Dynamic Traffic Signalling System Using IoT and Data Mining for Smart City Mobility and Emergency Healthcare Route Optimization

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ABSTRACT

Traffic congestion monitoring and controlling is the biggest challenge on many cities in this day, which affects environmental life and disturbs our daily life routine. Due to increasing population, number of roads and vehicles increases, which create many problems such as travel time delay, fuel wastage, air pollution and transport related issues. So traffic monitoring and controlling is a major challenge on traffic management authorities. The goal of the project is to make traffic management system work dynamically using Internet of Things(IoT)and Data mining, in order to make traffic system work efficiently. The traffic lights, operates on a periodic schedule to control the light (red/yellow/green) by capturing the image using cameras through crowed sensing we analyze the situation. Our project plan to provide a solution that makes traffic signals to shift the lights(red/yellow/green)with varying time. Ambulance services get affected on large amount due to traffic jams. Our system ensures quick response for emergency situations by automatically controlling traffic signals on the path of the ambulances.

KEYWORDS: Zigbee, ARM 11,CART

1. INTRODUCTION

The number of vehicles is increasing day-by-day increasing the traffic congestion on the roads which leads to accidents, jumping off the traffic signal. In our current system traffic signals lights have fixed time, due to this traffic congestion, pollution, blocked traffic may interfere with the passage of emergency vehicles traveling to their destinations where they are urgently needed. The management systems which involve in maintaining the traffic are all static in nature. Traffic management automation systems in the market aims to computerized the traffic lights, operates on a periodic schedule to shift the light (red/yellow/green).In current traffic signal system there is a fixed time for the traffic signals which leads to pollution, unwanted waiting time and traffic jam. So we propose a system in which traffic signal lights are periodically varied according to the situation. The traffic lights (red/green/yellow) are proportionally distributed to all. Our system analyse the current situation, according to that situation time is proportionally varied on the traffic signal lights. For emergency situations like ambulance our system provides a quick response in which the ambulance is detected with in a particular distance and the traffic signal lights on that particular road is cleared.

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2. MATERIALS AND METHODS

The major goal of the project is to make traffic management system work dynamically using Internet of Things (IoT) and Data mining, in order to make traffic system work efficiently. Our project plan to provide a solution that makes traffic signals to shift the lights (red/yellow/green) with varying time. In our current traffic system,if there is no vehicle on one side of the road we have to wait for a long time. So in our system we capture the image using camera and analyze the current situation using data mining. If there is no vehicle on the one side of the road the time is proportionally distributed to other sides. So we can avoid the wastage of time. The traffic lights, operates on a periodic schedule to control the light (red/yellow/green). Our system ensures quick response for emergency situations. The arrival of the ambulance is detected with in a particular distance by the traffic system and it controls the traffic signals to make that particular road cleared.

2.1.SIGNAL MODULE

The signal module consist of Raspberry Pi, Zigbee, power supply, traffic light. The Raspberry Pi controls the overall function. Raspberry Pi consists of a Micro SD card, Micro USB cable, HDMI cable. The SD card stores all the information's required for us. The camera connected to the Raspberry Pi capture the input image of the traffic congestion. This captured input image is send to the Raspberry Pi. The Raspberry Pi consist of a ARM 11 which uses the Raspbian operating system. Using the image captured we analyse the traffic congestion on the road. Using the image comparison algorithm we compare the situation of the traffic congestion on the road, according to the situation the traffic signal light is varied. In our project we use to have a dynamically varied

traffic signalling system which has proportionally varying time. The power supply is used to give the power to the Raspberry Pi using the power adapter. The Raspberry Pi consist of 40 pins,each pins are used to connect various applications. For an emergency situation, in case of an ambulance the ambulance is detected with in a range of 10-20km by the zigbee module. When the zigbee module detect an ambulance the zigbee sends an emergency message to the Raspberry Pi. When the Raspberry Pi gets an emergency message then the Raspberry Pi immediately change the traffic signal to green on that particular road. Here we are using python for our project.

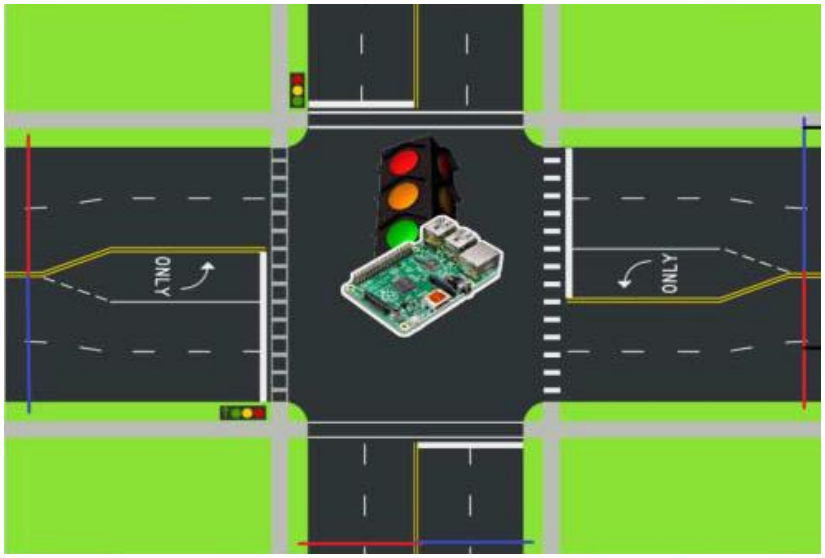

Figure.1 Schematic Diagram

2.2.AMBULANCE MODULE

In ambulance module there is a zigbee module. The zigbee module is used to detect the ambulance with in a range of 10-20 km. The zigbee placed in the traffic signal detect the ambulance, when the ambulance is detected the zigbee send an emergency message to the Raspberry Pi. When the Raspberry Pi gets an emergency message then the Raspberry Pi automatically change the traffic signal according to the situation,that is the traffic light is changed to green. So our proposed system proportionally vary the time of traffic signal.

2.3.DATA MINING MODULE

In data mining module the camera capture the image and this image is analysed using the CART(Classification and Regression Tree) data mining algorithm. This process is performed in all sides of the roads at a time and according to current situation the decision making algorithm decide which side to be cleared.

Algorithm

- Step 1: Initialize camera, traffic signal and serial port
- Step 2: Begin capturing the image.
- Step 3: Convert the image to gray-scale using gray-scale conversion.
- Step 4: Noise cancellation.
- Step 5: Divide the image in to segments.
- Step 6: Extract the features of the image.
- Step 7: Identify the intensity of the traffic.
- Step 8: Signal controlling using traffic intensity.
- Step 9: Receive value from the ambulance side.
- Step 10: Switch on the traffic time for a particular delay.
- Step 11: Go to step 2.
- Step 12: End.

3. RESULTS AND DISCUSSION

In our system hardware requirements used are Raspberry Pi, Zigbee,Rasberry Pi camera module and the software requirements used are Raspbain and the language used is python.In Figure.2 Block diagram we are mainly using Raspberry Pi, Zigbee, power supply, display, HDMI,ARM11,camera port, LAN port, USB port, camera, GPIO pins.Camera and zigbee are connected in the USB port. The camera can be also connected in the camera port. LAN port is used for internet connection. Power to the Raspberry Pi is given by the power adapter. Display is used to display the time duration of the traffic signals. ARM 11 is micro controller. ARM 11 is

worked in the Raspbian operating system. HDMI(High Definition Multimedia Interface) is a proprietary audio/video interface for transmitting uncompressed video data and digital audio data. GPIO is the general purpose input or output pins. It consist of 40 pins, it include SCL (serial clock) and SDA (serial data),SPIO4 (serial peripheral). Camera and the Zigbeemodule are connected to the USB port via serial through wired or wireless connection. The input to our system is a picture captured from the camera. The input image given to the open CV which is a computer vision library in which our image is compared with another image using the algorithm image comparison algorithm, the decision is made according to the situation, which area contains more traffic congestion and which area contains least traffic congestion. According to the situation the time is proportionally given to all.

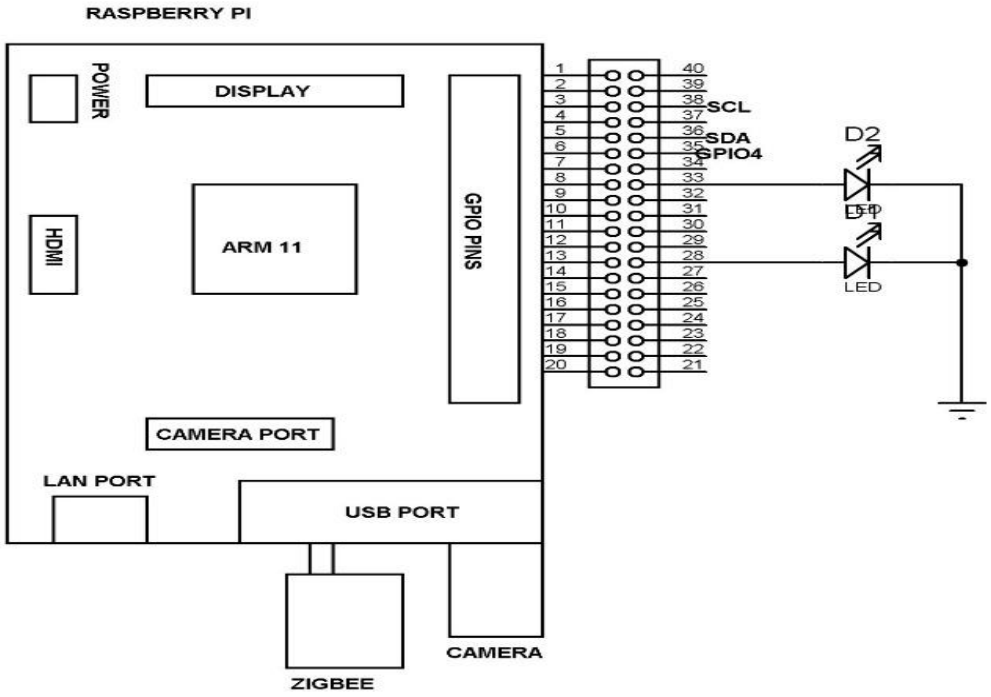

Figure.2. Block Diagram

When the Raspberry Pi gets an emergency message then the Raspberry Pi automatically change the traffic signal according to the situations that is the traffic light is changed to green. So our proposed system proportionally

vary the time of traffic signal. The outcome of our system avoid problems faced such as unwanted waiting time, pollution and it also controls the traffic congestion.

4. CONCLUSION

In our proposed system the major goal of the project is to make traffic management system work dynamically using Internet of Things (IoT) and Data mining, in order to make traffic system work efficiently. The traffic lights, operates on a periodic schedule to control the signal light (red/yellow/green). In our proposed system the time is proportionally distributed to all. So we can avoid the wastage of time.Our system ensures quick response for emergency situations by automatically controlling traffic signals on the path of the ambulances and the traffic signal is adjusted which make the traffic on that particular road is cleared. This major advantage rules out the happening of ‘unwanted wait’ for the vehicles in the more crowded region.

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