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Vehicle Tracking and Monitoring Using Raspberry Pi

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Abstract

Nowadays, the safety and security measures of the people travelling through app-based cab services like UBER/OLA are increasing. But only in the view of tracking a vehicle and not to the mark expected.This paper deals with such issues by the installation of cameras to the vehicles and allows the live streaming of the cameras in a website to different persons of user interest in addition to the tracking facilities. The proposed model mainly deals with the tracking and monitoring of the vehicle and its surroundings. For tracking the vehicle, we used a GSM-GPS modem SIM 808, GPS antenna and for interfacing it to the user, we take the help of Arduino UNO. For monitoring the vehicle through the cameras installed, we used Raspberry Pi.

Keywords: *GSM-GPS modem SIM 808, Arduino UNO, Raspberry Pi, USB Cameras, Live Streaming.*

1. Introduction:

India ranks 1st in the number of deaths due to road accidents across 199 countries reported in the global statistics of the road, 2018 followed by China and the United States. According to the WHO World Report on Road Safety 2018, India accounts for almost 11% of accidents related deaths worldwide.A total of 4,67,044 road accidents were reported by States and Union Territories in the calendar year 2018, 1,51,417 claiming lives and causing injuries to 4,69,418 people, said the report. Overspeed represented 64.4% of those killed.Of all the above accidents, only a few had enough evidence and that the cases are resolved. But other cases are still pending due to lack of evidence.The proposed model will play a big role in preventing all these cases and provide more safety and security measures to all vehicles, including public transport in all means.Also, to improve the safety and security measures of the people travelling through app-based cab services like UBER/OLA.

In olden days, the transportation mode is totally either by public transport systems or by individual vehicles. But nowadays the scenario is different. The population is increasing day-by-day. If we still follow the same age-old transport systems, not only the population but also the pollution will increase. To reduce such affects people adopted the private transport systems like cab services.

But now the problem comes with the safety and security measures of this transport system adopted. In recent days, these app-based cab services added a feature of tracking the vehicle by the people of user interest.Though they provide the tracking facility for their vehicles, the security and safety measures are not reached to the extent that is needed.So, in order to increase these measures, we came up with a model that provides the details of the vehicle surroundings through a live video captured from the camera attached to the vehicles.

This model is also implemented to improve the emergency medical facilities in the ambulance. Sometimes, the health condition of the patients in the vehicle may be degraded before reaching the hospitals. In such situations, the doctor can monitor the patients through the cameras installed inside the vehicles and can communicate with the near-by ones to take some preliminary actions to improve his/her health condition or can command to take the patient to the nearby hospital.This model starts working by

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the start of the vehicle. It will track and identifies the location of the vehicle and connected USB cameras will send live video recorded on all devices connected to the same wireless network.

This paper is organized into five sections which also includes this section; Section 2 illustrate related work; Section 3 explains the proposed model; Section 4 presents the experimental results; Section 5 summarizes the findings.

2. Related work:

Dr.P.V.Rama Raju, et al. [1] developed a model to control the robot from a remote place and stream video back to us. For the video stream from a remote location, they used an OpenCV library for capturing video from a Web Camera connected to the Raspberry Pi. OpenCV (Open Source Computer Vision) is a library of programming functions that are mainly aimed at real-time computer vision.

Dr. ShantanuK.Dixit, et al. [2] explains the procedure to design and implement wireless robots which enables us to control the robot with the help of the internet and with the help of the PIR sensor it will detect living bodies. It will help in the rescue operation and the user can access the video transmitted from the remote area. Camera movement is controlled through a webpage at the user interface.

W. Lao, J. Han and Peter H.N. de With, et al. [3] explains the study of a flexible framework for semantic analysis of human behaviour from a monocular surveillance video, captured using a consumer camera. Successful estimation of trajectory and human-body modelling will facilitate the semantic analysis of human events and activities in video sequences.

G. Naga Raju, et al. [4] developed a model for smart irrigation and monitoring system using the internet of things (IOT), which can be used for controlling irrigation of plants and monitoring temperature, humidity and light intensity in nurseries. It also provides a reliable real-time video streaming (live video streaming), which broadcasts over a local area network (LAN) with remote access.

Vamsi Krishna. P, et al. [5] developed a model to notify the user whenever there is human interference in the surveillance area. Using SimpleCV, a simple computer vision library, the ARS system captures surrounding and detects human presence.

Dr.P.V. Rama Raju, et al. [6] developed a model to shield the vehicle from adjoining vehicles crash, knowing the data of driving individual's condition whether he is driving mode or tired mode, and deciding the state of the road i.e., pothole discovery to shield vehicles from harm and accidents. The GPS module stores the pothole latitude and longitudinal position and constantly track the vehicle position and compares it with the stored pothole position and cautions the driver about the nearness of pothole.

JadhavAditiShrikant, et al. [7] developed an application system that captures video, shares among networked systems and alerts the controlling person with message service alarm according to the requirement of the client. This system works in a real-time environment and is supported by Raspberry Pi.

Pavan C, et al. [8] developed the design of a robot with a sensory device, Wi-Fi controlling, programming the system to recognize and to track the robot using GPS.

Dr.P.V. Rama Raju, et al. [9] proposed a model to robotize railroad passages without individuals and to check rail course scenes. If people try to cross the entry even after the voice sign from the voice module about the landing of the train then they will thusly get the fine with the help of the assistance of camera and Raspberry Pi.

Priyanga .M, et al. [10] developed a model to provide Unmanned Aerial Vehicle (UAVs)'s efficient use in case of situational awareness by the surveillance process in the disaster places. The real-time video surveillance using a system equipped for sensor support data is being developed to provide situational in the target of interest.

R. Simmons, et al. [11] proposed an article describe the autonomous robot system, web-based interfaces, and how they communicate with the robot. It highlights the lessons learned during this experience in robotics Web and includes recommendations to make future mobile robots on the web.

Padmashree TM, et al. [12] proposed a model to describe the design of a system that can provide vehicle location information every time when there is a demand for it. GPS (to indicate the location) and

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that data can be transmitted using a GSM modem (as a means to communicate with the vehicle) by SMS (Short Message Service). The information available through the site and the vehicle position will be displayed in the Google Map.

Hu Jian-Ming, et al. [14] proposed a model for the design of an automobile anti-theft system based on GSM and GPS module. The system is developed on the basis of single high-speed mixed chip type C8051F120 and detect stolen car to the owner of the automobile by the vibration sensor. car rental can be achieved with the integrated GPS module in the anti-theft system.

Dr.P.V. Rama Raju, et al. [15] proposed a model to build up an automatic density-based traffic system. The signal timing changes naturally on detecting the vehicle density at the junction.

Hoang Dat Pham, et al. [16] proposed a system that will allow users the ability to remotely monitor vehicle via the mobile network. This paper presents the development of the hardware prototype vehicle tracking system. Specifically, the system will use GPS to get a coordinate of the vehicle and transmitted using a GSM modem to the user's phone via the mobile network.

BG Nagaraja et al. [17] propose to design an advanced vehicle monitoring and tracking to track the vehicle position and speed in real time. The operation of the proposed system on the GPS module / GSM SIM900A which include both things i.e., GPS GSM. The current GPS location of a vehicle and the GSM is used to send the alert message to the mobile vehicle owner.

Nitesh Sehwani S., et al. [18] proposed a model completing the functions of current monitoring systems dealing with the real-time monitoring of remote modules placed in the car in motion with operating Arduino Uno's board of directors along with a SIM808 module and encrypted security algorithm that sets automatically identify the driver of the vehicle and warns the authority in the scenario of a possible theft.

Dr.P.V. Rama Raju, et al. [19] proposed a model todesign an efficient and real-time wireless network to monitor power consumption of electrical appliances. A web facilitating and space is made to get the orders from android application and send them to raspberry pi board at load, which triggers an electromagnetic transfer to change the condition of the heap.

Saaid MF, et al. [20] presented a controllable system that can display the location of a vehicle using the global positioning system (GPS) to an axis point and location Global System for Mobile (GSM) as means for communicating with the vehicle to facilitate the search after an attempted robbery.

Aleesha Susan Jacob, et al. [22] proposed a safety system which consists of a central mini-processing unit, motion detection sensor together with a camera module and the buzzer. Whenever the system detects motion, it triggers the alarm, take a picture and send it to the owner. Therefore, it can be used to monitor and control the wireless car.

3.Proposed Model:

The Proposed model is to track the location of a vehicle and also to monitor in and out of the vehicle through web in any device connected via local area network (LAN). This proposed model comprises of 4 major processes:

[1] Tracking the vehicle through GPS tracker and GPS antenna.
[2]Updating the location details to web by interfacing it with the help of Arduino UNO.
[3] Updating recorded videos using USB cameras to the server.
[4] Live broadcast Video from USB cameras on the web page.

The block diagrams for tracking and camera live broadcast of the vehicle are as mentioned in Figure 1 and Figure 2:

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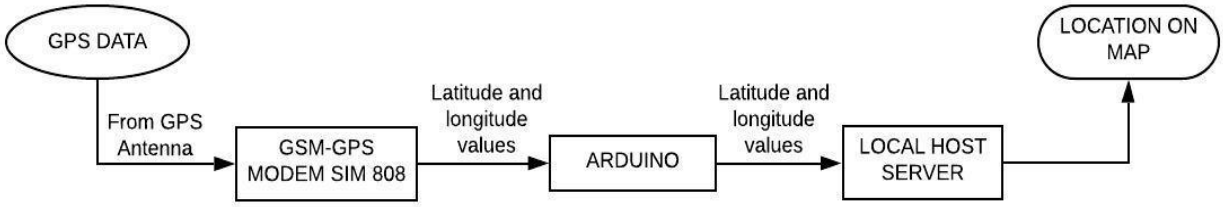

Figure 1. Schematic for monitoring

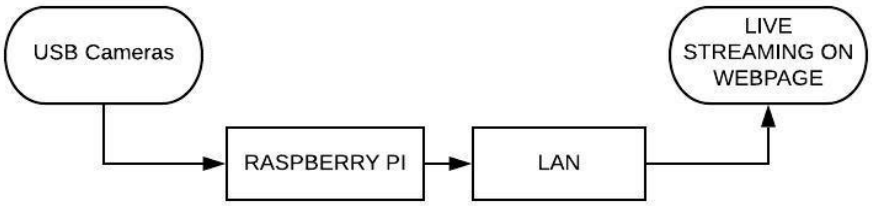

Figure 2. Schematic for live streaming

3.1. Tracking a Vehicle:

GPS is the positioning system that measures the vehicle location over time in any location. Even with a GPS, you will not be able to track a vehicle. GPS is only a receiver. To track a vehicle from a remote location it must be transmitting its location and you must be receiving it. There are other elaborate possibilities but GPS is a true source of the positioning of the vehicle second by second that can be mapped by any standard mapping software.

3.1.1.GSM-GPS modem SIM 808:

SIM808 module shown in Figure 3 is a complete module GSM / GPRS quad-band, which combines GPS technology for satellite navigation. The compact design with integrated GPRS and GPS in a SMT package significantly saves time and costs for customers to develop GPS enabled applications. Featuring a standard interface of industry and GPS, it allows variable assets to be tracked seamlessly at any location and anytime with signal coverage.
The modem has a SIM808 GSM chip and an RS232 interface while allows easy connection to a PC or a laptop using serial or USB connector to the microcontroller using the TTL to RS232 converter. Once you connect the SIM808 modem using the USB cable to the RS232 connector, you must find the COM port Feeder Device USB to serial adapter. Then you can open the terminal software and select the COM port at 9600 baud rates, which is the transmission rate of default of this modem.
Once the serial connection is opened by the computer or microcontroller, you can start sending AT commands. When you send AT commands like "AT \ r", you should receive back a response from the modem SIM808 saying "OK" or other response depending on the shipment of the order.
The SIM808 Module makes you able to use GSM and GPS communication has with your Arduino and Raspberry Pi. With this module you can send and receive SMS and can plot a location.

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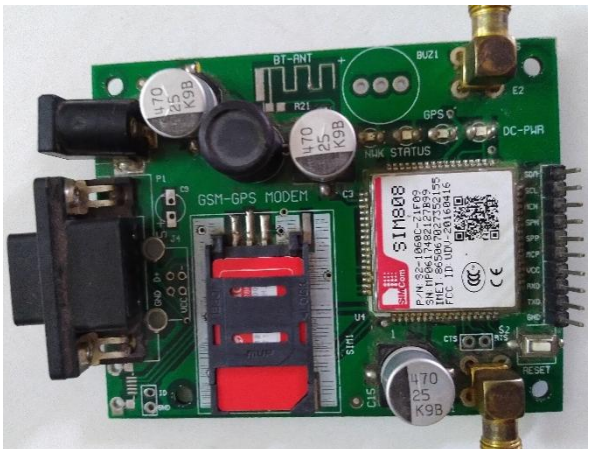

Figure 3. GPS-GSM modem SIM 808.

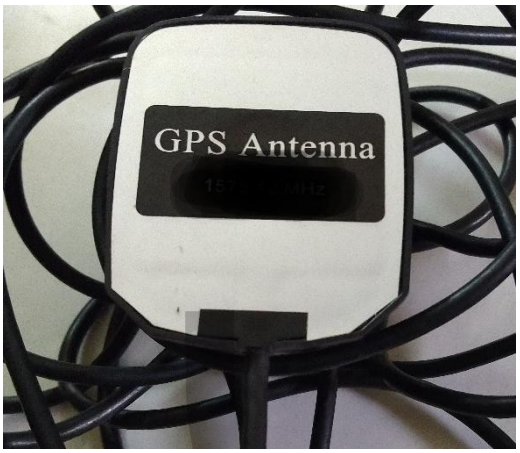

Figure 4. GPS antenna.

3.1.2. Arduino UNO:

Arduino shown in Figure 6 is a microcontroller board based on the ATmega328. It contains everything that is needed to support the microcontroller, just connect to a computer with a USB cable or power with an AC-DC adapter or battery to start. The Uno differs from all previous versions in that it does not use the FTDI USB-driver chip series. Instead, it presents the Atmega8U2 programmed as a USB-serial converter. The Arduino Uno has several facilities for communicating with another Arduino, a computer or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 1 (TX) and 0 (RX). An ATmega8U2 on communication channels aboard this series USB and appears as a virtual COM port to software on the computer.

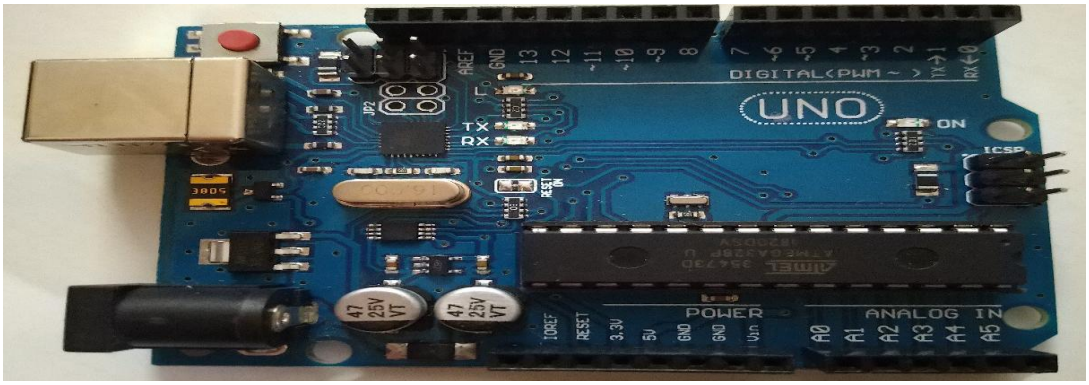

Figure 6. Arduino UNO.

The Arduino software has a serial monitor which allows data to be sent to and from the Arduino board. The RX and TX LEDs will flash when data is transmitted from the USB-Serial intermediate of the chip and a USB connection to the computer (but not for serial communication on pins 1 and 0). Software Serial Library establishes a serial communication on any of the Uno's digital pins.

3.1.3. Followed Procedure:

We need to install a GPS tracker in the vehicle needed to be tracked. The GPS tracker shown in Figure 3 provides the latitude and longitude values of the plot location by taking the GPS signal input from the

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GPS antenna shown in Figure 4. Using the latitude and longitude values in the website designed, we can have the vehicle location.

3.2. Monitoring a Vehicle:

Monitoring a vehicle is so far done only based on the location details. Now, we can monitor the surroundings and also inside the vehicle by installing the cameras to the vehicles. The camera recorded data is transferred to web using Raspberry Pi. Thus, we can monitor the vehicle and its surroundings based on the camera data.

3.2.1. Raspberry Pi:

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a TV or a computer screen and uses a standard keyboard and mouse. It is a device that allows people of all ages to explore computers and learn to program in languages like Scratch and Python. The Raspberry Pi has the ability to interact with the outside world and has been used in a wide range of digital manufacturer projects, music machines and detectors parents at weather stations and tweeting birdhouses with infrared cameras.

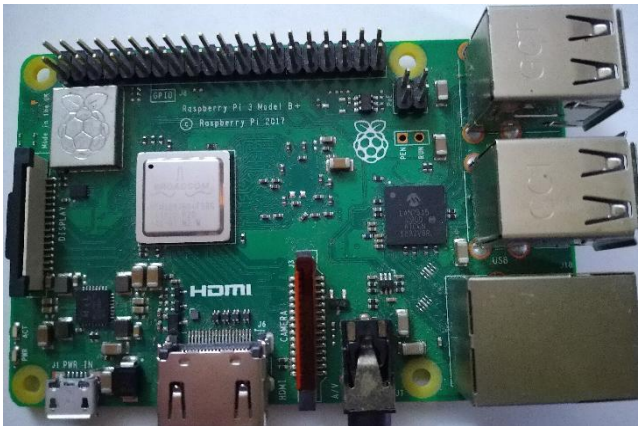

Figure 7. Raspberry Pi 3 Model B +.

Figure 8. USB Camera.

We used Raspberry Pi 3 Model B + as shown in Figure 7 for our proposed model. The Raspberry Pi 3 Model B + has a faster 64-bit 1.4GHz quad core processor, 1GB of RAM, faster dual-band 802.11 b/g/n/ac wireless LAN, Bluetooth 4.2 and much faster 300Mbit / s Ethernet.

3.2.2. Followed procedure:

The USB Camera shown in figure 8 which is used for live streaming is connected to one of the four USB ports of Raspberry Pi shown in figure 7. By installing and configuring details in the config files present in packages of camera through Raspberry Pi terminal, we can access the USB camera. The Pi is connected to a LAN network. Using the IP address of the network, we can access the live stream of the USB camera in any number of devices connected to the same network with an authorization grant.

4.Experimental Results:

The two major things that this model is concentrated at are the location of the vehicle and the live stream of a vehicle environment. Monitoring and control of the vehicle are performed using the procedures outlined above in the proposed model.

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We measure the effectiveness of monitoring on the basis of the accuracy of the location marked by the GPS tracker to the vehicle, and also in the update location every second, even when the vehicle is moving.

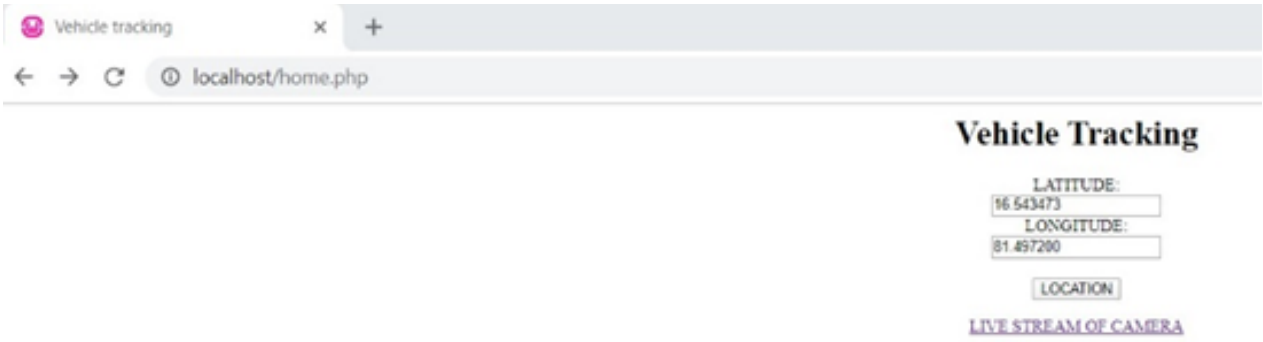

Figure 9. Vehicle Information.

The Web page shown in Figure 9 shows the coordinates of the vehicle from Arduino UNO which performs the necessary commands to the tracker device to say, SIM808 GPS-GSM Modem.

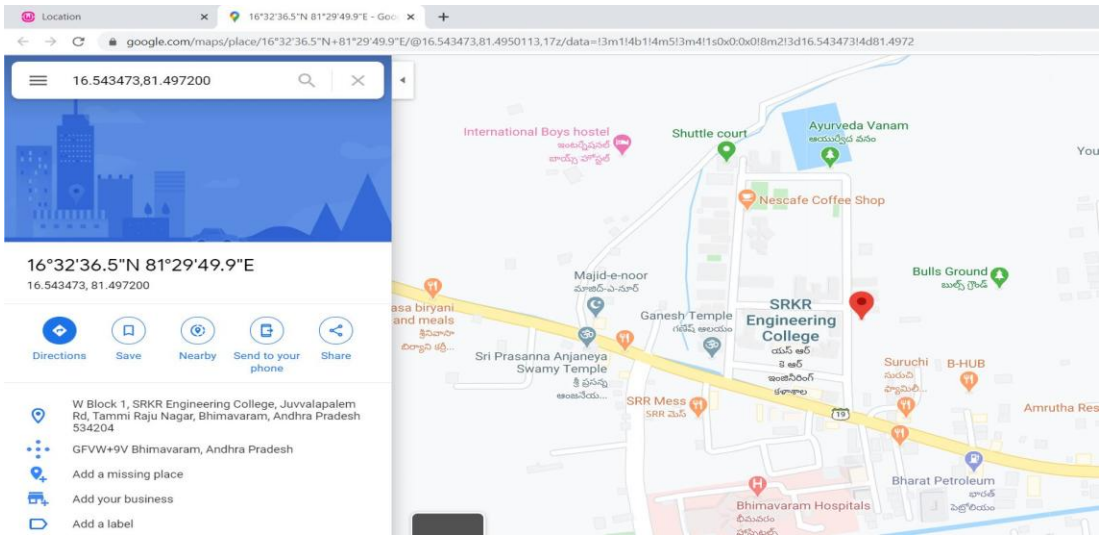

Figure 10. Location on Google maps.

Google Maps location shown on page 10 is loaded by clicking the Location button in the vehicle tracking web page shown in Figure 9.The effectiveness of monitoring a vehicle is based on the camera resolution and frame rate used to transfer the streamed data.

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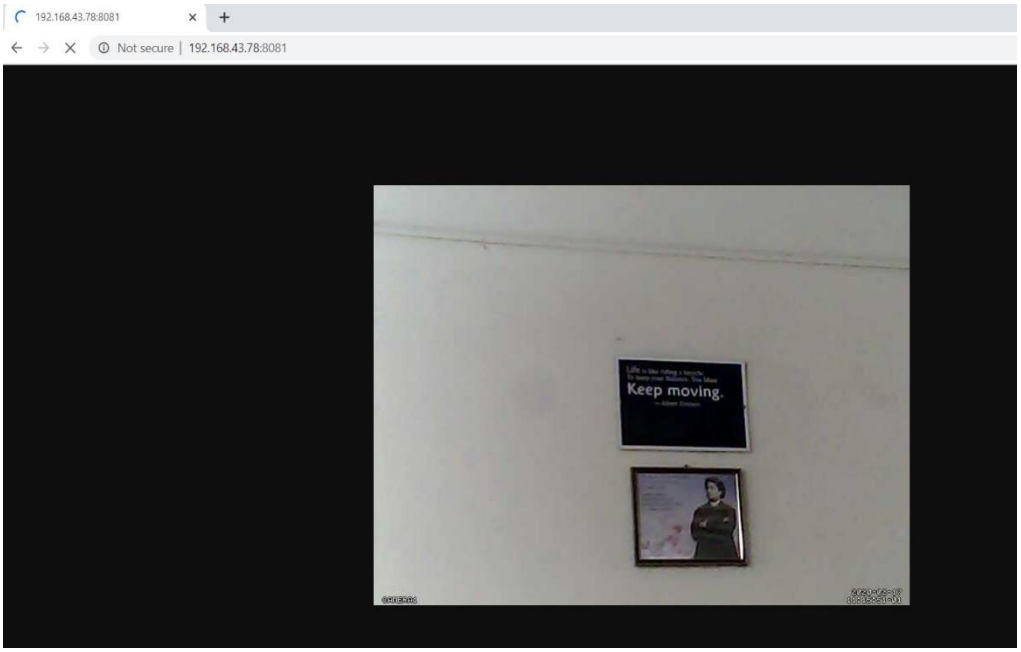

Figure 11. Snap-1 taken from the live stream from the camera.

The image shown in Figure 11 is an image captured from the live video stream of the camera connected to theRaspberry Pi displayed on a web page accessed by a private network. The Figure 11 is obtained by clicking on the live stream of camera option in the webpage of Figure 9.

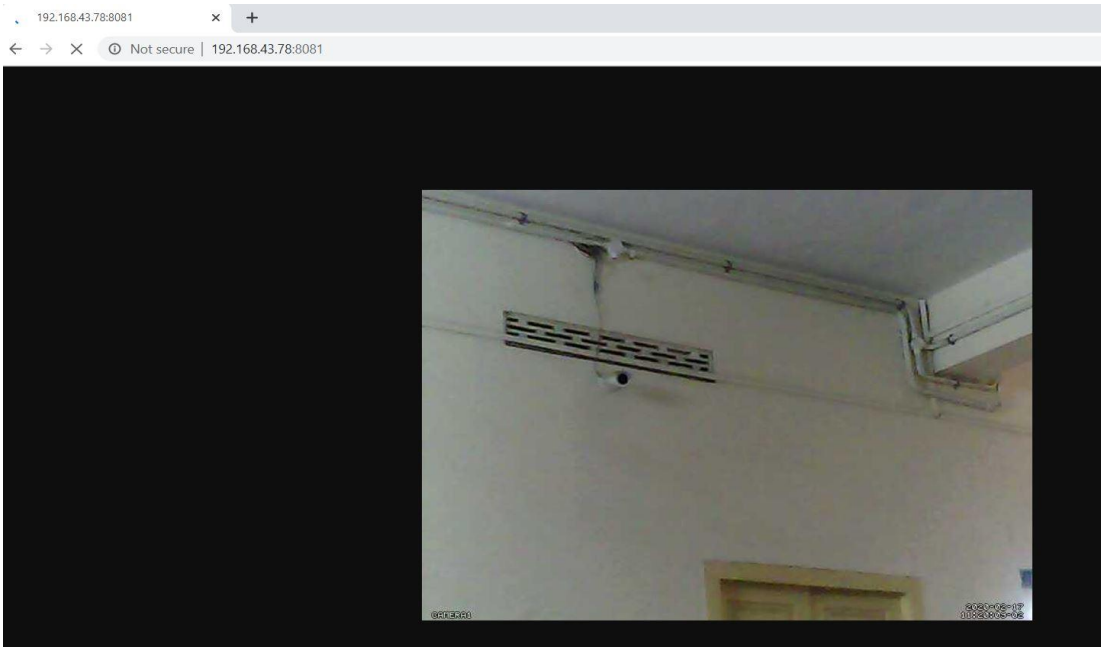

Figure 12. Snap-2 taken from the live stream from the camera.

The image shown in Figure 12 is a snap taken from the live video stream of the camera connected to Raspberry Pi displayed on a web page accessed by a private network.

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5. Conclusion:

The proposed model of tracking and monitoring a vehicle plays a good role in tracking a vehicle and also to monitor the vehicle using the cameras installed to the vehicle. This model can be employed in any organization operated under a common network to monitor its surroundings. The proposed model can be extended by deploying it to access data from any network which will play a major role in the security improvements of app-based cab services.

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