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DESIGN AND IMPLEMENTATION OF REAL TIME TRAFFIC LIGHT SYSTEM USING RASPBERRY PI

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ABSTRACT:

The most significant issue which is being looked at by the advanced world is the traffic blockage in the urban communities and towns. The system tries to reduce the possibility of traffic jams, caused by traffic lights, to an extent. The system contains raspberry-pi and based on different vehicles count, the raspberry pi takes decision and updates the traffic lights delays as a result. Thus it defines different ranges for traffic light delays and updates those accordingly. The cameras are placed at traffic intersections for ongoing traffic thickness. A camera will be placed along with the traffic light. It will catch picture groupings. Picture handling is a superior procedure to control the state change of the traffic light. The red sign turns into the green sign when the emergency vehicle lands by utilizing Message Queuing Telemetry Transport (MQTT). With the assistance of MQTT the red sign will change to green so as to give a reasonable method to crisis vehicles. This recorded vehicle count data can be used in future also to investigate traffic conditions at respective traffic lights connected to the system. For appropriate analysis, the record data can be downloaded through communication between raspberry-pi and the computer then it will send the correct signal into the LED lights. In the future this technique is often used to inform people about different places' traffic conditions.

KEYWORDS: Traffic control, Raspberry Pi, Camera, MQTT, Traffic light.

INTRODUCTION:

Congested driving conditions are a major issue in creating urban communities. In truth it's consistently expanding step by step nature makes it hard to discover where the traffic thickness is more continuously, so that to plan a superior traffic signal control and compelling traffic directing. In traffic environments, traffic sign recognition (TSR) is employed to manage traffic signs and command or prohibit certain actions .Technologies like RFID and GSM are utilized in existing traffic control systems to provide cost effective solutions. Traffic jams may arise because of large red light delays which are hard corded and are independent of traffic. The proposed system tries to lower the traffic jams to some extent. We have developed a cost effective system using Raspberry Pi kit and MQTT to achieve the desired results. We aim at controlling traffic density using Raspberry Pi. Raspberry Pi controls and counts the number of vehicles passing on the road. Raspberry Pi also stores vehicles count in its memory. The traffic thickness estimation can likewise be accomplished utilizing Image Processing**.**

LITERATURE REVIEW:

Previous works are done to dynamically control adaptive traffic lights. But due to the limited computing power and simulation tools, early studies focus on solving the problem by deep reinforcement learning network. In the traffic light control problem, since no labels are available and the traffic scenario is influenced by a series of actions, reinforcement learning is a good way to solve the problem and has been applied in traffic light control [1]. In these works, road traffic is modeled by limited information, which cannot be applied on a large scale. A cooperative traffic light control system based on reinforcement learning is proposed in [5]. The visual sensing technology is applied to the intelligent traffic control system[6]. The authors use this technology to calculate the traffic volume of every lane and queue. An intelligent road traffic management system is based on the Human Community Genetic Algorithm proposed in [7]. Light fidelity is proposed in [8] which is used to propagate faster through traffic-dense roads. Thus decreasing the waiting time of emergency vehicles in traffic dense lanes. Adaptive Routing for urban Vehicular Networks is based on the Back-Pressure algorithm proposed in [13]. The performance of the algorithms is analyzed using a microscopic traffic simulator. The average waiting time, queue length is reduced. Thus none of the previous works determines the traffic light timing during a whole cycle. The Internet of Things is a fast developing field, where a lot of new ideas are proposed. In this paper, our model guarantees that the traffic signal time smoothly changes and reduces the traffic congestion.

EXISTING SYSTEM:

In the existing system, the major problems are traffic congestion and long queues at intersections during peak hours. Increasing travelling times due to increasing numbers of road users and limited resources provided by current infrastructure. Inability of existing methods in determining traffic demand and allocating suitable time split when the traffic volume exceeds its capacity is another main factor which results in traffic jams. These problems are mainly due to poor coordination.

DISADVANTAGES OF EXISTING SYSTEM:

- These systems are very insufficient because they are unable to handle various simple situations which occur throughout the day.
- Major drawback is it's unnecessary waiting time and there is no facility to handle emergency vehicles.
- Gathering the data for some period and based on the analysis the traffic signals are changed which is an unnecessary process.

PROPOSED SYSTEM:

The existing system is based on the "time" which is already assigned within the system. According to those "time" the signals are working in each lane. But in these system conditions occur as all vehicles in lane(L1) are passed and vehicles in another lane(L2) are still in waiting state because time is not over and hence signal is still red. These systems are very inefficient because they are unable to handle various simple situations which occur throughout the day. Major drawback is that it has unnecessary waiting time. We propose a smart traffic signal controller system. The proposed system tries to reduce the possibility of traffic jams, caused by the traffic lights, to some extent by clearing the road with higher density of vehicles. The fewer vehicles in waiting state and can reduce time consuming. And our system also provides the clearance for the emergency vehicle if any. For example fire emergency, ambulance emergency etc. The code for this project is compiled in high tech PYTHON programming.

ADVANTAGES OF PROPOSED SYSTEM:

- Higher priority will be given to emergency vehicles like ambulances, fire engines.
- Low-cost system.
- Real time smart traffic light control system that aims to overcome many defects and improve the traffic management.

RELATED WORKS:-

1. INTERNET OF THINGS:

The Internet of Things (IoT) is that the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to gather and exchange data. IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and leading to improved efficiency, accuracy and economic benefit. Applications of IoT include building and residential automation, manufacturing, medical and healthcare systems, environmental monitoring and transportation.

2. IMAGE PROCESSING:

Picture improvement is preparing pictures to include extraction or picture understanding. Picture improvement strategies which change over the low quality picture to excellent picture for human survey, expelling obscuring and clamor, expanding difference and dim scale transformation are case of upgrade activity. In these improvement tasks we utilize dark scale transformation for upgrading the picture. Dark scale transformation is a strategy of picture improvement which is mapping three dimensional shading data onto a solitary measurement while as yet protecting the first appearance, differentiate and best subtleties. Dim scale transformation can be performed utilizing the accompanying capacity. $y = f(x)$ Where x is the first information and y is the changed over yield information. Direct Conversion is given by $y = ax + b$ Where a is increase and b is the balanced.

3. DENSITY ANALYSIS:

After the dim scale change and morphological activity we get a double dissolved picture. To check the quantity of vehicles we applied marking on two fold dissolve pictures. Subsequent to marking we set a limit to indicate diverse size extents to order the different kinds of vehicles. This gives us a proportion of the traffic thickness on the street at the crossing point. In the wake of applying the above portrayed calculation following outcomes are found. As indicated by the traffic thickness we can control the traffic flag or differ the traffic light time.

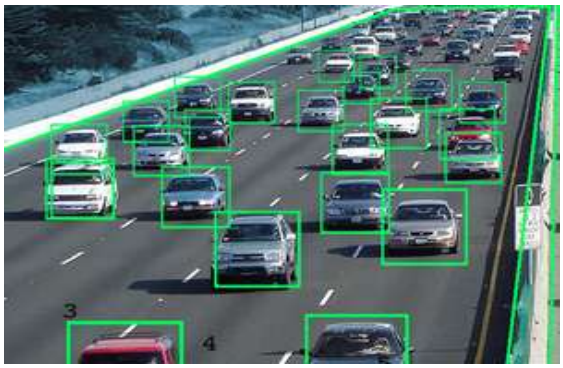

Fig 1.Density Analysis

The density of the vehicles are calculated by the cascade classifier algorithm.

4. RASPBERRY PI:

Raspberry Pi, commonly abbreviated as RPI is a low cost size of the size of a card that can be held on palm with the capacity of functioning as a full fledged computer. And with this small device, one can design and realize several applications and prototype models with the minimum knowledge of programming. It is the next gen computing device. Till date, a lot of RPI models are launched, all of which feature a Broadcom System on a Chip (SOC) BCM2837 with a CPU that Advanced RISC Machines (ARM) Cortex processor and on chip Graphics Processing Unit (GPU). RPI 3 has in-built Bluetooth and WiFi modules and Gigabit Ethernet for data transfer and connectivity. Via the USB ports, one can connect keyboard and mouse with the RPI. The RPI can be powered by a 5.1 micro USB port or through the USB ports, it has specified 3.3 V, 5 V and GND pins on GPIO.

5. MESSAGE QUEUING TELEMETRY TRANSPORT (MQTT):

MQTT is a lightweight protocol that provides resource-constrained network clients with a simple way to distribute telemetry information. The protocol which uses a publish/subscribe communication pattern is employed for machine-to-machine communication and plays an important role in the internet of things. The MQTT protocol contains a client and a broker. An MQTT broker is a server, while the clients are connected devices. An MQTT session is divided into four stages. They are connection, authentication, communication and termination. MQTT protocol is widely used in Facebook messenger application, AWS, Google cloud, Microsoft Azure, Smart homes, Healthcare, Logistics.

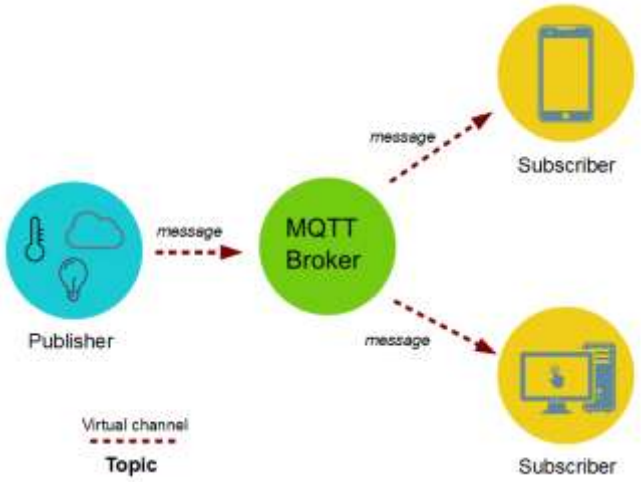

Fig 2. MQTT

ARCHITECTURE:

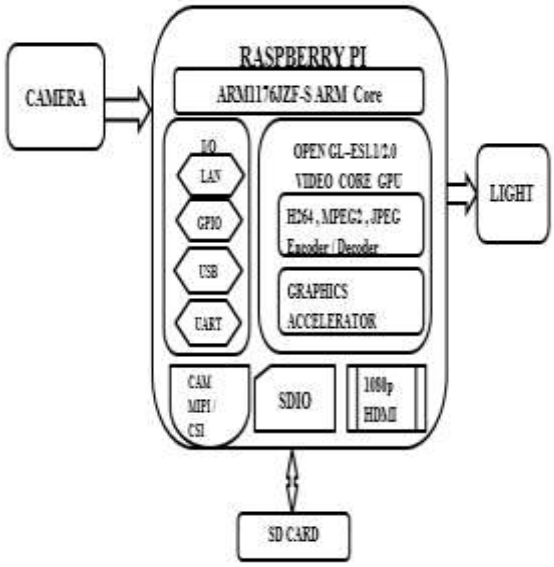

Fig 3. ARCHITECTURE DIAGRAM

PROBLEM STATEMENT:

A traffic light at an intersection has three signals: Red, Yellow and Green. When there are vehicles from multiple directions at an intersection, one traffic light may not be enough to manage all the vehicles and multiple traffic lights need to cooperate at a multi-direction intersection. This paper targets on controlling the traffic lights at road intersections. The proposed system tries to lower the traffic jams to some extent. We have developed a cost effective system using Raspberry Pi kit and MQTT to achieve the desired results. We aim at controlling traffic density using Raspberry Pi. Raspberry Pi controls and

counts the number of vehicles passing on the road. A camera will be placed along with the traffic light. It will catch picture groupings. Picture handling is a superior procedure to control the state change of the traffic light. The red sign turns into the green sign when the emergency vehicle lands by utilizing MQTT. Less number of vehicles in waiting state and can reduce time consuming. And our system also provides the clearance for the emergency vehicle if any.

MODULES OVERVIEW:

1. **Monitoring**
2. **Data Processing**
3. **Traffic Controlling**

MODULE 1: MONITORING

Fig 4. Monitoring

DESCRIPTION:

Camera is placed in each direction to monitor the traffic density on the road. When the traffic density of one direction is high, green signal will change in that direction and rest will be in red.

MODULE 2: DATA PROCESSING

Fig 5.Data Processing

DESCRIPTION:

Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. Acquired data is processed using raspberry pi. Raspberry pi will make decisions based on that processed data. Raspberry pi is used for interfacing the camera and all sensors. Python language is used for programming raspberry pi.

MODULE 3: TRAFFIC CONTROLLING

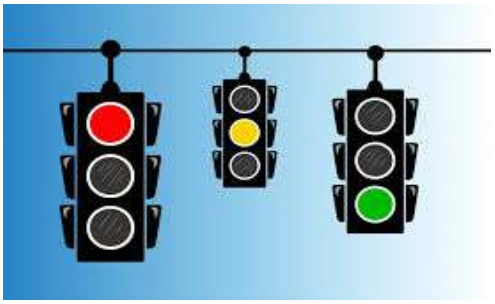

Fig 6. Traffic Controlling

DESCRIPTION:

The process of monitoring the traffic density of each side and changing the signal according to the density in each direction. When the number of vehicles on the road is high then the traffic signals will be automatically changed. The red signal will get changed to green signal when the traffic density on the road is high.

CONCLUSION:

To solve the traffic light cycle control problem using Internet of Things technology, the system reduces the possibility of traffic jams, caused by high red light delays and provides the clearance to the emergency vehicle, to an extent successfully. In this system, we find the traffic density using camera. The road with high density is cleared first. The proposed system also gives importance to emergency vehicles. If any ambulance is waiting during a signal then the particular lane is given high priority and the traffic in that lane is cleared. The proposed system gives good performance and helps to reduce traffic congestion. The proposed system is suitable for real time vehicle management.

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