if event == cv2.EVENT\_MOUSEMOVE :

        colorsBGR = [x, y]

cv2.namedWindow('RGB')

cv2.setMouseCallback('RGB', RGB)

cap=cv2.VideoCapture('veh2.mp4')

my\_file = open("coco.txt", "r")

data = my\_file.read()

class\_list = data.split("\n")

cy1,cy2,offset,count,traker=322,368,6,0,Traker()

while True:

    ret,frame = cap.read()

    if not ret:

        break

    count += 1

    frame=cv2.resize(frame,(1020,500))

    results=model.predict(frame)

    a=results[0].boxes.boxes

    px=pd.DataFrame(a).astype("float")

    list=[]

    for index,row in px.iterrows():

        x1=int(row[0])

        y1=int(row[1])

        x2=int(row[2])

        y2=int(row[3])

        d=int(row[5])

        c=class\_list[d]

        if 'car' in c:

            list.append([x1,y1,x2,y2])

    bbox\_id=tracker.update(list)

    for bbox in bbox\_id:

        x3,y3,x4,y4,id=bbox

        cx=int(x3+x4)//2

        cy=int(y3+y4)//2

        cv2.circle(frame,(cx,cy),4,(0,0,255),-1)

        cv2.putText(frame,str(id),(cx,cy),cv2.FONT\_HERSHEY\_COMPLEX,0.8,(0,255,255),2)

    cv2.imshow("RGB", frame)

    if cv2.waitKey(1)&0xFF==27:

        break

cap.release()

cv2.destroyAllWindows()

* + 1. **Arduino Linker**

import pyfirmata

import time

board = pyfirmata.Arduino('COM4')

it = pyfirmata.util.Iterator(board)

it.start()

red = board.get\_pin('d:11:o')

yellow = board.get\_pin('d:12:o')

green = board.get\_pin('d:13:o')

def RedToGreen(wait\_yellow):

    red.write(0)

    yellow.write(1)

    time.sleep(wait\_yellow)

    yellow.write(0)

    green.write(1)

def GreenToRed(wait\_yellow):

    green.write(0)

    yellow.write(1)

    time.sleep(wait\_yellow)

    yellow.write(0)

    red.write(1)

def main():

    pass

**2.4 COMPONENTS**

**1. ARDUINO UNO R3**

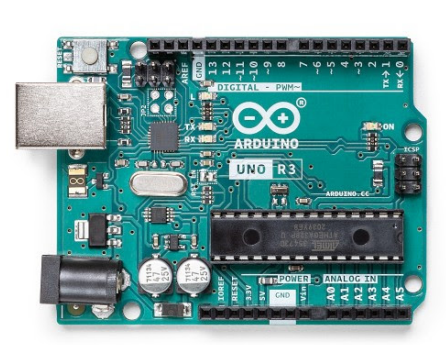
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Fig (b). Arduino UNO R3

The Arduino UNO R3 is the perfect board to get familiar with electronics and coding. This versatile development board is equipped with the well-known ATmega328P and the ATMega 16U2 Processor. This board will give you a great first experience within the world of Arduino.

**2. BREADBOARD**

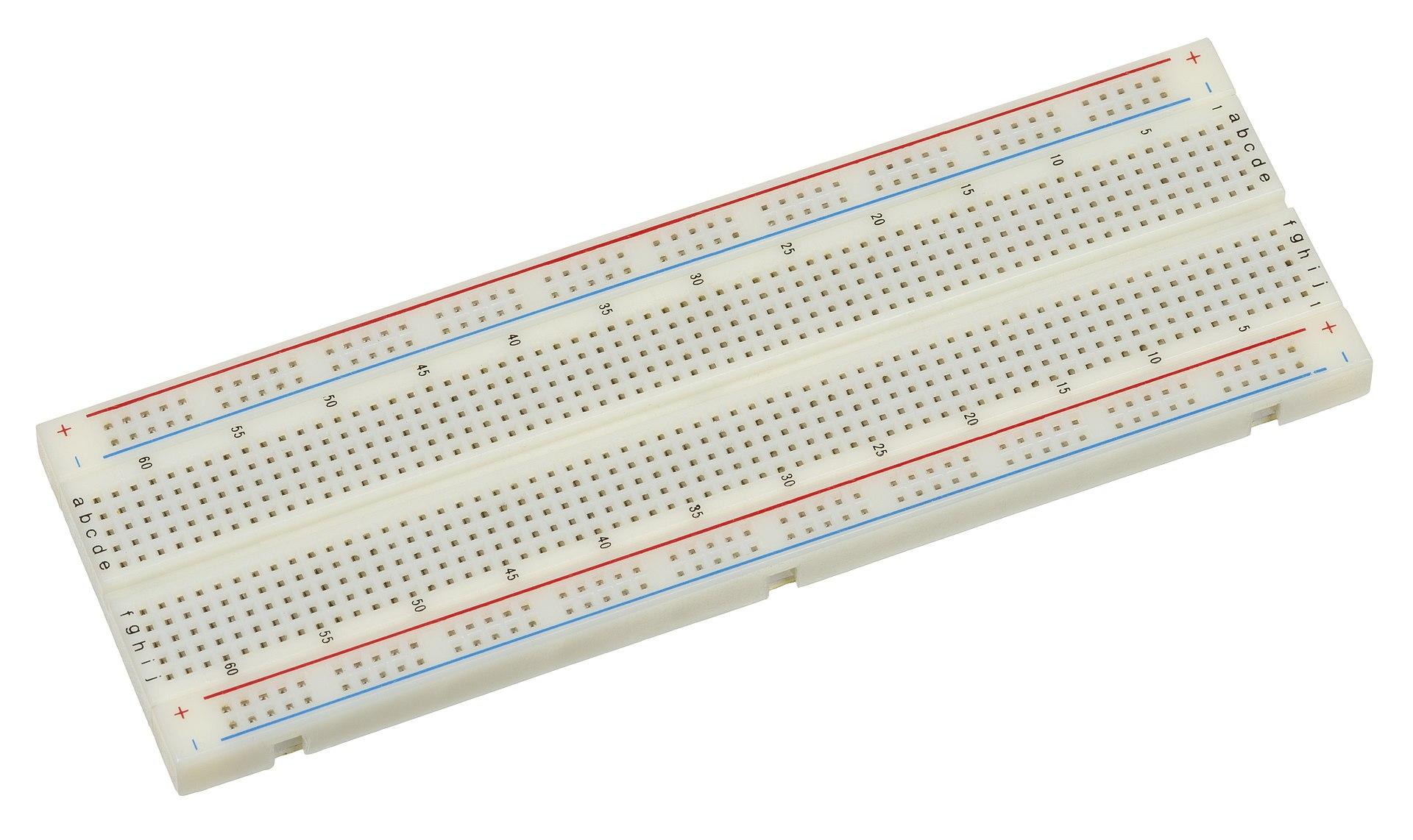


Fig (c). Breadboard

A breadboard, solderless breadboard, or protoboard is a construction base used to build semi-permanent prototypes of electronic circuits. Unlike a perfboard or stripboard, breadboards do not require soldering or destruction of tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education.

**3. LED LIGHTS**

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Fig (d). LED’s of Different Colors

LED lights or light emitting diode lights, represent a cutting edge lighting technology that has revolutionized the way we illuminate spaces. It emits light when an electric current passes through semiconductor material.

**4. JUMPER WIRES:**

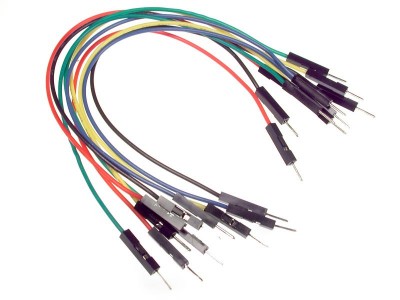
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Fig (e). Male to Male Jumper Wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboard and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn’t get much more basic than jumper wires.

**5. WEB CAMERA**



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Fig (f). Generic Webcam

A webcam is a video camera which is designed to record or stream to a computer or computer network. They are primarily used in video telephony, live streaming and socialmedia, and security. Webcams can be built-in computer hardware or peripheral devices, and are commonly connected to a device using USB or wirelessprotocols.

**6. ARDUINO USB CABLE**

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Fig (g). Type A to Type B USB 2.0 Cable

The Arduino USB Cable for UNO and Mega (50 cm) is a type of USB cable designed specifically for the Arduino UNO and Mega microcontroller boards. It has a standard USB connector on one end and a type B USB connector on the other, allowing it to be connected to a computer or other USB device.

**CHAPTER 3. CONCLUSION**

The proposed system sets the green signal time adaptively according to the traffic density at the signal and ensures that the direction with more traffic is allotted a green signal for a longer duration of time as compared to the direction with lesser traffic. This will lower the unwanted delays, and delays, and reduce congestion and waiting time which in turn will reduce the fuel consumption and pollution.

According to simulation results, the system shows much improvement over the current system in terms of the number of vehicles crossing the intersection, which is a significant improvement. This system can thus be integrated with the CCTV cameras in major cities in order to facilitate better management of traffic.

The solutions explored in the project span a wide spectrum, from short-term interventions like optimizing traffic signals timings to long-term strategies like promoting sustainable transportation modes and urban planning revisions.

The project has quantified the tangible impacts of traffic congestion, ranging from increased travel times and decreased productivity to heightened pollution levels and compromised public safety.

**3.2 LEARNING OUTCOMES**

* Environmental Awareness: Recognize the role traffic management plays in reducing emissions and promoting sustainable transportation practices.
* Evaluation and Analysis: Develop skills to evaluate the effectiveness of traffic light strategies by analyzing data and making evidence-based decisions.
* Traffic Management Skill: Develop a strong understanding of traffic management principles, including signal timing, intersection design, and traffic flow dynamics.
* Future Relevance: Gain knowledge and skills that are applicable in a rapidly urbanizing world where traffic management solutions are of increasing importance.
* Overall, participation in this project provides a well-rounded learning experience that encompasses technical skills, problem-solving abilities, teamwork, and a broader understanding of urban transportation challenges and solutions.
* Engaging in a project focused on solutions for traffic congestion using traffic lights can result in several valuable learning outcomes.

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