Panipat Institute of Engineering & Technology

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Department of Computer Science and Engineering

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PANIPAT INSTITUTE OF ENGINEERING & TECHNOLOGY

(Approved by AICTE, New Delhi & Affiliated to Kurukshetra University, Kurukshetra)

Department Vision

Department of Computer Science and Engineering aspires to become a center of excellence for quality technical education by keeping pace with new technologies to create competent professionals.

Department Mission

M1: To develop professionals with analytical and technical competency for productive career in industry, academia and as entrepreneurs.

M2: To build theoretical and applied skills of faculty and student in computer science and engineering through need based training, research and development on industrially and socially relevant issues.

M3: Continuously improve and provide state-of-the-art laboratories to keep up with the new developments in the area of computer science and engineering.

M4: Create nurturing environment through competitive events, industry interactions, global collaborations and creating concern for lifelong learning.

About Department

PIET-CSE aims to encourage research and innovation in Computer Science and allied areas. The objective of the BTech program in Computer Science and Engineering (CSE) is to prepare students to undertake careers involving innovation and problem solving using computational techniques and technologies, or to undertake advanced studies for research careers or to take up Entrepreneurship.

In order to give due importance to applied as well as theoretical aspects of computing, the curriculum for the BTech (CSE) program covers most of the foundational aspects of computing sciences, and also develops in students the engineering skills for problem solving using computing sciences.

Most engineering programs start with general courses in Sciences, and then migrate to specialized courses for the disciplines. While these courses are indeed foundational for many engineering disciplines, they can be treated as application domains (as is evidenced from the fact that most sciences and Engineering disciplines heavily use computing now) Hence, the BTech (CSE) program at PIET starts with computing oriented courses first, and allows the possibility of doing science courses later. Besides being better suited for a CSE program, it also enables the possibility of students seeing newer applications and possibilities of using computing in these subjects.

PROGRAM EDUCATIONAL OUTCOMES (PEOS)

PEO1

- To impart an in-depth knowledge of science, mathematics, and computer science and engineering to create a foundation for building capacity and competence in using the fundamental and core knowledge.

PEO2

- To facilitate and foster technical and analytical skills in students to develop innovative solutions to complex real life problems using existing and novel technologies.

PEO3

- To train students with the relevant soft skills and also with a concern for lifelong learning.

PEO4

- To expose them to various contemporary and social issues which will enable them become ethical and responsible citizens of the society.

MESSAGE

DIRECTOR's MESSAGE

Professor (Dr) Shakti Kumar
(Director)

On behalf of the faculty members, staff, and students of the Department of Computer Science and Engineering of PIET, I welcome you all to the creative world of CSE. I believe the CSE discipline has been widely recognized as an essential source and technique for the advancements in all spheres of human Endeavour now and in future. In PIET all the students gets the opportunity to excel in their academic activities. This is the department where students publish papers in international journals, at the same time a student wishing to achieve some recognition in extra-curricular or co-curricular activities will also find the atmosphere helpful.

Among the reasons why our graduates are such favorites of industry is the consistent hands-on experience-based approach of our curriculum, our excellent laboratories, the long-time connections between Department and the industry. Whether you are a student, parent, prospective faculty member or a curious member of the public, I invite you to read our web pages and find a way to become part of the PIET family. We hope you will also have the opportunity to visit us in our state-of-the-art facilities.

MESSAGE

HOD's MESSAGE

Dr. S. C. Gupta
Professor and HOD,
Department of Computer Science and Engineering

I congratulate to the team of faculty members and the students for their brilliant and original efforts. Depending upon the interest of the student, he/she may choose to go for higher studies or if employed can choose to do research, development, design, production, application, testing or management in the Information Technology industry. We strongly encourage innovation in research, in teaching and in service to the profession, the local community and industry. Our faculty and students are constantly striving to excel and to advance the state of the art in computer science. I invite you to be part of our efforts as we propel the Computer Science Department to ever-greater heights. In closing, I wish all the students and faculty a good academic career.

EDITORIAL TEAM

Ms. Shally Chawla
Assistant Professor, CSE

Gaurav Gakhar
B. Tech, 3rd Year

FACULTY ARTICLES

Understanding Emotions in Text Using Deep Learning and Big Data

Big Data and Deep Learning algorithms combined with enormous computing power have paved ways for significant technological advancements. Technology is evolving to anticipate, understand and address our unmet needs. However, to fully meet human needs, machines or computers must deeply understand human behaviour including emotions. Emotions are physiological states generated in humans as a reaction to internal or external events. They are complex and studied across numerous fields including computer science. As humans, on reading *"Why don't you ever text me!"*, we can either interpret it as a sad or an angry emotion and the same ambiguity exists for machines as well. Lack of facial expressions and voice modulations make detecting emotions in text a challenging problem. However, in today's online world, humans are increasingly communicating using text messaging applications and digital agents. Hence, it is imperative for machines to understand emotions in textual dialogue to provide emotionally aware responses to users. In this paper, we propose a novel Deep Learning based approach to detect emotions - Happy, Sad and Angry in textual dialogues. The essence of our approach lies in combining both semantic and sentiment based representations for more accurate emotion detection. We use semi-automated techniques to gather large scale training data with diverse ways of expressing emotions to train our model. Evaluation of our approach on real world dialogue datasets reveals that it significantly outperforms traditional Machine Learning baselines as well as other *off-the-shelf* Deep Learning models.

Ms.Shally Chawla
(Assistant Professor)

FACULTY ARTICLES

Scheduling Frameworks in Big Data

Cloud and big data technologies are now converging to enable organisations to outsource data in the cloud and get value from data. Big data systems typically exploit computer clusters to gain scalability and obtain a good cost-performance ratio. However, scheduling a workload in a computer cluster remains a well-known open problem. Scheduling methods are typically implemented in a scheduling framework. In this paper, we survey scheduling methods and frameworks for big data systems, propose taxonomy and analyse the features of scheduling frameworks. These frameworks have been designed initially for the cloud (Map Reduce) to process web data. We examine 16 popular scheduling frameworks. Our study shows that different frameworks are proposed for different big data systems, different scales of computer clusters and different objectives. We propose the main dimensions for workloads and metrics for benchmarks to evaluate these scheduling frameworks. Finally, we analyse their limitations and propose new research directions.

Ms.Shivani Gaba
(Assistant Professor)

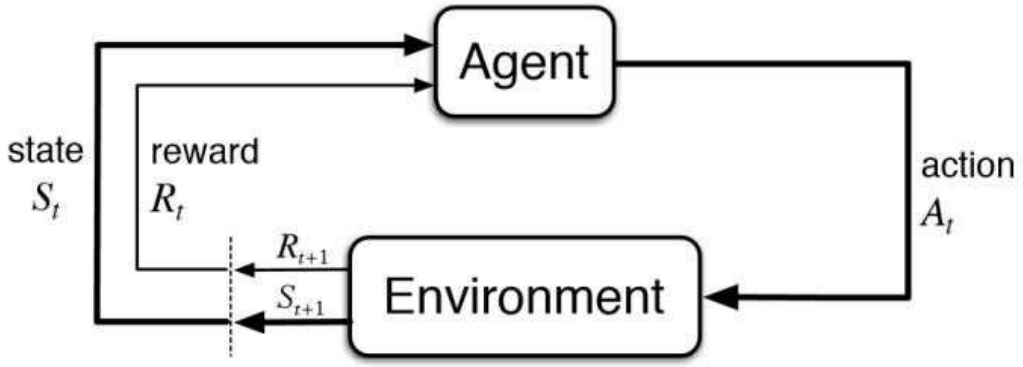
FACULTY ARTICLES

Reinforcement Learning

Reinforcement Learning(RL) is a type of machine learning technique that enables an agent to learn in an interactive environment by trial and error using feedback from its own actions and experiences.

Though both supervised and reinforcement learning use mapping between input and output, unlike supervised learning where feedback provided to the agent is correct set of actions for performing a task, reinforcement learning uses rewards and punishment as signals for positive and negative behaviour.

As compared to unsupervised learning, reinforcement learning is different in terms of goals. While the goal in unsupervised learning is to find similarities and differences between data points, in reinforcement learning the goal is to find a suitable action model that would maximize the total cumulative reward of the agent. The figure below represents the basic idea and elements involved in a reinforcement learning model.



Ms.Shakti Arora
(Assistant Professor)

STUDENTS'S ARTICLES

Security protocols of Block Chain technology

Hyperledger is an open-source enterprise framework. It is managed by the Linux Foundation. It is an umbrella project which has tons of frameworks and protocols. As it is open-source, anyone with the right expertise can contribute to the project. Also, Hyperledger is all about permissioned block chain. The main aim is to provide enterprise block chain solutions a universal framework or guidelines for block chain implementation. There are many tech giants that are currently participating in the project, working on the same vision of creating a protocol that can be followed by enterprise solutions.

Quorum is yet another enterprise block chain protocol that is aimed to solve finance sector problems. JP Morgan invented Quorum, which can be described as an enterprise-focused Ethereum block chain. This protocol-based system is key when it comes to solving finance related problems. It can change how financial enterprises function and implement block chain in-house.

Quorum, just like Hyperledger , is an open-source project and is available under the LGPL 3.0 license. It benefits from Ethereum architecture and approach. With over 10,000+ commits, it is growing into one of the best possible enterprise block chain framework. Also, it can be used

Pratham Kataria
(B.Tech, 4th Year)

STUDENTS'S ARTICLES

INTERNET OF THINGS (IOT)

The Internet of Things is a network of physical objects – vehicles, machines, home appliances, and more – that use sensors and APIs to connect and exchange data over the Internet. The IOT depends on a whole host of technologies – such as application programming interfaces (APIs) that connect devices to the Internet. Other key IOT technologies are Big Data management tools, predictive analytics, AI and machine learning, the cloud, and radiofrequency identification (RFID). Cloud-based IOT platforms and architecture connect the real and virtual worlds. They help companies manage IOT device connectivity and security – as well as collect device data, link devices to backend systems, ensure IOT interoperability, and build and run IOT applications. Smart devices generate a massive amount of IOT data that needs to be analysed and leveraged in real time. This is where predictive and Big Data analytics come into play. Machine learning is also used to add context to data – and trigger actions without human intervention. In manufacturing, the IOT becomes the Industrial Internet of Things (IIOT) – also known as the Industrial Internet or Industry 4.0. The IIOT uses machine to machine (M2M) technology to support everything from remote monitoring and telemetry to predictive maintenance.

Gaurav Gakhar
(B.Tech, 3rd Year)

DEPARTMENTAL ACHIEVEMENTS

The department is NBA accredited. National Board of Accreditation (NBA) is one of the two major bodies responsible for accreditation of higher education institutions in India. It is a very big achievement. This is only possible with the help of Management, HOD, Teachers and students.

DEPARTMENTAL ACHIEVEMENTS

Students of CSE Department won 1st price in **YOUNG IT PROFESSIONAL AWARDS-2020 REGION-I HOST-GHAZIABAD CHAPTER**. The competition was on the technologies in today era and the use of that technology. The project was on, how, Internet of Things can be used in the farming, removing the unpractical manner of farming.

ACTIVITIES IN DEPARTMENT

MATLAB WORKSHOP

Computer Science and Engineering Department in collaboration of PIET Innovation Cell has organized the two days workshop on “MATLAB AND ITS APPLICATIONS”on 9th-10th October, 2019. The Expert Mr. Jitender Kumar, Sr. Engineer- Technical Support, from Design Tech Systems Ltd. delivered practical sessions on Machine Learning Toolbox, Fuzzy Logic Toolbox, etc. The students and Faculty of different engineering streams participated into the workshop and enhances their skills.

ACTIVITIES IN DEPARTMENT

WORKSHOP ON DATA SCIENCE AND BIG DATA ANALYSIS

Workshop on “Data science and Big Data Analytics” held from 11th Nov, 2019 to 18th Nov, 2019 in the Department of Computer Science and Engineering. Total 50 students were participated in this workshop. This workshop enabled the participants to learn, design and build big data analytic solutions to solve business problems and improve decision making. The program also stressed to make participants aware about various issues, challenges and best practices in implementing big data analytic solutions in organizations.

ACTIVITIES IN DEPARTMENT

IIT SPOKEN TUTORIALS

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Real-Time Traffic Light Management System with Manual Control

Pratham Kataria
Panipat Institute of Engineering and Technology
Panipat, India
pratham.cse@gmail.com

Anshul Rani
Panipat Institute of Engineering and Technology
Panipat, India
anuvinayak5@gmail.com

***Abstract*— Congestion at road intersections is a widespread problem. Congestion is a result of improper management of traffic. To make this traffic management process less hectic and automated, Traffic Lights are used at intersections which are effective too. Various researches focus on making traffic lights more reliable and effective which include a) Survey System b) Induction Loops c) Proximity Sensors d) Image Classification. Every proposed technique computes the vehicle count using any technique and accordingly timing of lights is set. In this paper, a system has been proposed which primarily utilizes image classification and has three main parts: Vehicle Count using Image Classification, Decision making Algorithm and Manual Control. Real-time traffic is analysed using image processing and computed vehicle count is given as input to decision-making algorithm, in return algorithm sets the timing of green signal to a selected lane. The timing of signals can also be updated by utilising manual control unit of the system. The proposed system provides manual control to lights along with real-time analysis of traffic and performs 75% times better in comparison with the survey system.**

Keywords*— *Real-time, Traffic Light, Smart Traffic light, Image Processing

I. INTRODUCTION

INDIA is the 2nd most populated country in the world with a still-growing population. Due to its large population, the traffic density is also increasing, majorly contributed by the urban area of the country [2]. Traffic congestion waste a large amount of time, fuel and cost [10,11]. INDIA's traffic being a non-lane based and chaotic, an add-on to traffic congestion, resulting in more wastage of resources like fuel, time, etc. To assure less congestion on roads, it is important to have a reliable and intelligent traffic control system that works on real-time analysis of vehicles. To have a reliable traffic control system many previous types of research focus on managing congestion on the roads to save time and cost.

Some researches propose to increase the width of the roads so that traffic congestion can be reduced. However, the existing road size cannot be increased due to the unavailability of space near the road as it is occupied by houses and shops. Also, the destruction of houses and shops will affect the common people. The idea is only applicable near highways but not in cities. Many other methods have also been suggested; as shown in Fig. 1, followed by detailed discussion.

A. Manual Control System

In this method, traffic is manually controlled by man power. Traffic policemen are given signboards, whistles, light rods, etc. to manage the traffic at the intersection of roads [2,3].

B. Automated Control System

Automated control System is a combination of hardware and software which is designed and programmed to work automatically, minimizing the need of human interaction. In these systems, inputs can be Static (Survey System) or Dynamic/ Variable (real-time analysis). These methods are based on traffic density calculated via different technologies and procedures. Some exemplary technologies [5,6,9,12] are discussed in subsections.

Fig. 1. Categorization of Traffic Light Management Techniques

1. Survey System

The survey system is a static technique of automated control systems. In this system, the timing of traffic lights is set to fixed time according to traffic density analysis done through survey [3]. As no real-time analysis of traffic density is taken into consideration so this technique is neither efficient nor works suitable for critical scenarios.

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2. *Magnetic Detectors*

Magnetic sensors provide an attractive, low-cost alternative to induction loops for calculation of traffic density at the intersection [5,9]. Magnetic detectors are installed on the side of the roads. When a vehicle passes the magnetic detector due to the quantity of iron in the vehicle the value of the magnetic field is affected [4]. Vehicles of smaller size affect fewer magnetic fields whereas bigger vehicles change more; This difference helps object classification and accordingly traffic lights are operated. This technique is effective however, it does not provide any counter-measure for critical situations.

3. *Induction loops*

Induction loops use magnetic inductors which are fixed inside the road. Whenever a car passes above the induction loop there is a change in the energy level and this gradual change in energy level reflects the presence of a vehicle [12] and thus traffic density can be calculated in a real-time scenario. As there are multiple induction loops installed; car on adjacent lane crosses the induction loop it influences the adjacent induction loop adding their value to the traffic density due to which a car may be counted multiple times making this technique less reliable. Also, this technique needs induction loops to be fixed inside the road, which is possible only while construction of roads due to which the existing roads cannot adopt induction loops [8]. The life of the induction loop is also very less due to thermal expansion on the highway the shape of loop gets distorted. The distorted shape gives false results for traffic density and it needs regular maintenance, which is not feasible [8].

4. *Proximity Sensors*

The proximity sensor is an electronic device that is used to detect the presence of an object within its vicinity without any physical contact. Proximity sensors can identify whether there is a vehicle present or not in a real-time scenario. Every vehicle sends a positive signal to the server [6]. Count of the positive signal/vehicles gradually increases and as it reaches the set threshold, a command to the system is generated and in return system assigns priority to different lanes.

Further, Object Classification is not possible using proximity. Also, these are not suitable for critical scenarios.

5. *Image Classification*

Traffic management techniques discussed till now are calculating traffic density using different techniques but these techniques lack in one or another major factor in terms of maintenance, establishment cost, and object classification. To overcome these problems Image classification technique is proposed [13] which works on real-time data.

In this technique, image processing is used for the detection of vehicles and to calculate the traffic density on roads [13]. It easily categorizes the type of vehicle, which helps in emergency situations like accidents. And prerequisite for this technique is Security Camera, which nowadays can be found at every intersection. Thus image classification can be used to trade off the various factors cost, time, accuracy, reliability[7].

In this paper, a system that primarily uses image classification technique is proposed. The proposed system works on real-time analysis of vehicles. The system is divided into 3 parts namely a) Vehicle density Calculation using Image Classification b) Decision making Algorithm c) Manual Control Unit (section III). Image classification is used to find vehicle count at each intersection [1], for this live feed video are acquired from each lane using camera module of RP and is processed using a defined algorithm and then traffic density and number of vehicle present are calculated using OPEN-CV [15,16] and a PYTHON function. The duration of green light at the determined lane is decided by taking vehicle count as the input to the decision-making algorithm (section III .B). To handle critical situations third unit of system that is manual control works. Using its GUI, lights can be manually controlled at any time. Manual interrupts generated by this unit are well managed by the decision making algorithm. To the best knowledge of authors, no such full-fledged system which comprises real-time traffic analysis and manual control at once is not proposed in research till now.

Further, this paper details about the literature of this field are illustrated in section 2, the proposed system is discussed in section 3 and section 4 and 5 encompass details of test cases, results in validation and Conclusion respectively.

II. RELATED WORK

Traffic congestion at intersections is a very common problem these days. To cope up with this problem many methods/techniques have been proposed. This section illustrates such traffic management techniques.

Initially, the static system was used, the time duration was calculated according to fixed time, which was decided before installation of a traffic light. For Static system, a survey is conducted repeatedly at every intersection of the road to find the traffic density in the fixed time span. According to the traffic density, the time duration of every traffic light is set at each intersection. This method sometimes chokes the intersection causing heavy traffic jams as the survey is always error-prone.

To overcome the problems of a static model, a new Dynamic model was developed which utilized the real-time

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analysis of vehicles and according to the real-time data feed, the time duration of a traffic light is set at an intersection. Many different techniques were used to get the exact traffic density on road like induction loops, magnetic detectors, proximity sensors. [5, 6, 9, 12]

Induction loops have become most common in the last 50 years in traffic light control systems. Induction loop contains an inductive detector which consists of three main components: (i) Two to three turns of wire underneath the road surface, (ii) a lead in the cable connecting the loop to the detector, (iii) an electronic unit-that detects the presence of vehicles above the loop. When a vehicle is/was above the magnetic loop detector, the vehicle act as the core of the coil and increases its inductance (this is known as ferromagnetic effect. Due to this change in inductance, the electronic unit detects the vehicle. The major drawback of the induction loop was the induction loops were needed to be installed inside the road before construction of road. So existing road cannot/can't adopt induction loops and if some induction loop fails the maintenance of loop was also very difficult. [8] Another drawback was that when multiple induction loops are installed, induction loops affect the adjacent loops by increasing their energy level which gives false results by increasing the traffic density. Magnetic Detector network offered enhanced alternative to induction loops for traffic control management at the intersection, in terms of maintenance and increases the efficiency of detection and classification of vehicles. Magnetic Detectors were used over 2,000 years for navigation, now for detection and classification of vehicles. The magnetic detector used earth's magnetic field as a parameter for reference change in magnetic field for detection and classification of vehicles. These Detectors not needed to be bury inside the road, they are easily installed on roadside on the intersection. When a vehicle passes by the magnetic detector there was magnetic disturbance which helped in detection of a vehicle. The type of vehicle can be/was classified with the use of pattern recognition and matching algorithm. Magnetometer curve output helps to study the variation in earth's magnetic field according to the vehicle over the magnetic detector. Single-axis Magnetic Sensor can be used to find the direction of moving vehicles as direction is required for safety reasons at highway, tunnel to display warning sign, etc. When there is no car, sensor initial output is equal to earth's magnetic field. If a car approaches the flux lines are drawn toward the ferrous vehicle. If the sensitive axis of magnetic detector points right that tells a car is moving left to right.

Another well-known technique for Traffic light control is proximity sensors at traffic light signals. The proximity sensor is a device that helps us to know whether an object is present in front of the sensor or not. It sends a signal as '0' for no object is detected and signal '1' if the object is detected. The sensor array was used for the detection of vehicles. The sensor array consisted of a predefined number of proximity sensors. [6] According to the size of the intersection, the number of proximity sensors varied. The number of sensors detecting the vehicles increases than the threshold value, Proximity array sends a command to the system and command in return used to assign priority to the signal.

Traffic Light management using image processing is rarely touched in literature, this paper works on the same and it is proven that this technique is boon with no extra cost involved in adopting this technology.

III. PROPOSED SYSTEM

The proposed system works on real-time analysis of vehicles; the system is divided into 3 parts namely a) Vehicle density Calculation using Image Classification b) Decision making Algorithm and c) Manual Control as shown in Fig. 2.

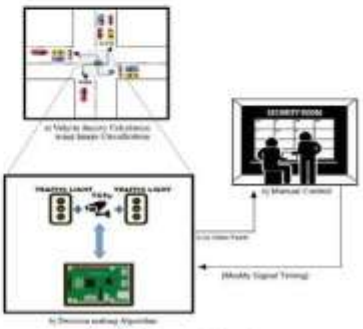

Fig. 2. Proposed System

Details of each part of the system are given below:

A. Vehicle Count using Image Classification

This system takes live-feed video from already installed cameras on intersections. Live-feed video will be given to raspberry pi for image processing. Raspberry pi executes a customized haar-cascade file which a) identifies vehicles on road by extracting their x, y co-ordinates and determining their height and width b) gives the vehicle count on the particular lane up to the defined distance.

B. Decision making Algorithm

This algorithm takes vehicle count as input and calculates the duration of green light after deciding the particular lane. Steps followed by the algorithm are as given in Fig. 3.

A sample Example for the working of the algorithm is given in table I. It shows how lanes get their turn (highlighted cells) one after another based on the calculated time according to the formula stated in step 3 of algorithm.

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TABLE I. Working of Decision Making Algorithm

Proposed System				
	Lane1	Lane2	Lane3	Lane4
Vehicle Count	**2**	**91**	**18**	**181**
Time	1.369863	62.32877	12.32877	123.9726
	1.369863	62.32877	12.32877	123.9726
	1.369863	62.32877	12.32877	123.9726
	1.369863	62.32877	12.32877	123.9726
Vehicle Count	**187**	**98**	**139**	**55**
Time	78.07933	40.91858	58.03758	22.96451
	78.07933	40.91858	58.03758	22.96451
	78.07933	40.91858	58.03758	22.96451
	78.07933	40.91858	58.03758	22.96451

C. Manual Control

Manual Control is an advanced and important part added in this system to enhance and maintain the traffic at any cross-section during emergency situations. This unit helps control room people to control lights manually from their place. This unit consists of a GUI, which can be easily used to generate interrupt by specifying the lane and time duration of the green signal. This interrupt is handled in already specified algorithm (Step 3 of algorithm).

Step 1
Set $Flag_i = 0$ for every $Lane_i$ # i= 1 to 4.
Set $Count_i$=0 for every $Lane_i$ #i = 1 to 4

Step 2
Get vehicle count i.e. $Count_i$ for every $Lane_i$

Step 3
if (manual_interupt)
Go to step 5.
else
Calculate $Time_i$ according to given formula for every lane

$$Time_i = \frac{Vehicle\ Count_i}{\sum_{i=1}^{4} Vehicle\ Count_i} X\ T$$

{# T is collective time of lanes}

Step 4
a) Find $Time_{(max)}$ where $Count_i$ == 0
b) Put $Lane_i$ = green
If $Count_i$ (1 to 4) == 1 then go to Step 1

Step 5
a) Put green light on specified lane for given time duration (t_d)
b) After time t_d go to step 1.

Fig. 3. Decision Making Algorithm

IV. RESULT VALIDATION

In this section, the proposed technique is compared with the survey system; As authors could not find data sets on any trusted source in the literature to compare proposed technique with another technique. The authors performed survey on an intersection and recorded vehicle count at different instances and noted the timing of green signal. Some of the recorded data is shown in table II. Vehicle count is shown emptied as survey system does not consider real-time traffic for green light timings.

TABLE II. Data Reported by Survey System

Survey System						
	Lane1	Lane2	Lane3	Lane4	Waiting Time	Avg. Waiting Time
Vehicle Count	-	-	-	-		
Time	70	60	40	30	0	92.5
	70	60	40	30	70	
	70	60	40	30	130	
	70	60	40	30	170	
Vehicle Count	-	-	-	-		
Time	70	60	40	30	130	150
	70	60	40	30	140	
	70	60	40	30	160	
	70	60	40	30	170	
Vehicle Count	-	-	-	-		
Time	70	60	40	30	130	150
	70	60	40	30	140	
	70	60	40	30	160	
	70	60	40	30	170	
Vehicle Count	-	-	-	-		
Time	70	60	40	30	130	150
	70	60	40	30	140	
	70	60	40	30	160	
	70	60	40	30	170	
Vehicle Count	-	-	-	-		
Time	70	60	40	30	130	150
	70	60	40	30	140	
	70	60	40	30	160	
	70	60	40	30	170	

The recorded data of vehicle count was put as input to the proposed system and timing was analyzed for the same depicted in table III. The turn of different lanes is shown by highlighting corresponding cells in tables. Along with Vehicle count and Timing of green signal of a lane, its waiting time is

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also shown. This waiting time is the time elapsed between two turns of a specific lane. And then computed average time is depicted after a complete round. Here round is said complete when each lane has got its turn one time.

TABLE III. Data reported by Proposed System

Proposed System						
	Lane1	Lane2	Lane3	Lane4	Waiting time	Avg. W.T
Density	2	91	18	181		
Time	1.36	62.32	12.32	123.97	0	126.975
	1.36	62.32	12.32	123.97	123	
	1.36	62.32	12.32	123.97	186.29	
	1.36	62.32	12.32	123.97	198.61	
Density	187	98	159	55		
Time	78.07	40.91	58.03	22.96	0	120.555
	78.07	40.91	58.03	22.96	79.43	
	78.07	40.91	58.03	22.96	149.78	
	78.07	40.91	58.03	22.96	253.01	
Density	125	156	127	25		
Time	57.73	72.05	58.66	11.54	22.96	149.9825
	57.73	72.05	58.66	11.54	135.92	
	57.73	72.05	58.66	11.54	252.61	
	57.73	72.05	58.66	11.54	188.44	
Density	74	41	39	96		
Time	59.2	32.8	31.2	76.8	0	147.585
	59.2	32.8	31.2	76.8	88.34	
	59.2	32.8	31.2	76.8	263.93	
	59.2	32.8	31.2	76.8	238.07	
Density	128	68	124	70		
Time	65.64	34.87	63.58	35.8	64	144.57
	65.64	34.87	63.58	35.8	65.64	
	65.64	34.87	63.58	35.8	252.42	
	65.64	34.87	63.58	35.8	196.22	

A comparison graph is plotted between the average time computed at different instances of survey system and proposed technique as shown in Fig. 4.

Following major points have been analyzed by the author after studying the data sets and comparison graph

- The proposed system reports never put any lane for starvation.
- The average waiting time in 75% of the data sets is less than that of the survey system.
- Lanes with high density get a turn first, resulting reduction in hustle on the intersection.
- No extra cost is required to adopt this method other than a raspberry pi module.

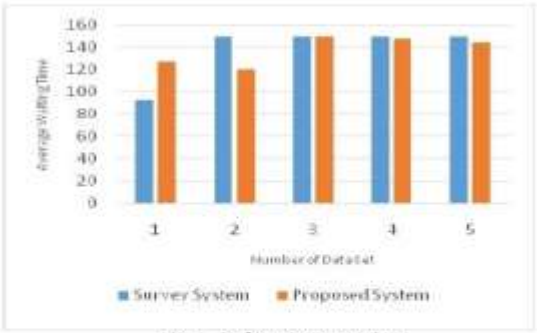

Fig. 4. Performance comparison, System vs Proposed System

V. CONCLUSION

A real-time traffic light management system with manual control is proposed in this paper. The duration of green light at determined lane is decided by a decision making algorithm. The algorithm is based on two principles; denser lane is allotted more time than others and no lane shall get into starvation (a very long waiting) during implementation. In nutshell, this can be said that proposed system provides facility to control traffic lights while taking real-time traffic into consideration along with manual control whenever necessary. To prove the effectiveness of proposed system and its algorithm a comparison between traditional survey system and proposed system is shown; it was evident that proposed technique performance (in terms of average waiting time of lanes) was better 75% of the time in comparison with survey system.

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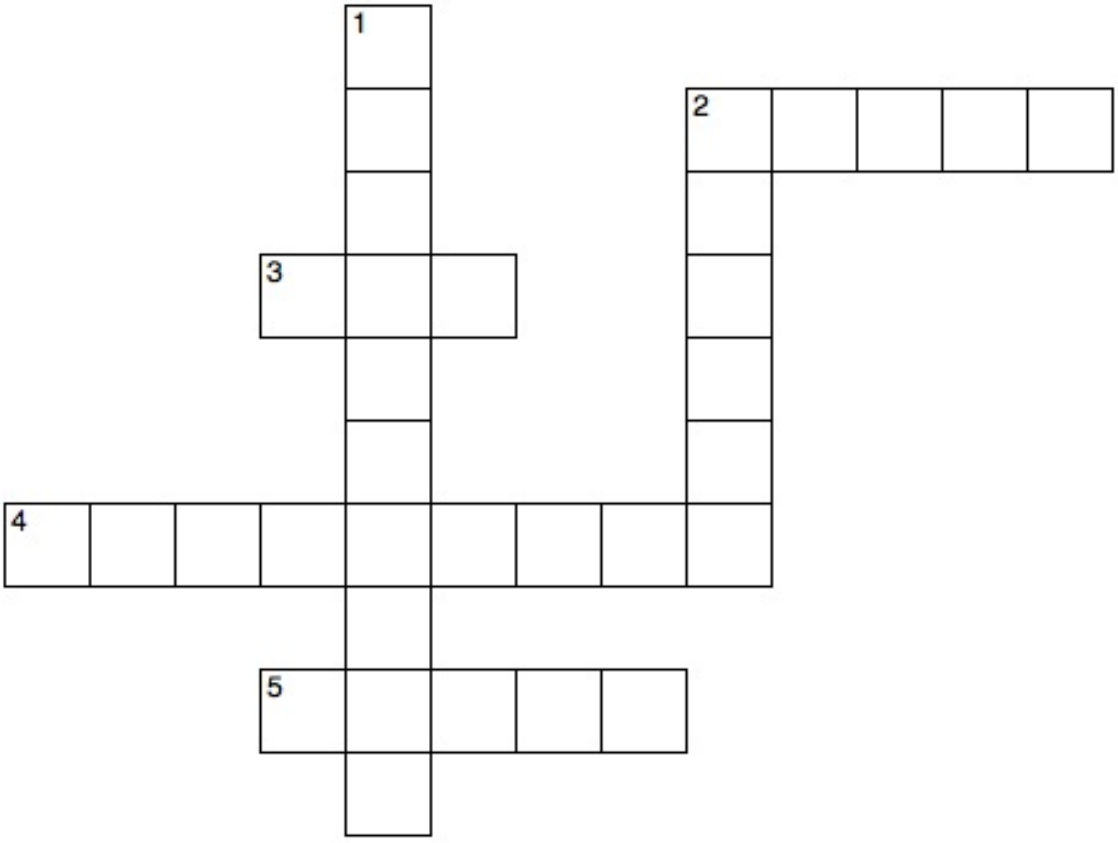
CROSS-WORD



ACROSS
2 Cactus 1: How did you do in the latest VSA assignment? Cactus 2: oh _____
3 Type of photosynthesis carried out by Rhipsalis baccifera
4 Initially, Reading's horticulturally intriguing, provided students are learning interesting species.
5 Tequilla and Prickly pears are used in horrific activities

DOWN
1 periodical around advertisements, precede automobile
2 Rhipsalis has these to for the some reason

RIDDLE

L A Z A R U S A S L E E P Z K W T R G X
A D E S P N B E G H V C X J E E S R N N
F I R D X K C A I A P H A S A S E U I P
E S D E I S E H P O R P Y C E T E Z P E
O C Y M T G O W O P S N H S V O S S E R
Y I S A T S E M A N A E R O E M I I E T
B P S R F P A S L H R C E B I B R G W U
S L Z T T S S M T A E J S G L B A N E R
C E P H O O A E Q I W Z U C E C H S P B
B S F A V N B N O S P L R U B R P G H E
L E Z E M R E H H S D X R J R D F B R D
I E R W S L J U D E A K E U H E P U A X
N F R O M A N S R M D R C Y B M T R I E
D L W A W N R A B B I R T Q X U E I M U
U H R A W A K E N K Z C I A U F M A E W
R Y H G L O R I F I E D O N Y R P L R T
R E H T A F J W X W K L N Q K E L L I H
W M E L A S U R E J O D J D Y P E E S G
T J S J D T R O U B L E D C L I F E E I
R S A C F W R E H T O R B S I S T E R L

ASLEEP
AWAKEN
BELIEVE
BETHANY
BLIND
BROTHER
BURIAL
CAIAPHAS
DISCIPLES
EPHRAIM
FATHER
GLORIFIED
JERUSALEM
JUDEA
LAZARUS
LIFE
LIGHT
MARTHA
MARY
MASTER
MESSIAH
PASSOVER
PERFUMED
PERTURBED
PHARISEES
PROPHESIED
RABBI
RESURRECTION
RISE
ROMANS
SANHEDRIN
SIGNS
SISTER
STONE
TEACHER
TEMPLE
TOMB
TROUBLED
WEEPING
WEPT