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AN IOT BASED SYSTEM FOR TRAFFIC CONTROL

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ABSTRACT
A webcam and sensor-based automated Pi-based traffic control system that helps to lessen traffic density at congested intersections. This traffic infrastructure's design can aid in preventing traffic jams. This paper discusses a system that uses webcams and a Raspberry Pi to control traffic junction lanes based on traffic volume and RFID sensors to prioritize emergency vehicles for passenger safety. Consequently, the traffic system can be made exponentially better, which could result in a progressive improvement in the traffic system as a whole.

KEYWORD-*IoT, Webcam, Traffic Control*

I.INTRODUCTION

Micro Electro Mechanical Systems (MEMS), micro-services, the internet, and wireless technologies have all come together to form the Internet of Things. Through the dismantling of silos between information technology (IT) and operational technology (OT), it is now possible to analyze unstructured machine-generated data and find insights that will lead to improvements. A standard traffic system has four lanes, each with a clockwise or counterclockwise-operating signal that has a set time interval. Due to inaccurate traffic density calculations, the previously designed ultrasonic sensor-based system and conventional system are unable to accurately detect traffic on each lane. As a result, time passes even when a lane is vacant, creating a bottleneck situation.

Numerous technologies, including GPS tracking [1], RFID (radio frequency identification) technology [2], CCTV camera image processing [3], VANET (Vehicular Ad-Hoc Network) [4], and ultrasonic sensor-based, are used by traffic management systems.

In each lane, a Raspberry Pi microcomputer and many webcams are utilized to count the traffic and control the lane accordingly. The webcams are utilized to automate the lanes, calculate vehicle density, and update the lights at each lane. The goal of this strategy was to develop an efficient image processing system that would be incredibly easy to use. The next sections cover the design of the system, its parts, and how it is built and operated.

II. PROPOSED SYSTEM

The system's general architecture is displayed in Fig. 1. Four webcams in each outgoing lane at this intersection compute and update the Raspberry lane signal traffic conditions. Additionally, each lane's RFID system will recognize any approaching emergency vehicles and update the signal.

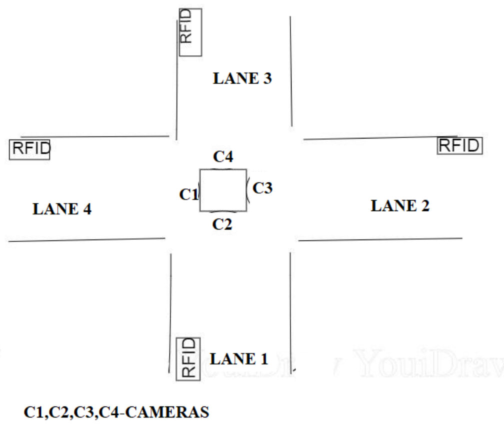

Fig.1.Proposed Model of Traffic Control

III.SYSTEM COMPONENT DESCRIPTION

The following are the components of the proposed system:

*a. Raspberry Pi 3 B+:*A Raspberry Pi is simply a tiny computer's motherboard the size of a credit card. There are other variations of Raspberry Pi, some of which are even smaller than a credit card. Thus, simply attach a mouse, keyboard, and screen (with an HDMI cable). The SD card has an operating system that may be installed on it in place of a hard drive. The benefit of the Raspberry Pi is that, once configured, it can function without the need for external peripherals, so you may unplug your keyboard, mouse, and even screen. It contains GPIO pins for attaching sensors, LEDs, and other electronics gear in addition to peripherals.

b. MCP23S17: The MCP23S17 is an integrated circuit (IC) that uses a serial peripheral interface (SPI) to expand I/O 16 bits. If new devices are needed, this IC allows them to be added to the system.

*c. Light Emitting Diode (LED):*It is used for indication purposes *d. Webcam*: It is a high-resolution, megapixel camera for vehicle detection. They function by connecting via their USB.

e. *EM-18 RFID Sensors:* Radio-frequency identification sensors are devices that use radio waves to detect digital data stored in tags or smart labels (explained below) and pick it up by a reader. The MCP23S17 expands the system's I/O pin count. An additional 16 I/O pins can be added to the system by each MCP23S17. Due to the four RFID sensors per lane in the planned system, two MCP23S17s are required to balance the number of I/O pins required. The Raspberry Pi 3 verifies an MCP23S17's 3-bit control address before establishing a communication

IV.WORKING PRINCIPLE

A. WEBCAM DETECTION

The fundamental concept of foreground detection techniques that use background removal. Background subtraction has several distinct algorithms, but they all have a pretty basic principle at their core.

Current_frame - Background_Layer = Foreground_objects. For background subtraction, the MOG algorithm will be applied. We will attempt to eliminate the noise on the foreground mask using some common filtering techniques.

B. FILTERING

We will require the following filters in our situation: threshold, erode, dilate, opening, and closing. They will help us get rid of some of the noise on the foreground mask. Closing will be used to eliminate gaps in sections first, followed by opening to eliminate one or two px points, then dilatation to make the item bolder.

C.CONTOUR BASED OBJECT DETECTION

The normal cv2.findContours method will be employed. We add some height, width, and centroid filtering on the exit. Lastly, combine the BG subtraction, filtering, and detection sections. identified items on various frames, created routes, and tallied the number of cars that reached the departure area.

The Raspberry Pi 3 is used to write the system's code, which is written in Python. Figure 2 shows a basic program flowchart.

VI.RESULTS

The inability of ultrasonic sensor-based traffic analysis to reliably detect moving vehicles is a major flaw. The only way around this is to use a USB camera, which records frames, counts the density of vehicles, and changes the signal automatically without the need for human labor. Fig.3. shows hardware prototype.

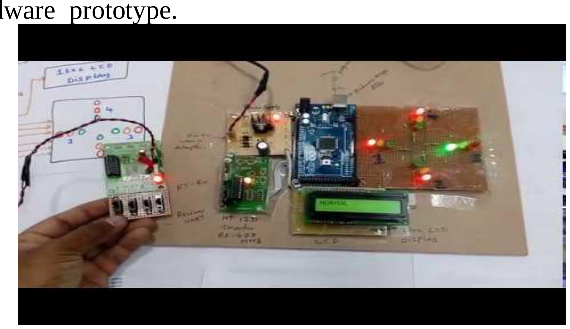

Fig3.Hardware Prototype

The traffic model, which is a simple prototype with two RFIDs affixed to separate lanes and connected to the PI via GPIO pins, is depicted in the above diagram from above.

The Pi also has two Qualcomm USB webcams built in. It can therefore quickly determine the number of vehicles at a traffic crossing by adding any video frame there and updating the traffic accordingly.

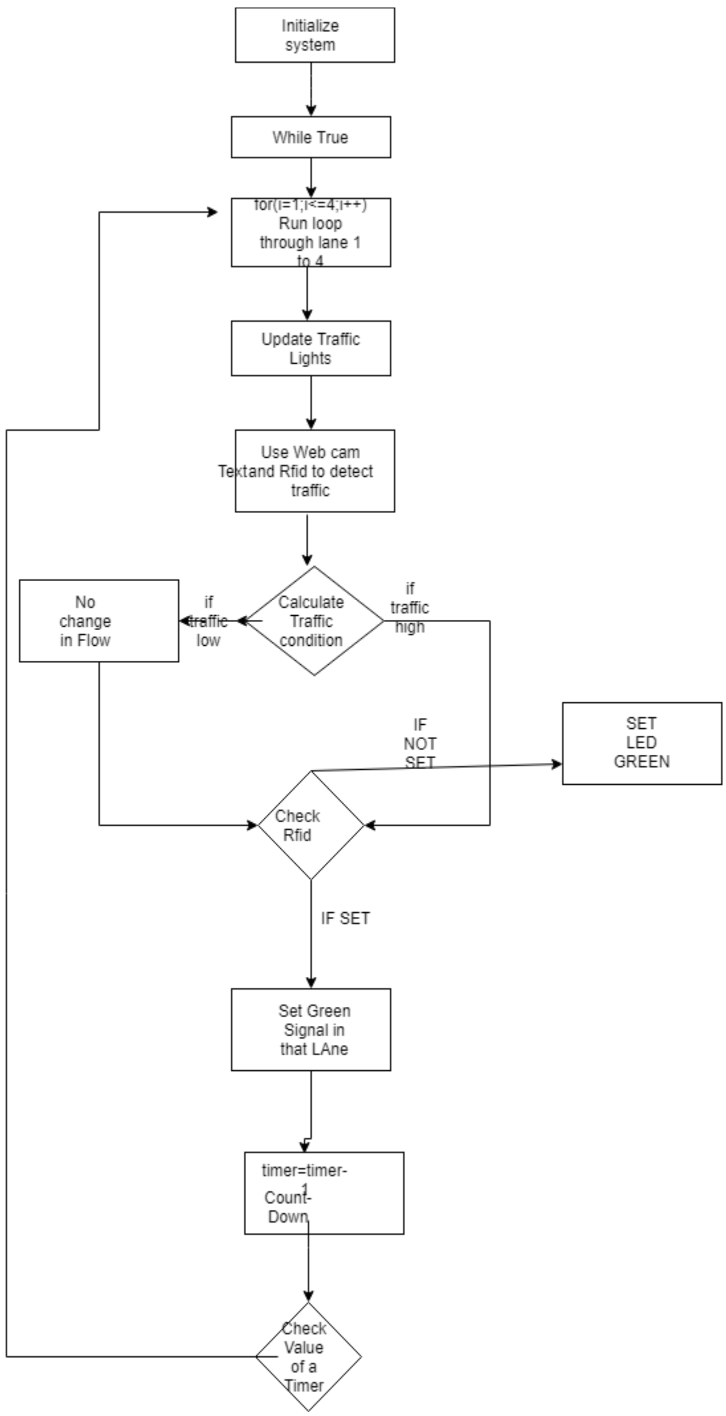

Fig.2.Flow chart of Operation

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VII.CONCLUSION

However, there may be a minor issue with foreground items overlapping if you run the Python script, and there is no type classification for the cars. However, it still provides quite excellent accuracy when the camera is positioned well (above the road). This indicates that, when applied appropriately, even little, basic algorithms can produce positive outcomes. To segregate items for improved detection, one method is to try adding some extra filters. Using more intricate algorithms, like deep convolution networks, is a further option. Additionally, a minicomputer or microcontroller with a fast boot time and high mega pixels can increase system accuracy.

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