AUTONOMOUS NAVIGATION GUIDANCE SYSTEM

April 26, 2017

Abstract

Nowadays traffic accidents have increased a lot. This can be partly blamed on the Vehicle drivers. Human factor plays a key role in these accidents. So we intend to build a Traffic guidance system. Using a microprocessor ,Traffic lights are detected using Color masking techniques. For example if a red traffic signal is detected, the vehicle stops .It doesn't move even if the driver tries to move the vehicle. The system also detects the traffic signs such as speed limit using the Google Cloud Vision API.If the car is moving at a speed higher than th speed limit, the system sets the speed to the speed limit and it does not allow the car to increase it's speed further. A safety service is implemented in the system. When the pressure sensor detects a crash, alert messages are sent over a broker to the hospitals for ambulance and to the relatives.

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Project report on:

AUTONOMOUS NAVIGATION GUIDANCE SYSTEM

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Acknowledgement

We are thankful to the Department of Electronics and Communication, SJCE, for creating this opportunity to work on our Ideas and providing the necessary resources, through Reference Library, Lab equipment and more for implementing the same. We are also thankful to Prof. A Thyagaraja Murthy for advising through Lab. We are especially thankful to Dr. T Shreekanth and Chandrashekhar B.N for guiding us in every step of the Project.

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1 APPLICATIONS

1. The car drivers tend to violate the traffic signals which mostly results in serious accidents.This system can be implemented in two wheelers and four wheelers.
2. Alert messages are sent to the hospitals and relatives with the help of MQTT broker.
3. The concepts of detection and recognition can further be extended to home automation.

2 CONCEPTS

The concepts used in this project are Color Masking, Image Segmentation and mqtt broker-client communication which is used control devices. Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention.

Color masking is a process of detecting only certain colors based on their threshold values. These threshold values can be in different color spaces like HSV, RGB, etc. A mask is created based on the thresholds and then bitwise AND with the original image resulting in the detected color image.

Image segmentation is a process of segmenting only certain part of the image to be processed.

MQTT is a lightweight message queueing and transport protocol. MQTT, as its name implies, is suited for the transport of telemetry data (sensor and actor data).this mqtt server is used to communicte to ESP8266 Wi-Fi module connected to home network.MQTT is very lightweight and thus suited for M2M (Mobile to Mobile), WSN

(Wireless Sensor Networks) and ultimately IoT (Internet of Things) scenarios where sensor and actor nodes communicate with applications through the MQTT message broker. MQTT is designed to support wireless networks with varying levels of latency due to occasional bandwidth constraints or unreliable connections.

3 Literature Survey

1. Bahlmann, Y. Zhu, V. Ramesh, M. Pellkofer, T. Koehler, "A System for Traffic Sign Detection, Tracking, and Recognition Using Color, Shape, and Motion Information", Proceedings of the 2005 IEEE Intelligent Vehicles Symposium, Las Vegas, USA., June 6-8, 2005. This paper describes a computer vision based system for real-time robust traffic sign detection, tracking, and recognition. Such a framework is of major interest for driver assistance in an intelligent automotive cockpit environment. The proposed approach consists of two components. First, signs are detected using a set of Haar wavelet features obtained from AdaBoost training. Compared to previously published approaches, our solution offers a generic, joint modeling of color and shape information without the need of tuning free parameters. Once

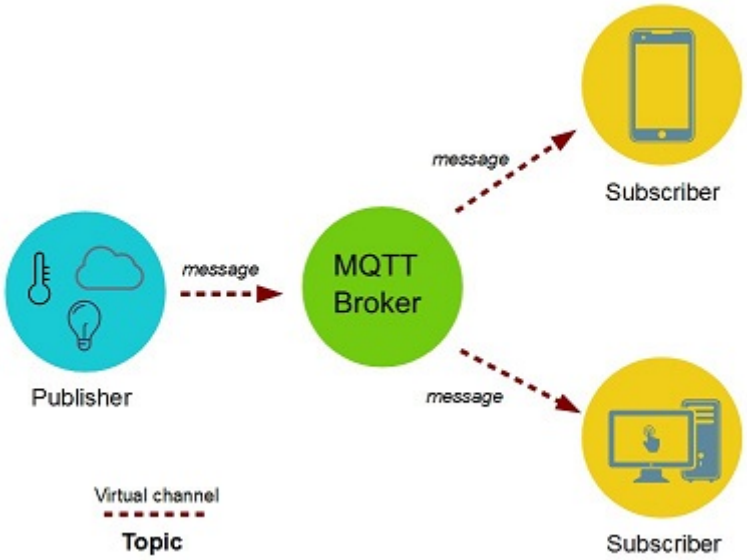

Figure 1: Working of MQTT

detected, objects are efficiently tracked within a temporal information propagation framework. Second, classification is performed using Bayesian generative modeling. Making use of the tracking information, hypotheses are fused over multiple frames. Experiments show high detection and recognition accuracy and a frame rate of approximately 10 frames per second on a standard PC.

2. L. Pacheco, J. Batlle, X. Cufi, "A new approach to real time traffic sign recognition based on colour information", Proceedings of the Intelligent Vehicles Symposium, Paris, 1994, pp. 339-344. The automatic interpretation of conventional traffic signs is very complex and time consuming. The paper concerns an automatic warning system for driving assistance. It does not interpret the standard traffic signs on the roadside; the proposal is to incorporate into the existing signs another type of traffic sign whose information will be more easily interpreted by a processor. The type of information to be added is profuse and therefore the most important object is the robustness of the system. The basic proposal of this new philosophy is that the co-pilot system for automatic warning and driving assistance can interpret with greater ease the information contained in the new sign, whilst the human driver only has to interpret the "classic" sign.

4 METHODOLOGY

A microprocessor like raspberry Pi along with the Pi camera can be used for this purpose. Traffic lights can be detected using Color masking techniques. For example if a red traffic signal is detected, the vehicle stops .It doesn't move even if the driver tries to move the vehicle. Similarly traffic signs can be detected using Haar Cascades. For example if there is a compulsory left turn

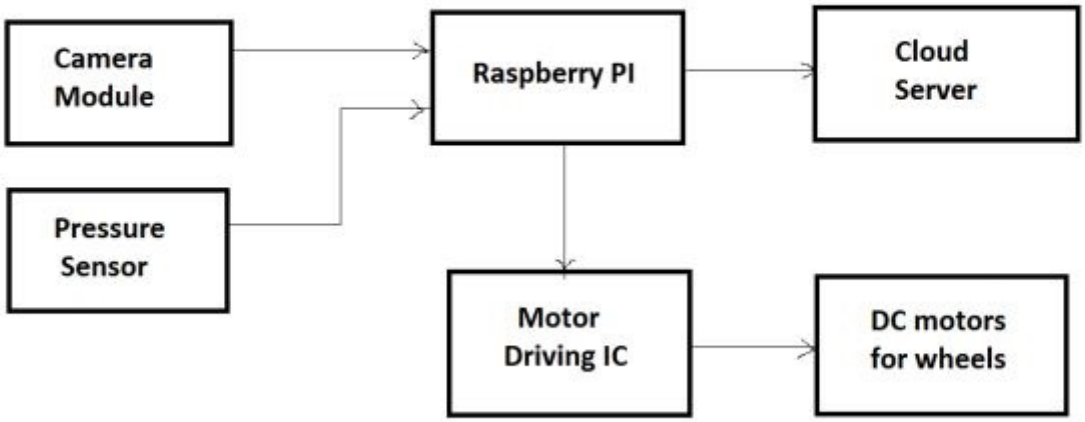

Figure 2: Implementation of Methodology

then the guidance system makes the vehicle turn to its left even if the driver doesn't do it. Also the system can detect various obstacles in front of it. It can be done by both the Pi camera and the ultrasonic sensor used. Ultra-sonic sensor is used for redundancy. It acts as a backup just in case the Pi camera doesn't detect the obstacles. Again this can be done using Haar cascades. The speed limit signs are detected using the Google Cloud Vision API. The images captured by the PiCamera are sent to the Google Cloud Vision API and the features of the picture are obtained which are used to control the speed of the motors such that the speed does not exceed the detected speed limit. When a crash occurs, it is detected by the pressure sensor. Crash messages can be sent to the hospitals through Cloud servers. The cloud server which will be used is Amazon Web Services. Messages are sent to the cloud by Raspberry Pi. Then, the server broadcasts this message to the hospitals. This communication happens through MQTT protocol.

Scenario 1: Consider a situation where the driver is driving a vehicle. The driver may try to jump the traffic signal. Now the PI camera used with Raspberry Pi detects the red light in the traffic signal and stops the car. It doesn't allow the driver to drive by skipping the traffic signals. This can be done by using the color masking technique written in python 2.7. It makes use of OpenCV library.(2) The above situation can be implemented with the following algorithm in OpenCV: Step 1: Keep checking if red is detected in the captured frame, if yes go to next step. Step 2: Check if the detected red is at the upper 1/3 portion of the frame. Step 3: Check if the detected red coloured object's shape is a circle. Step4: If the above 3 conditions are satisfied, then the vehicle automatically stops.

Scenario 2: If the speed limit is 50 kmph on the particular road, the vehicle wouldn't cross this speed at all. The implementation of the above case is as follows:

1. The captured frames are continuously sent to the Google cloud servers using 'Google Cloud Vision API Client Library' on the Raspberry PI.
2. It processes the image using the existing database in the cloud and checks for the match of the speed limit image.
3. It sends back the respective match for different properties of the image in JSON format.
4. Using the data, if a circular property of the object is detected then detection of number is detected it.
5. If the above condition is satisfied, then the speed of the vehicle is automatically kept below that number in kmph.

Scenario 3: When a crash occurs, it is detected by the pressure sensor. Crash messages can be sent to the hospitals through Cloud servers. The cloud server which will be used is Amazon Web Services. A message is Sent to the cloud from the raspberry pi. Then the server broadcasts this message to the hospitals. This communication happens through MQTT protocol (4)

Future Scope: Now consider a situation where the driver doesn't follow the traffic Signs. The Pi camera detects the Signs and does the appropriate work. Consider that the road is a One-way road. The driver tries to enter the road from the wrong direction. The Pi camera detects this and prevents the driver from entering from the wrong direction. This can be done using Haar cascades. Here a set of negative images is taken. Also a set of positive images is taken. The positive images contain the traffic sign to be detected. Both of the sets are compared and appropriate traffic signs are recognized (1).

Also the bot can detect various obstacles in front of it. It can be done by both the Pi camera and the ultrasonic sensor used. Ultra-sonic sensor is used for redundancy. It acts as a backup just in case the Pi camera doesn't detect the obstacles. Again this can be done using Haar cascades (1).

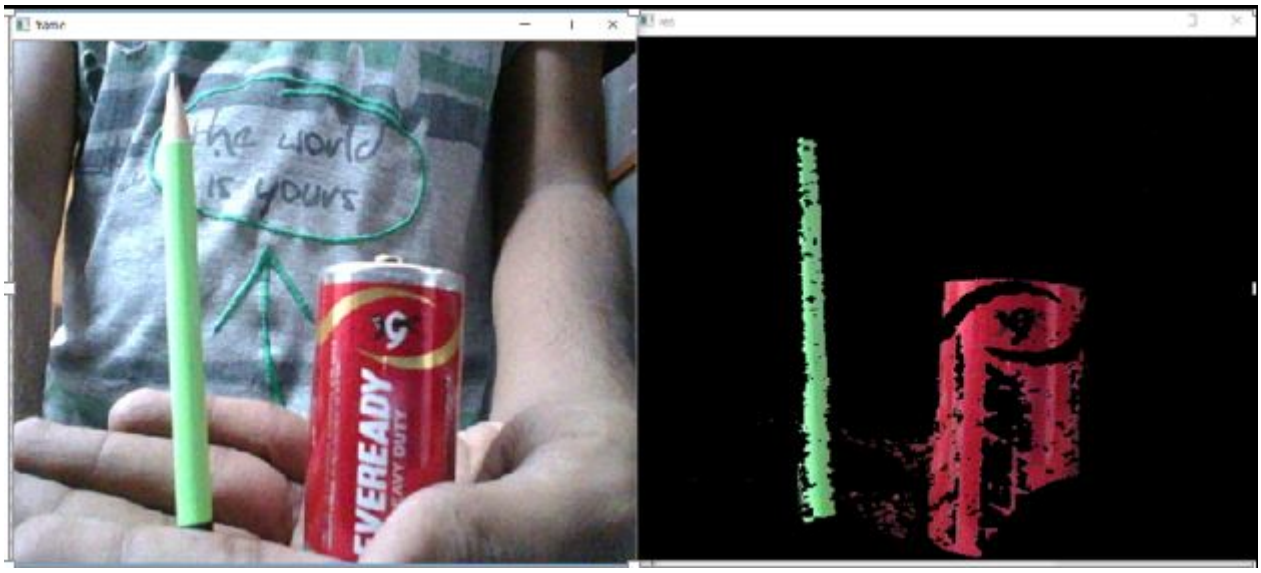

Figure 3: Red and green colour detection in traffic lights

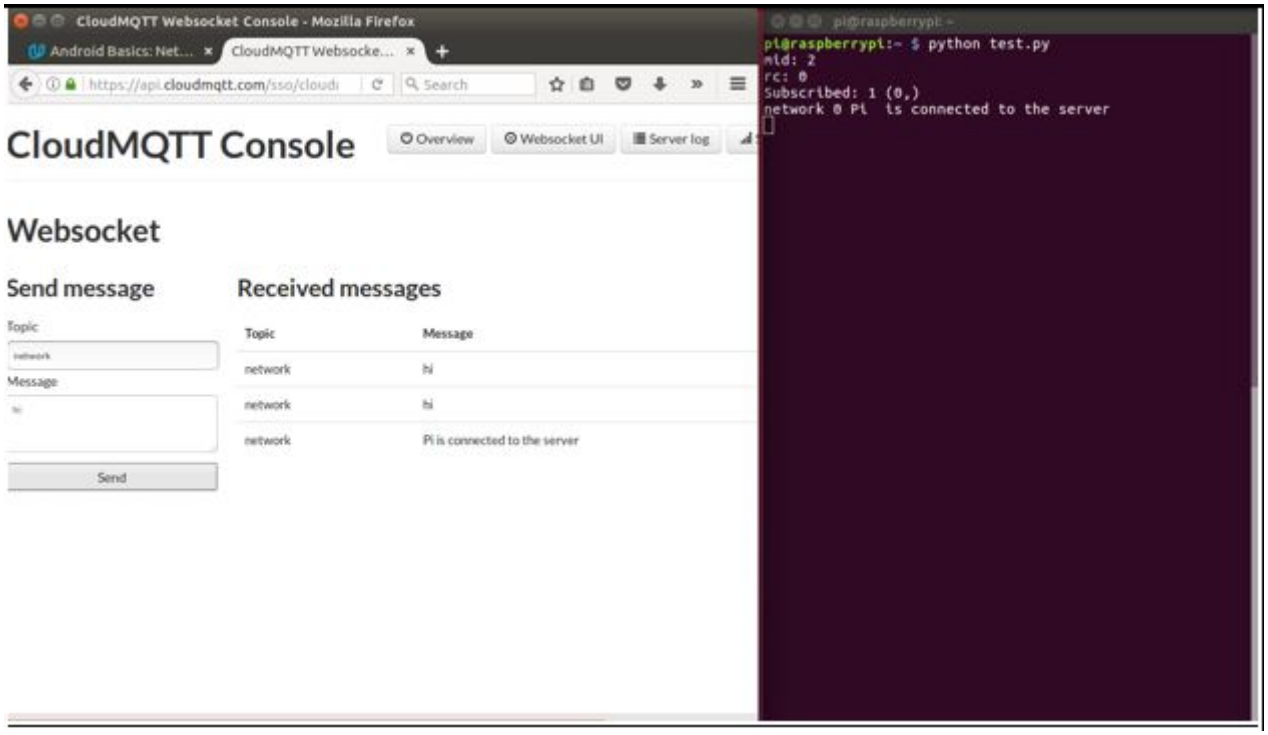

Figure 4: Sending message to R-Pi and Cloud Server

5 CONCLUSION

The traffic light system has been experimentally proven to inhibit drivers from breaking traffic rules and thus preventing accidents and saving lives.Also, sending of crash messages has helped emergency services to respond fast and effectively.

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[4] http://research.ijcaonline.org/volume120/number24/pxc3904265.pdf, Md.Safaet Hossain, Zakir Hyder, "Traffic Road Sign Detection and Recognition For Automotive Vehicles", International Journal of Computer Applications (0975 – 8887) Volume 120 – No.24, June 2015 Page No.10 - 15

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