AUTOMATED TRAFFIC TRAP

Project Design

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Content

Introduction

First let me tell what this project is about. This is not a system for controlling vehicles or traffic jam. The system designed for measure the speed of the vehicles. There are systems available that have ability to measure vehicle speed. But that systems are useful when they only handling manually. Then what are the additional features that the system can offer?

Automated traffic trap is a system design which capable of snap of vehicles which are moving than allowed speed. How this progress happen is described within the document. For brief introduction, the system will be measuring speed of all the vehicles and compare each speed with speed limit at instant and find out which vehicle moves faster than allowed limit. If it so, the camera that connected will be activated and frame vehicle. (Here most important is not the vehicle but the number plate.)

The snaps will be sent to centralized server which only permit access to limited authorized persons. With the snap some important details are contained such as speed, time, venue. According to that authorities able to get the required action.

Uses.

Thought automated traffic trap system can be applied to any highways when considering with features which the system includes according to the design; it would be very beneficial when system is with express ways.

Advantages

- The system is fully automated
- Simple mechanism and low cost
- Authorities able to access the system from anywhere

Hardware

Let's get an idea on how this system works. The main function which the system offers is, measuring the vehicle speed. That is where Doppler Radar Sensor Module associates in action.

Doppler Radar Sensor Module

This sensor can detect motion or speed of moving objects through Doppler principle. It transmits a 10 GHz microwave frequency electromagnetic signal and waits for the signal to receive back and monitors the shift in frequency signal. The Doppler Effect is a shift in frequency perceived by a receiver from a signal source due to relative movement of the source.

Features

- Simple to Use an Analog Output
- Works at 5V power
- Outputs Analog data in range of 0-5V suitable for Direct ADC interfacing of any microcontroller.
- Reliable and continuous output
- Many applications for Speed Sensing of Objects and Motion Sensing
- Range around 20 meters

Web camera

The one of the features that we decided to add to system is take a photo of the vehicles that are travelling more than maximum speed. This is where the web camera comes in action.

Features

- Simple to Use
- Reliable and continuous output
- Range around 20 meters
- Can be focused

Raspberry-pi 2

Raspberry-pi is the main component that the 'Automated speed trap' system includes. That is because it connected to all other components like camera and Doppler sensor. The Raspberry-pi runs Linux operating system from a SD card and powered by a USB charger. The size, portability, cost, programmability and connectability are some of the advantages that we can achieve through this component.

Features

- A 900MHz quad-core ARM Cortex-A7 CPU
- 1GB RAM
- 4 USB ports
- 40 GPIO pins
- Full HDMI port
- Ethernet port
- Combined 3.5mm audio jack and composite video
- Camera interface (CSI)
- Display interface (DSI)
- Micro SD card slot
- Video Core IV 3D graphics core
- 5V @ 2000mA!

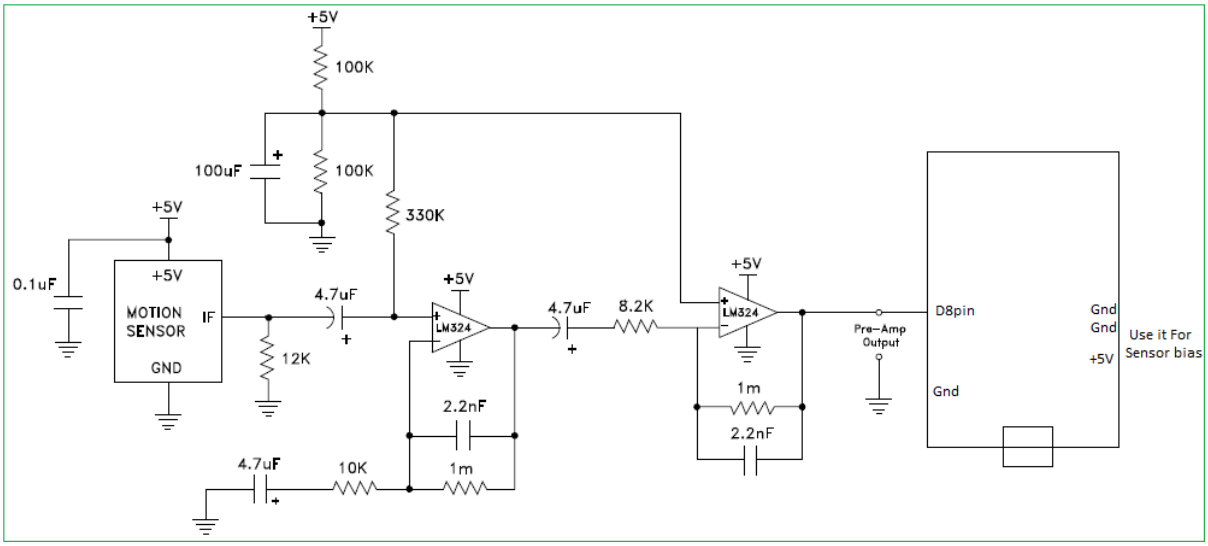
Router

The router is used to make connection between the centralized server and the raspberry pi. Via router connection to the server, the required details and snap will be sent.

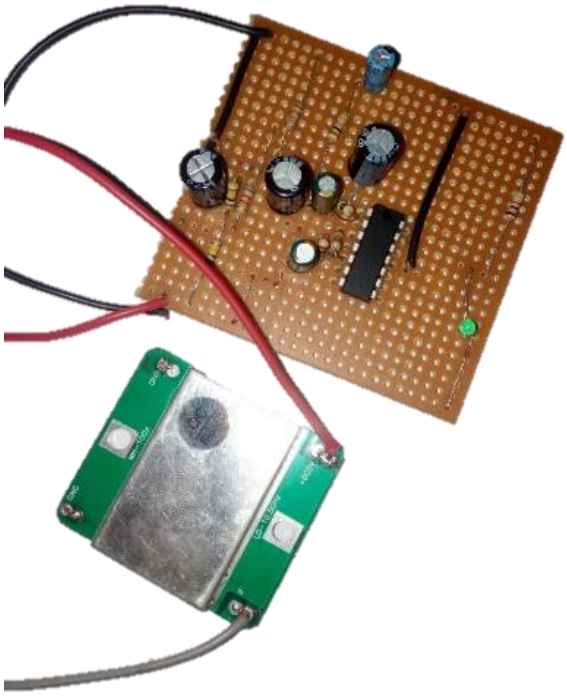
Hardware Implementation

Doppler sensor need some amplification from a circuit. That is because the output of the sensor is not enough to measure.

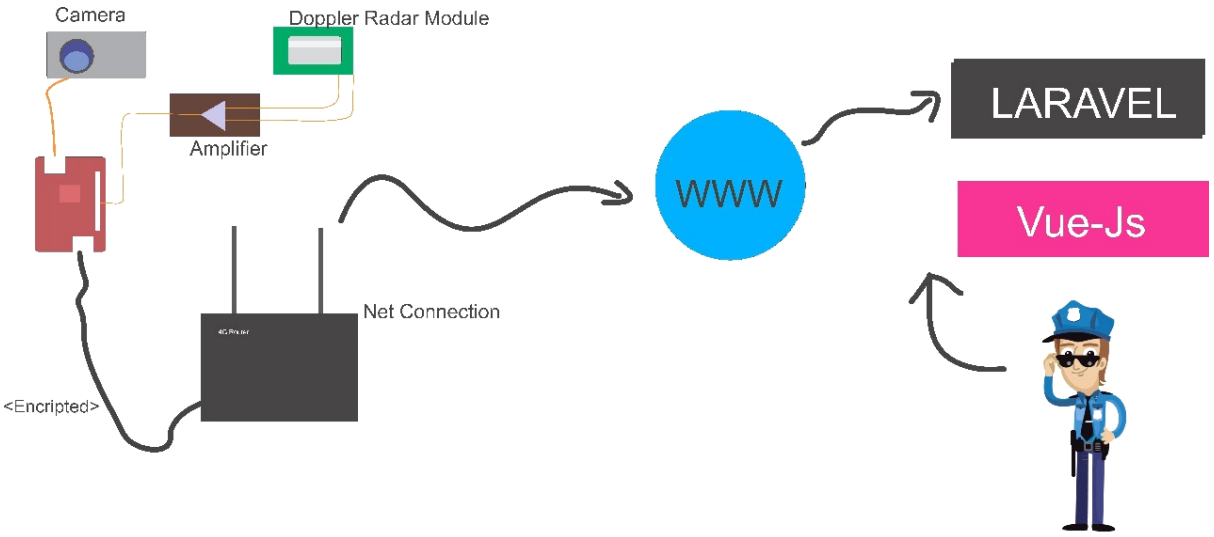
The circuit diagram of the amplification is below.



And the outcome of the implementation of the above diagram is below.



Circuit Design

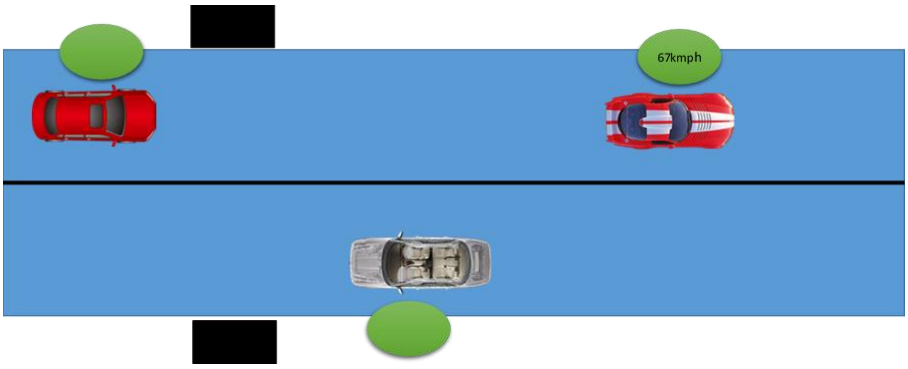


Up to now the final design is developed to build one system for one direction of the road.

Development of the system will be placed near the express ways as below. The black box shown below will be the hardware development. It contains the sensor with amplifier, the camera and the raspberry pi.

In the developed design there will be one router both system at one place and via a wired connection they will be connected.

There will be more systems lay within roads at required places and from all the points snaps will be sent to the centralized server for authorized persons to further actions.



Software

Python - To make connection Raspberry-Pi with camera, python is used

PHP

HTML

Third Party Software

Laravel - Laravel is a PHP framework that used to build the backend of the design as well as the frontend

MySQL - To store data in database MySQL is used

JavaScript

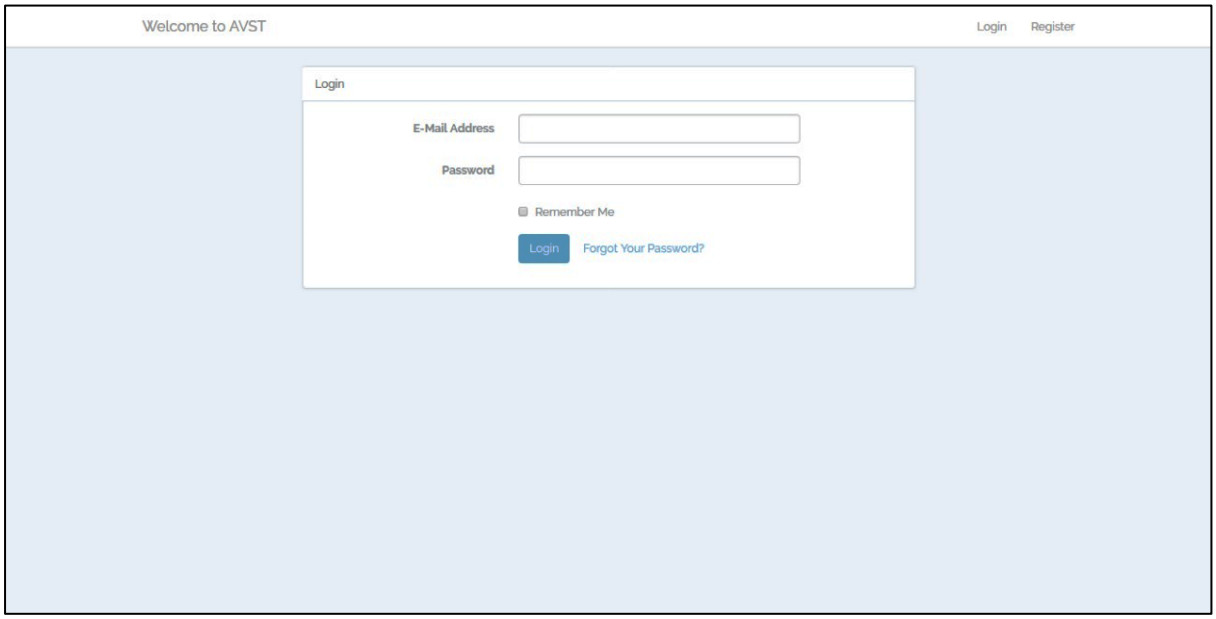
CSS

Software implementation

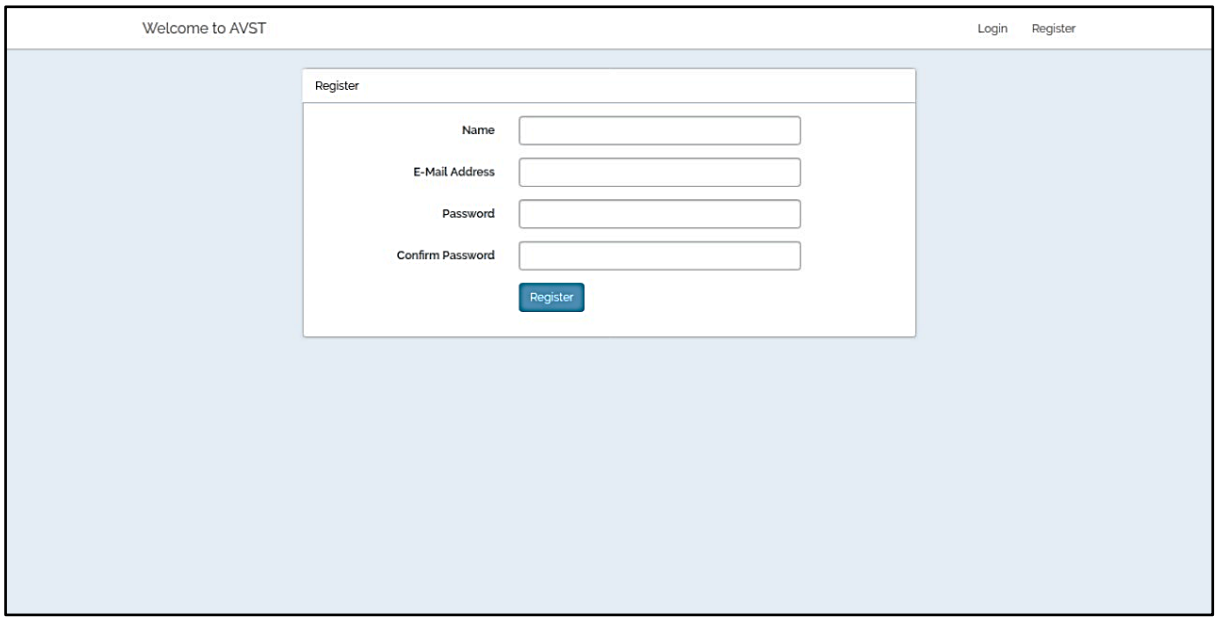
Frontend

The frontend is under construction nowadays. So far, the frontend appears as below. (Those ideas and appearance might be different when it publishes.) All the locations where the systems are going to established will be displayed in a map for better progress. The home page will be displayed day-to-day details by graphs.

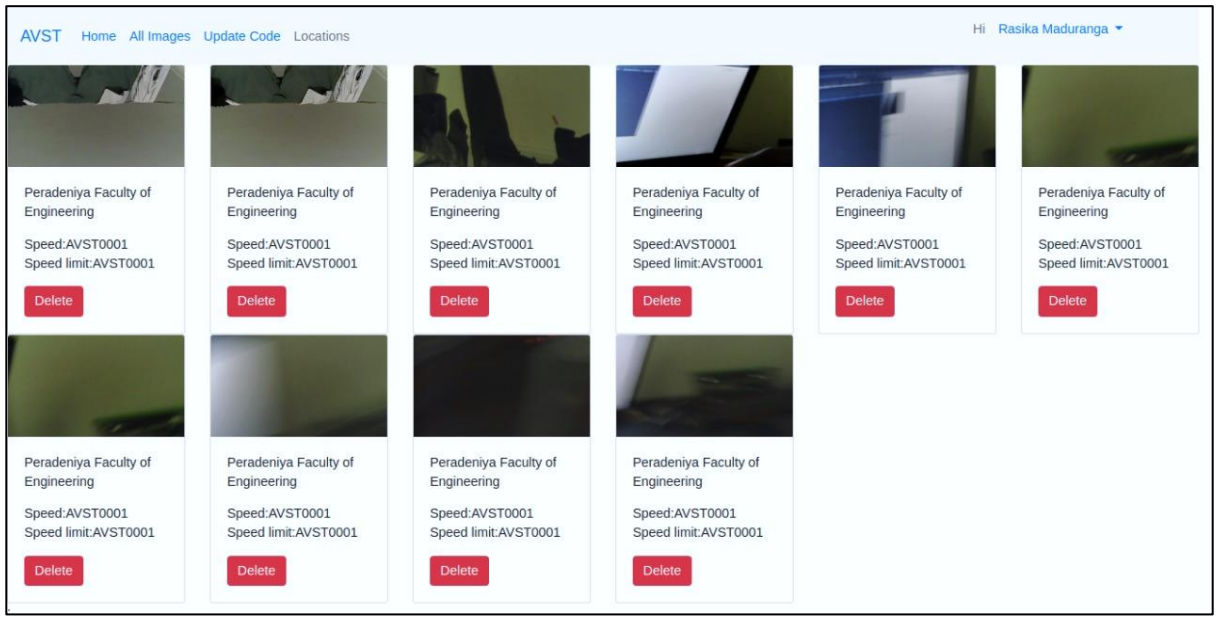
The frontend will be used by authorized person only. So, there should be a login page and it developed as below.



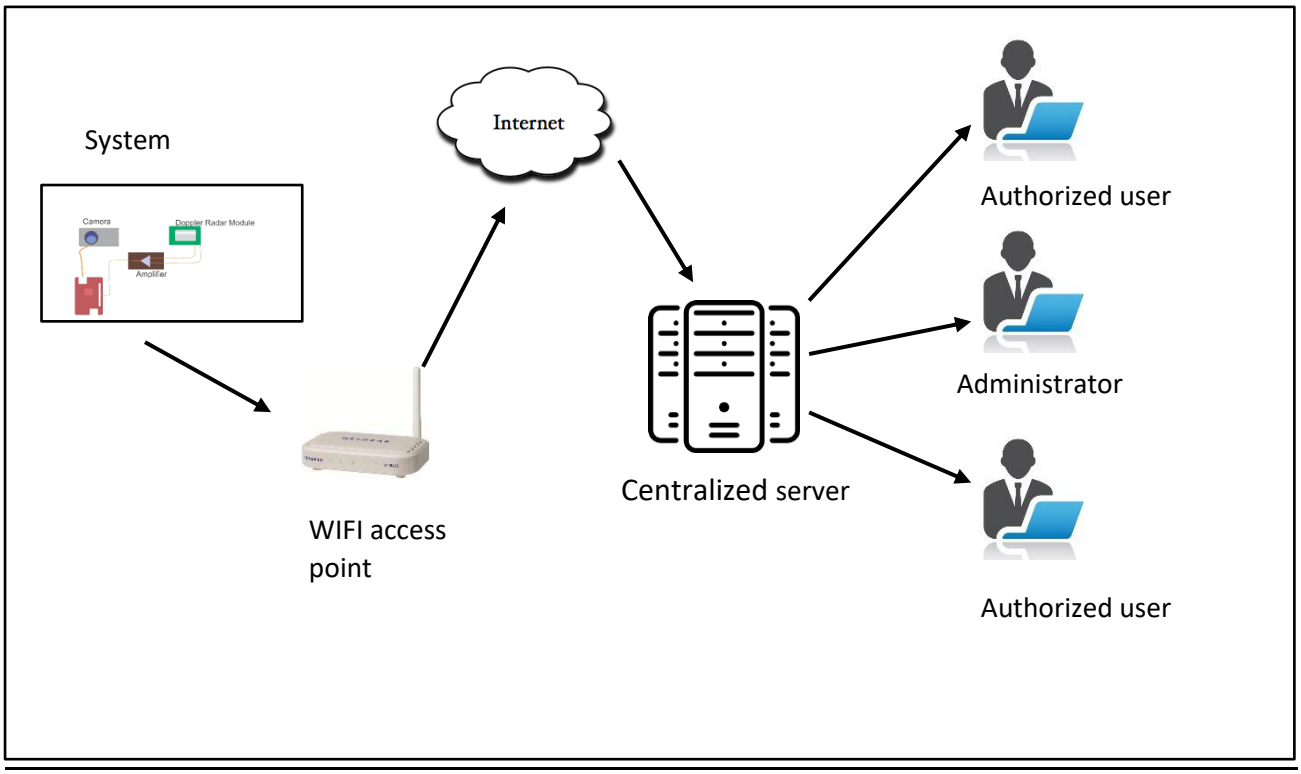
If there is a new user, he/she is required to sign-up by creating a new account and via only an administrator he/she can create a new account. That feature applied for the system because of the security reasons.



When a user logged for view snaps that will be appeared as below. The required details are display along with each snap. (The following snaps are samples that were taken for checking the progress.)



Network Diagram



Security implementation

When the system takes a photo, it will be encrypted via encrypted method and send that encryption to the centralized server with making available to authorized users.

Encryption method

The encryption key will be changed once a photo/request which sent to the server and the new key will be generated according to the data that were sent with previous photo/request. Then, raspberry pi and centralized server will be generated the key themselves. Then there won't be any key exchanges. This will be a key chain method.

This key will be differed from location to location, time to time and request to request.

Additional details (under discussion up to now)

When a system is stablished it will be marked by a unique ID. The ID will be connected with its location. When a snap is taken and send to the centralized server, it contains the details that are required. To avoid being a mess with snaps in centralized server, each snap also marked by unique ID. The ID is generated with contain system ID and the time and date. Because there won't be two images at the same time in one system.

The location (system ID), date and time, snap ID, speed of the vehicle, speed limit will be sent along with snap. By them, it might possible to apply further actions.

Automated Traffic Trap is not just a system that have ability to measure speed and take snaps. It will give more details. It will gather details about how day goes such as about busy times, traffic jams, how many snaps taken each day.

Failures

In any system there could be failures. The few failures that Automated Traffic Trap might be faced listed below.

Network Failures

There might be failures in centralized server or the router that uses. So, to face that kind of the failures there will be a storage in the system to store snap until the network comes in action.

Power Failures

Power failures are mostly common failure. So avoid the effect of the power failure, the system will contain a battery that have ability to power up the system for few hours.

Timeline

	Week													
Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Project introduction														
Project proposal														
Feasibility study and plan														
Handling hardware														
Developments with web application and hardware														
3rd milestone														
Working with remaining and adding security into system														
Completion and demonstration														

Final Budget

Item	Quantity	Price(Rs.)
USB Web Camera	1	950.00
Ultra Sound Sensor	1	275.00
Circuit Equipment		128.00
Doppler Sensor	1	531.00
Raspberry Pi 2 Model B	1	7450.00
TOTAL		**9334.00**