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Raspberry Pi based Smart Surveillance System using TensorFlow

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Abstract - *Human life is more precious than any machine or robot. So here we introduce a Portable Surveillance System Which Consists of Both hardware and software. Hardware Consist Of the Raspberry Pi based System which will Capture and stream back the live footage in the targeted parameter. The software will do the further process of receiving back the transmission and playing it in real-time to the remotely operating human operator while also maintaining the database of found records, which can be accessed by a front-end software by authorized personnel thus securing the whole system. Detection of the object is a challenging task; here real-time detection of an object is proposed. The system consists of a PC, Raspberry pi and R pi-camera. The video is continuously captured by camera. It is then sent to Raspberry pi for further processing. Video Surveillance is highly important as far as security is concerned these days. The current technologies require RFIDs which are very costly and hence the security domain in all becomes expensive. We have used a low-cost single –board computer Raspberry Pi which follows object detection algorithm written in Python as a default programming environment. This technology is less expensive and it is used as a standalone platform for hosting image processing. The algorithm for object detection is being implemented on raspberry pi due to which live video streaming is done along with the detection of objects.*

Key Words: Raspberry pi, R pi camera, surveillance

1. INTRODUCTION

This project designs a remotely controlled two-wheeled robotic rover over a Wi-Fi network, using a raspberry pi 3 connected to a Wi-Fi adapter and two stepper motors. The robot can be controlled from an ordinary internet browser, using an HTML designed interface. The rover car is often easily moved from one place to a different just by one device. Rover can be used for security purposes with the installation of a camera. This rover will also be able to detect and identify objects of interest in real-time.

1.1 NEED

So many humans lose their lives while rescue operations or military operations. When there is a disaster be it man made or natural there are places which are impossible to reach by humans. Places like enemy territory, volcanic openings, earthquake hit areas etc. can be accessible but can be dangerous to human life. Here an electronic smart robot can be useful. Rover can be sent to make a plan on how to reach such places. Rover can also analyze this place to find possible threats and harmful materials.

1.2 APPLICATION AND SCOPE

APPLICATION

The proposed system can be able to go to places where humans can't or places where human life can come in danger. This rover with built in object detection can detect objects of interest. It can detect any object it sees with accuracy. Dangerous elements like bombs, guns, assault rifles, rocket launchers can be detected by this system, and can be seen in real time hence, live object detection.

SCOPE

The system will be easily able to live Stream the captured footage in real Time on the computer system itself. This information can be further accessed by the front-end software situated on the system by the appropriate person monitoring the whole system

1.3 AIM:

To create a portable surveillance system containing software and hardware that can also detect objects that come across its camera.

1.4 PROBLEM STATEMENT

As life is more precious than machines more and more automation is taking place within the industry. The surveillance system that already exists gives only live video feed. But this system will be giving live video feed as well as to detect objects of interest or of danger. This system will be remotely controlled using the internet and will have live video feedback and can detect objects of interest with the same. Using a raspberry pi as the Brain of the machine and an R pi camera to capture live video this Rover will be made. For the detection of the object, image processing will be used. Using Convolution neural network algorithm specifically The MobileNet ssd lite model of CNN algorithm which is a lightweight CNN model used in systems with very limited computing power such as Raspberry pi to detect and track objects.

2. LITERATURE SURVEY

Wireless multifunctional robot for Military application. [1]

The robot is basically an electro-mechanical machine or device that is controlled either by computer program or with electronic circuit to perform a variety of physical tasks. With the gradual development in technology scientists come up with new ideas and inventions of robots. In today's life robots are becoming an indispensable part of human life. The robotic technology also provides automation in hospital, office and factory.

Wi-fi Controlled Rover. [2]

Nowadays technology plays a significant role in human life. Robotics has developed drastically over the years. This project designs a remotely controlled two-wheeled robotic rover over a Wi-Fi network, using an Arduino Uno connected to an ESP8266 Wi-Fi module and two stepper motors. The robot are often controlled from a standard internet browser, employing a HTML designed interface. An Android smartphone is used to broadcast video and audio from the robot to the operator's control interface. The rover car are often easily moved from one place to a different just by one device. Rover cars are often used for security purposes with the installation of a camera. The end user can get the live video of wherever the rover is moving. One of the main uses of robot is their flexibility and therefore the ease with which they will be utilized in all places

IP Camera Video Surveillance using Raspberry Pi. [3]

Surveillance refers to observation and video surveillance thus refers to observation of real time video of a neighborhood from a foreign area. Performance of the cameras thus becomes important. IP and PTZ cameras are used for deliverance of real time video remotely. However, their usage is restricted when cost matter cares. Raspberry Pi is that the least expensive technology whose usage is being proposed during this paper as an alternate for video surveillance. It is the most cost effective and commercially available option when comparing with other alternatives. We present a new dimension in the security domain by utilizing this mini board. This is not only cost effective but when the important time video quality is taken into account it delivers 120x cost effective per megapixel of resolution which is less than other alternatives.

3. REQUIREMENT ANALYSIS

User:

The proposed system could be used by military personnel and/or emergency rescue personnel.

Application:

This system as its name suggests is a surveillance system at its core, with video live streaming capabilities which are further enhanced by adding the live object detection and identification capabilities.

4. METHDOLOGY

When the information is brought by means of the Pi Camera Module, the framework will have the option to perceive objects that come before the camera.

Four Main Components were utilized to actualize the framework:

1. Tensor stream:
Tensor Flow is essentially a free and open-source programming library for dataflow and differentiable programming over a spread of undertakings. It is an emblematic math library, and is moreover utilized for AI applications like neural systems. It is utilized for both research and creation at Google.

TensorFlow was created by the Google Brain group for interior Google use. It was discharged under the Apache License 2.0 on November 9, 2015.

2. Protobuf:
Convention Buffers (Protobuf) is fundamentally a technique for serializing organized information. It is valuable in creating projects to talk with each other over a wire or for putting away information. The strategy includes an interface depiction language that portrays the structure of certain information and a program that produces ASCII archive from that portrayal for creating or parsing a flood of bytes that speaks to the organized information. Google created Protocol Buffers to be utilized inside and has given a code generator to numerous dialects under an open source permit

3. OpenCV:
OpenCV (Open source PC vision) is essentially a library of programming capacities basically pointed toward ongoing PC vision. Initially created by Intel, it had been later upheld by Willow

4. Convolutional neural system:
In profound learning, a convolutional neural system is essentially a classification of profound neural systems, most regularly applied to breaking down visual symbolism. They are likewise alluded to as move invariant or space invariant fake neural systems, bolstered their common loads engineering and interpretation invariance qualities.

5. IMPLEMENTATION

In the proposed system we present two main components namely Raspberry pi board and Raspberry pi camera. First step will be to establish a connection with the r-pi camera and Raspberry pi board for the video recording, The footage captured by the r-pi camera then can be sent over to the front end users system and can be viewed using the front user interface provided to the user, The Livestream will start immediately after the user starts the streaming service using the User interface

Proposed System Does have a smart surveillance mode also which could be used for the live object detection purpose in this mode the recorded footage recorded by the r pi camera is then sent to the r-pi board for further processing which is processed using TensorFlow using Convolutional neural network specifically the "MobileNet SSD Lite"

After the Processing is done by the TensorFlow the processed video feed is then displayed on the display which can be viewed by the user who can watch live object detection through provided user interface the object detection is done by OpenCV and identification is done by TensorFlow

5.1 RESULTS

Fig -1: Results shown on display

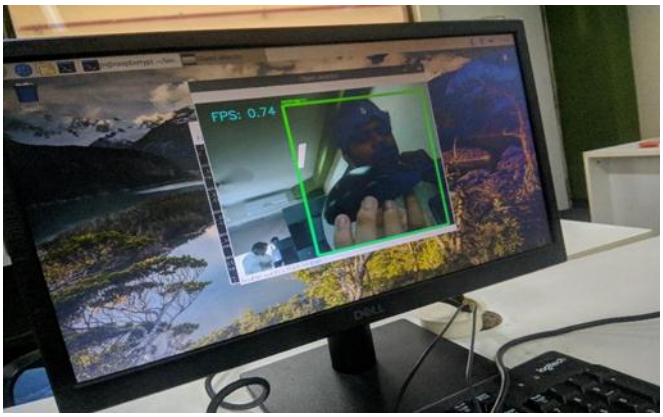

Fig -2: Results shown on display

5.2 FLOW CHART

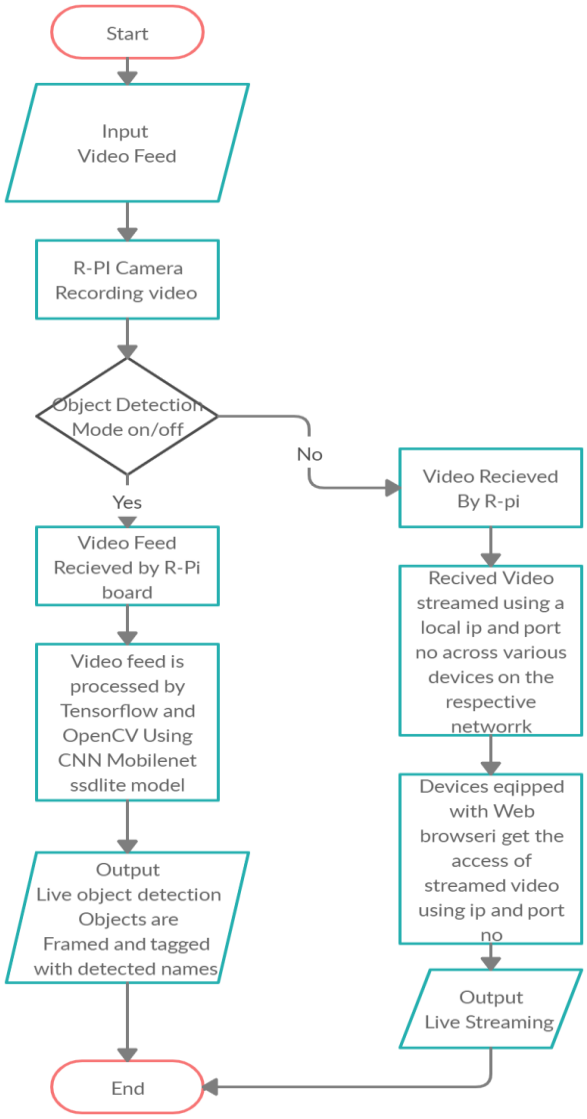

Fig -3: Flow Chart

6. CONCLUSION

The System will be Portable as well as easy to use for the ultimate consumer with Direct feed and secure playback functionality to the legitimate user by using the dedicated software for both Live Streaming as well as for the detection of object that may come in field of view of the camera during live feed, the system will be a great remotely accessible device because of the real time footage, secure playback facility and real time object detection.

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