DEVELOPMENT OF REMOTE VEHICLE MONITORING SYSTEM FOR SURVEILLANCE APPLICATIONS

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***ABSTRACT*--** **This paper focuses on the development of a portable road side sensor system for vehicle classification, and speed measurement. Vehicle classification is done based on the vehicle length and an estimate of the height of the vehicle. Vehicle length is estimated from the product of occupancy and estimated speed. The average vertical vehicle height is estimated using ultrasonic sensors that are vertically spaced by 2 m. To calculate the speed of the vehicle with an accuracy of 95%. The developed sensor system is compact, portable, wireless, and in-expensive. Data are presented from a large number of vehicles and different type of vehicles are passed in the roadside. To the types of vehicle and speed of the particular vehicle is displayed in the display unit. Finally, the remote monitoring system is used in Lab-VIEW.**

Keywords: vehicle classification, vehicle speed measurement, vehicle height, Display unit.

I) INTRODUCTION:

This paper describes a portable sensing system that can be placed adjacent to a road and can be used for vehicle counting, vehicle classification, and vehicle speed measurements. The proposed system can make these traffic measurements reliably for traffic in the lane adjacent to the sensors. The developed signal processing algorithms enable the sensor to be robust to the presence of traffic in other lanes of the road.

Vehicle classification into pre-defined classes such as cars, trucks, and tractor trailers typically requires measuring the size or length of vehicle. Classification model based on feature extraction from piecewise slope rate values in single loop inductive signature data was pursued in and classified vehicles into 15 classes. However, the accuracy rate is not 100% and can vary from 40% to 100%, depending on the amount of "problematic" data present in the sensor readings and the class of vehicle under consideration. Finally, the traffic remote monitoring system used in LabVIEW.

II) PROPOSED SYSTEM:

In the proposed system we use ultrasonic transmitter and receiver for sensing the vehicle. The controller used here is AT mega 128 microcontrollers which has more memory and five ports which has capability of performing multitasking. ZigBee module is used for the transferring of information to control section as shown.

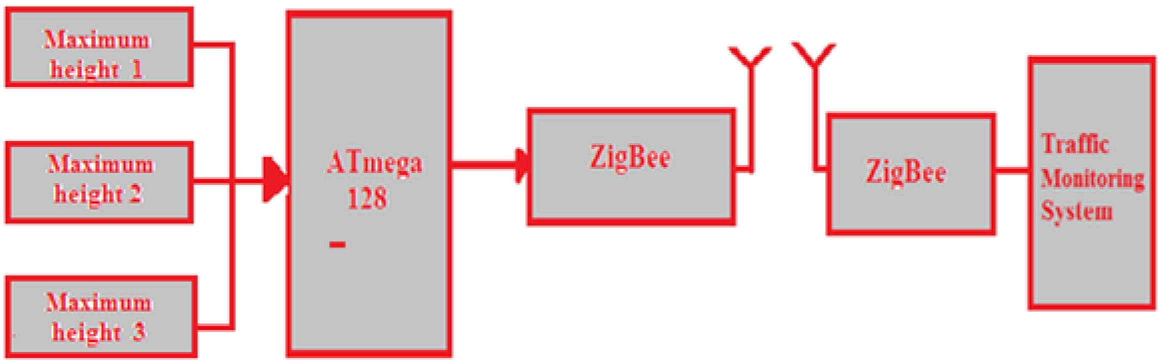


Figure 1: Block Diagram of Proposed System

VEHICLE DETECTION:

As stated above, because the environment of a moving vehicle greatly varies, it is so difficult to detect vehicles using a single feature or pre-established vehicle templates. Although we use various features or templates for various environments, we must apply the appropriate algorithm to the current environment and these may be any obstacles to implement the real-time processing system. In this paper, we first divide the environment into two conditions by the intensity of illumination and apply a proper algorithm for each.

1)Start the operation for ultrasonic sensor

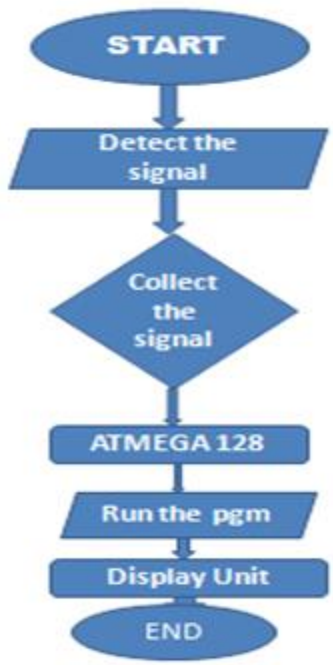
2)Detect the signal.

3)Collect the different data's

4)Run the program.

5)Displaying the data unit

6)End the program.



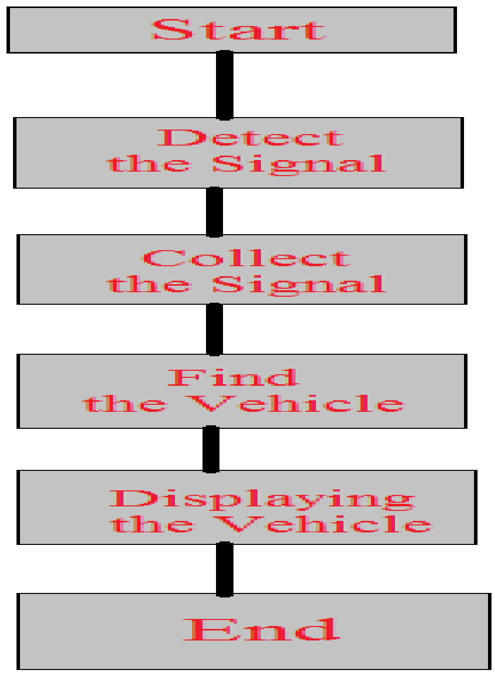


Figure2: FLOW CHART FOR VEHICLE CLASSIFICATION

Figure3: Flowchart of Car Classification

SENSOR AND MEASUREMENT SYSTEM:

Figure 4: ULTRASONIC SENSOR

FEATURES:

• Supply Voltage – 5 VDC

• Supply Current – 30 mA type; 35 mA max

• Range – 2 cm to 3 m (0.8 in to 3.3 yards)

• Input Trigger – positive TTL pulse, 2 us min, 5 as typ.

• Echo Pulse – positive TTL pulse, 115 up to 18.5 MS

• Echo Hold-off – 750 as from fall of Trigger pulse

• Burst Frequency – 40 kHz for 200 as

• Burst Indicator LED shows sensor activity

OBJECT DISTANCE MEASUREMENT:

This is done in two parts. The first part consists of taking visual information of the object. We are using a camera to take images and we would use various image processing techniques to extract the object from the image. The second part consists of taking the range information of the object. We are using an ultrasonic sensor for this job. For a fixed field, the horizontal and vertical distance the camera can see is constant at a particular distance. If the angle of vision is known, then we can find the area if we know the distance. Obstacle avoidance is the task of satisfying the control objective subject to non-intersection or non-collision position constraints. Normally obstacle avoidance involves the pre-computation of an obstacle-free path along which the controller will then guide a robot. Though inverse perspective mapping helps to find the distance of the objects far

away from the car with the help of known camera parameters and generating a model but it takes more computations

INFRARED BASED OPTICAL SENSOR:

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. Infrared light is a small part of the light spectrum. In order to understand night vision, it is important to understand something about light. The amount of energy in a light wave is related to its wavelength: Shorter wavelengths have higher energy. Of visible light, violet has the most energy, and red has the least.

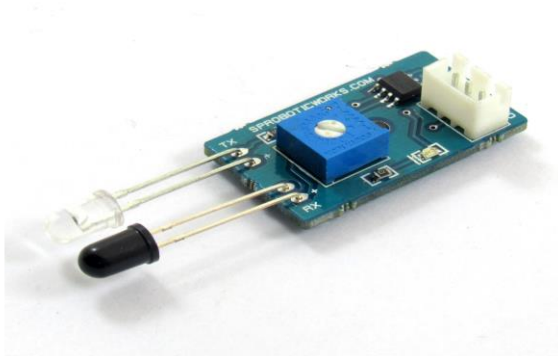


Figure:5 INFRARED SENSOR

Working of IR LED Sensor is followed by four types,

1. IR LED work similar to normal LED
2. IR LED Transmit an Infrared light
3. IR light is not visible to necked eye
4. IR Light detected by Photodiode

IR sensor it consists of the two types are,

1. Digital IR Sensor
2. Analog IR Sensor

6.2.1: Digital IR Sensor:

Digital IR sensor is digital. It presented High or Low Value (1’s and 0’s)

6.2.1: Analog IR sensor:

Analog sensor detection depends on intensity of light received.

DATA ACQUISTION SYSTEM:

An Arduino is connected to the Ultrasonic Sensor. An ultrasonic sensor is calculated to distance measurement in cm. After the process of the given data s are collected to the storage unit. The ultrasonic sensor which may be collected data are passed to the AT mega 128 processors.

SENSOR MODULE is,

1) Ultrasonic sensor HC-SR04 is used here to measure distance in range of 2cm-400cm with accuracy of 3mm. The sensor module consists of ultrasonic transmitter, receiver and the control circuit. ...

2) Distance= (Time x Speed of Sound in Air (340 m/s))/2.

3) Timing Diagram.

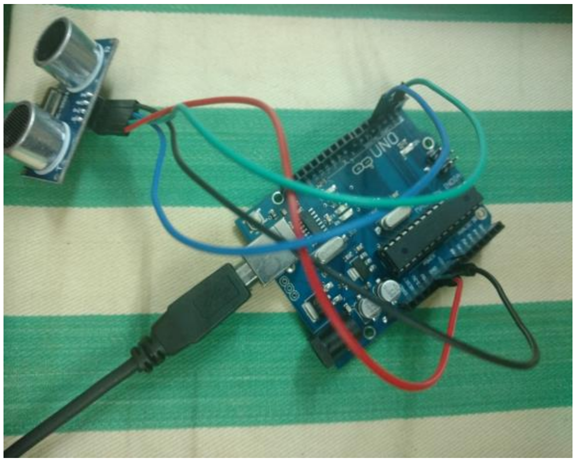


Figure:6 Ultrasonic Sensor interface to the Arduino

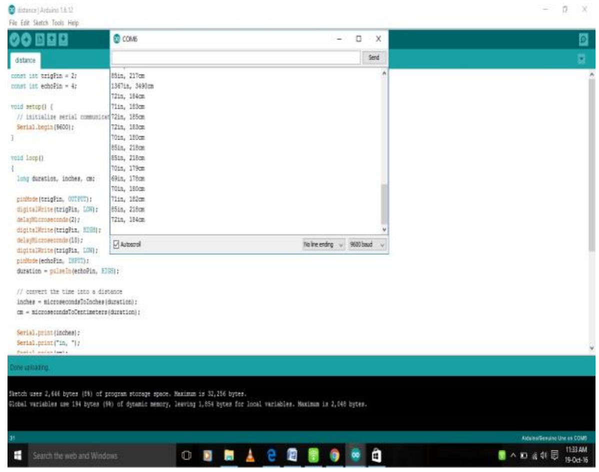


Figure:7 Testing outputs for ultrasonic sensor

Figure 8: Sensor placement of Road Lane

To the waveform generation of the distance measurement is calculated to the levels of the plot levels are shown in the figure. It’s a standard IR sensor for obstacle detection and line detection purposes. The Sensor is provided with a potentiometer for calibration and comes with an added advantage of selecting analog or digital output. The solder jumper setting for output selection is available on the bottom side.

1)TREE BASED ON NEURAL NETWORKS:

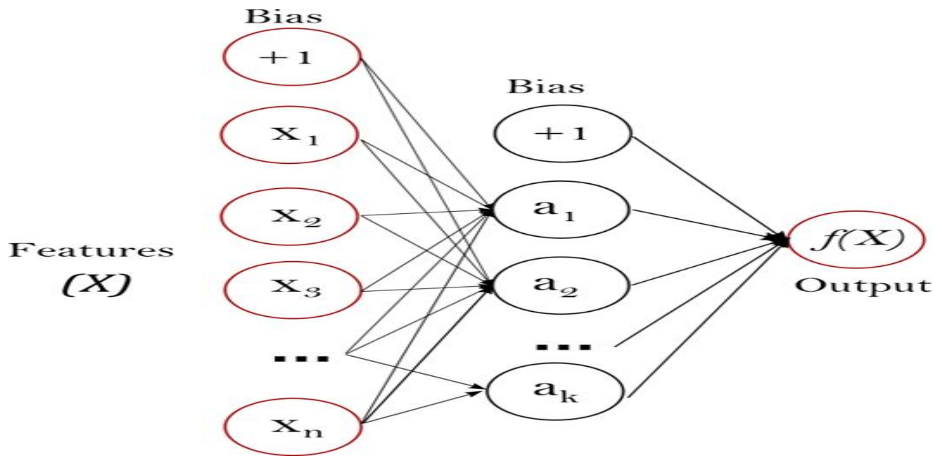


Figure 9: Tree based algorithm using vehicle classification

HARDWARE RESULTS:

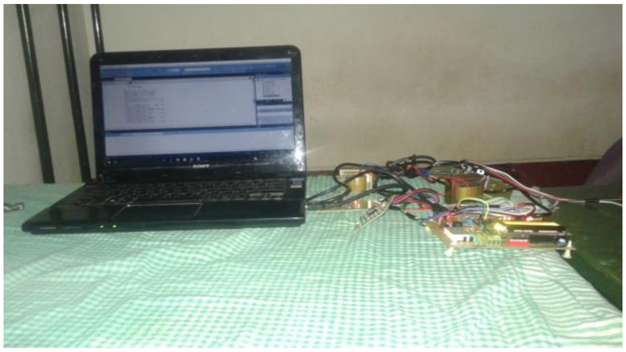


Figure: 10 Ultrasonic Sensor Interfaced to AT mega 128

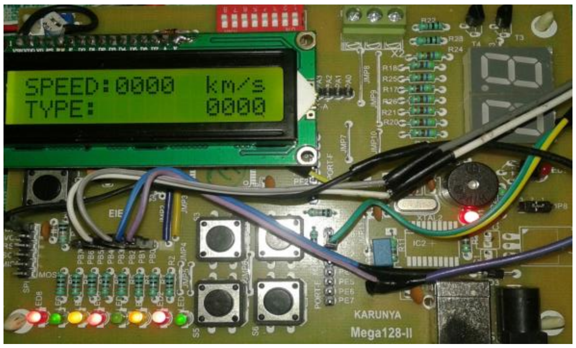


Figure 11: Initialization of LCD

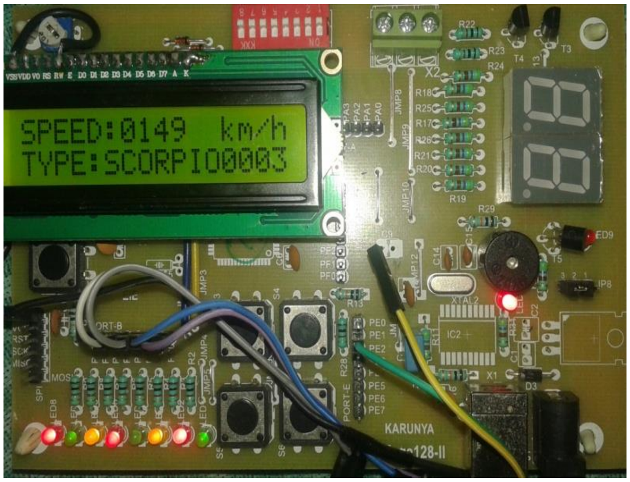


Figure 12: Scorpio Detection and Speed Monitoring

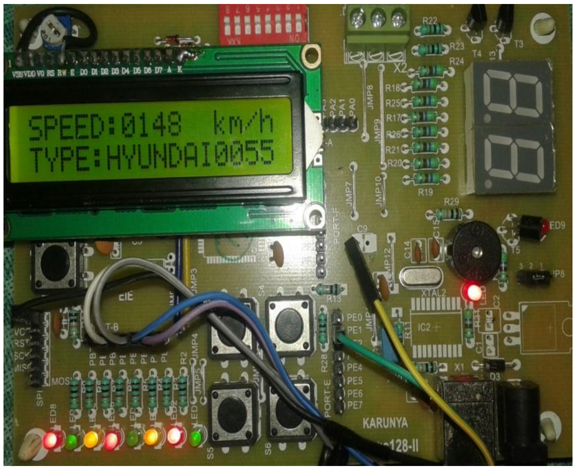


Figure 13: Hyundai I 20 Detection and Speed Monitoring

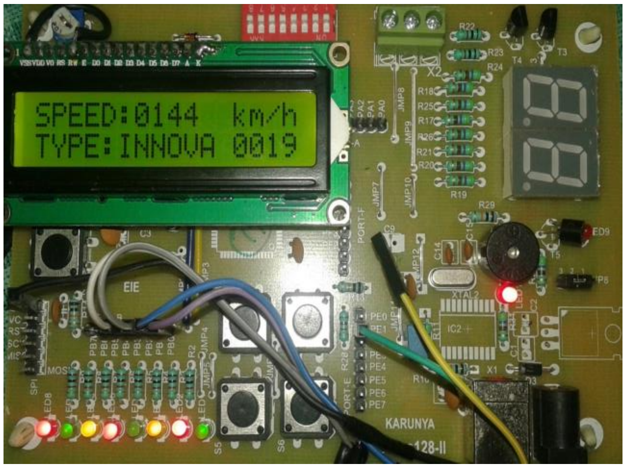


Figure 14: INNOVA Detection and Speed Monitoring

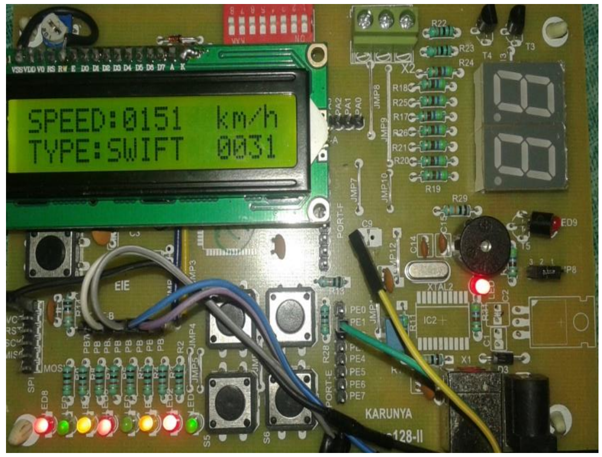


Figure 15: SWIFT Detection and Speed Monitoring

Figure 16: Height Calculations of SCORPIO

figure 17: Height Calculation of HONDA CITY

figure 18: Height Calculation of SWIFT

figure 19: Height Calculation of HYUNDAI i10

SOFTWARE RESULTS:

Finally, the displaying output will be displayed from the display unit, but ZigBee unit will be used in transmitted and receiving unit. As the formation of the power supply will have passed on the 6volt battery source will connect to the transmitted and receiving unit. A supply power voltage is connected to the capacitor level of the positive and negative branch of the module. The Lab-VIEW are displaying to the front panel of an experiment and the block diagram will be plotted to the block diagram slide will be used in the several documents. To the several documents of the LabVIEW results are displayed to the displaying unit.

To the LabVIEW result will be displayed from the collected different data are passed to the hardware unit but select the one data of the maximum value of three values are collected after the process of the vehicle name will be displayed the displaying unit.

For example, of one Ultrasonic sensor will be placed on the road side. Sensor will be turned on from the power supply. Power supply will be going on the 6volts from the transmitting and receiving end of the hardware unit.

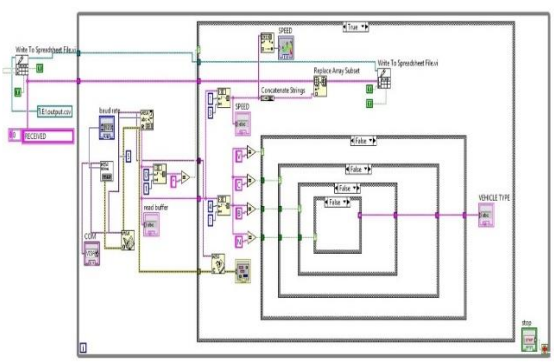


Figure20: Lab VIEW based data acquisition system

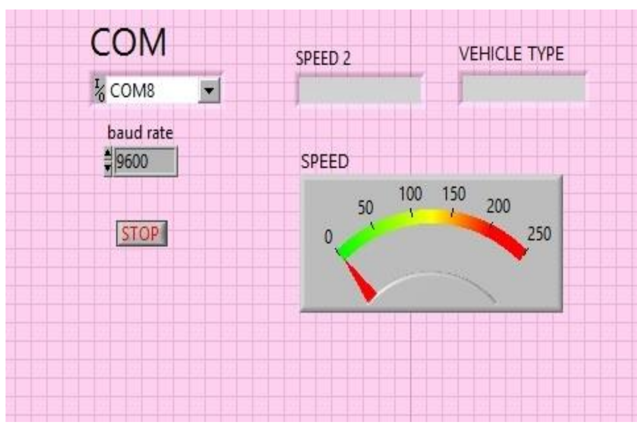


Figure21: Initialization of lab VIEW in Front panel

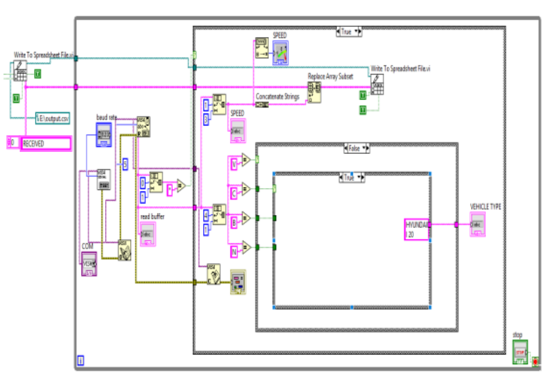


Figure22 Lab VIEW results of Hyundai i10 of block diagram

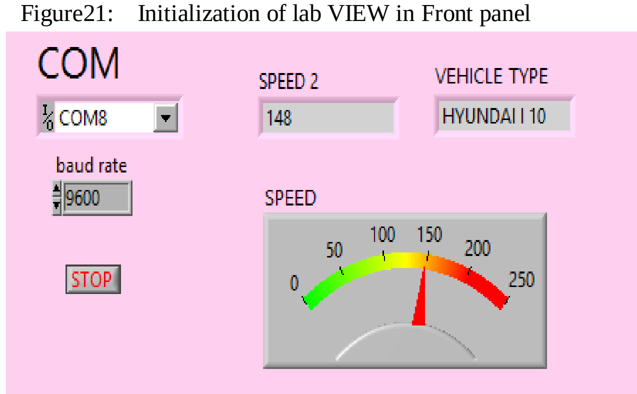
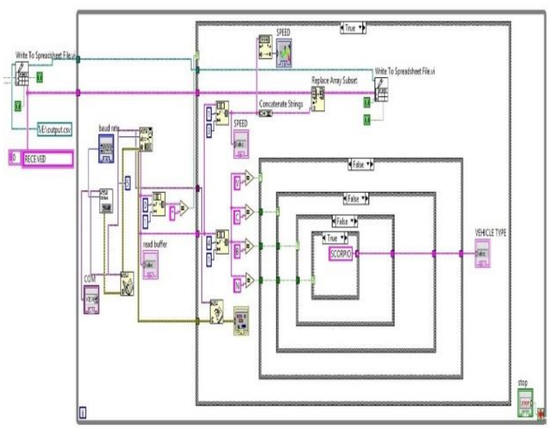


Figure23: Lab VIEW results of HYUNDAI I 10 front panel

Table 1: Sensor readings for Low End and High End vehicles

S.NO	CAR TYPE	LOW END (cm)	High END (cm)
1	SWIFT	28	32
2	HYUNDAI I 10	50	55
3	SCORPIO	2.6	4.6
4	INNOVA	18	22



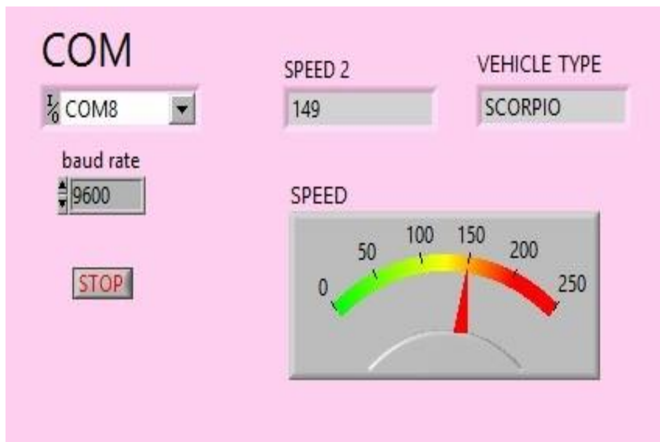
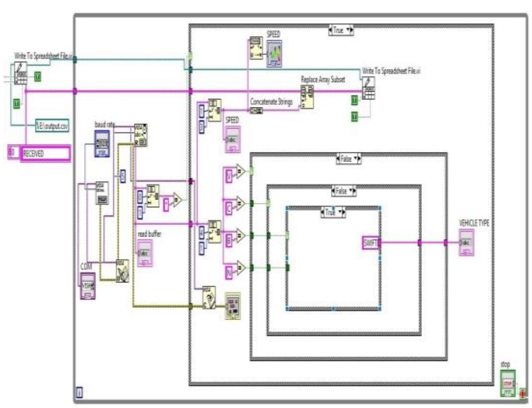


Figure24: Lab VIEW results of SCORPIO in Block Diagram

Figure25: Lab VIEW results of SCORPIO in front panel



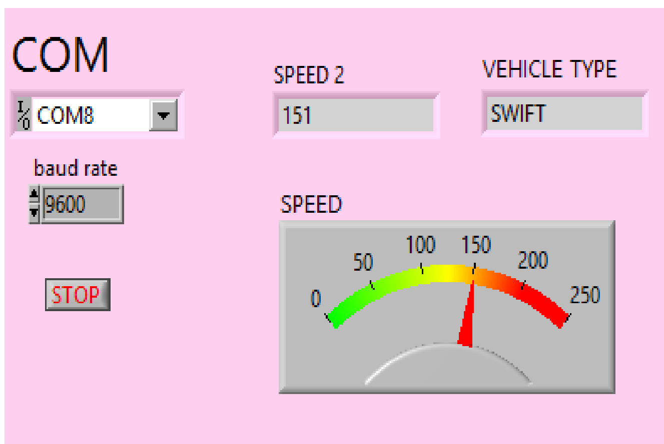


Figure26: Lab VIEW results of SWIFT of block diagram

Figure27: Lab VIEW results of SWIFT of front panel

S.NO	CAR TYPE	LOW END (cm)	High END (cm)
1	SWIFT	172	168
2	HYUNDAI I 10	150	145
3	SCORPIO	197.4	195.4
4	INNOVA	182	178

Table 2. Calculated height of the vehicle

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Types	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	HYUNDAI I20	129.54	131.65	134.12	134.87	135	136.23	137.76	145.32	145.87	146.23	146.87	147.27	147.3	147.4	147.4	147.4	147.4	146.96	146.93	146.93
3	BALENO	128.9	128.5	129.15	130.14	132.6	134.6	136.87	137.98	141.74	143.56	145.76	146.77	146.8	147	147	147	143.34	143.12	143	143
4	SKODA OCTAVIA	127.3	129.4	133.12	134.22	136.34	137.1	137.43	143.91	143.93	144.74	145.12	145.43	145.54	146	146.34	134.34	134	132.43	128.23	128.23
5	SWIFT DZIRE	127.67	128.43	129	129.32	135.22	137.32	145.23	146.34	148.43	148.87	148.89	149.11	149.22	149.5	149.5	149.5	138.23	137.435	134.65	134.65
6	INNOVA	139.33	142.11	146.35	147.11	147.53	148.63	171.89	172.32	172.44	173	174.11	174.23	174.87	175	175	175	175	174.82	173.33	173.33
7	SCORPIO	156.44	157.33	157.75	158.45	158.92	159.92	162.34	167.48	178.34	179	183.44	188.33	193.33	198	198	198	198	198	188.22	188.22
8	NISSAN SUNNY	126.82	127	127.34	127.43	134.77	135.11	135.34	148.11	148.23	149.234	150.12	151	151.11	151.5	151.5	151.5	146.37	143	139.23	139.23
9	SKODA RAPID	125.24	126	127.23	133.24	133.45	134.23	143.34	144	144.34	145	145.23	145.64	146	146.1	146.1	146.1	129.11	128.43	127.66	127.66
10	AUDI A1 SPORT	125.12	125.87	126.34	126.77	135.99	136	136.99	137.26	138.12	138.35	139.98	140.38	141.63	142.2	142.2	142.2	142.2	132.77	129.44	129.44
11	SKODA FABIA	126.35	128.45	137.241	140.6	141.1	141.34	142	143.11	143.43	143.67	144.12	144.43	144.75	145.2	145.2	145.2	145.2	145.2	142.44	142.44
12	HONDA JAZZ	124.6	124.87	125.87	126.34	126.56	126.78	136.99	137.56	139.33	139.64	143.67	147.64	149.87	152.5	152.5	152.5	148.33	147	146.99	146.99
13	HONDA CIVIC	127.77	130.33	132.66	133.55	134.34	134.87	135.65	141.76	142	142.42	142.63	142.76	142.8	143.4	143.4	143.4	132.33	132.11	130.44	130.44
14	VOLKSWEGON POLO	125.34	127.5	133.56	136.65	137.23	137.3	138.76	144.45	144.76	145.2	145.8	146.14	146.2	146.2	146.2	146.2	146.2	146.2	146.2	146.2
15	HYUNDAI I10	129.87	131.45	132.54	132.98	133.88	134.56	135	135.78	139.56	142.98	147.8	148.22	149.7	150	150	150	150.3	150.5	150.7	150.7

TABLE3: COLLECTED DATA

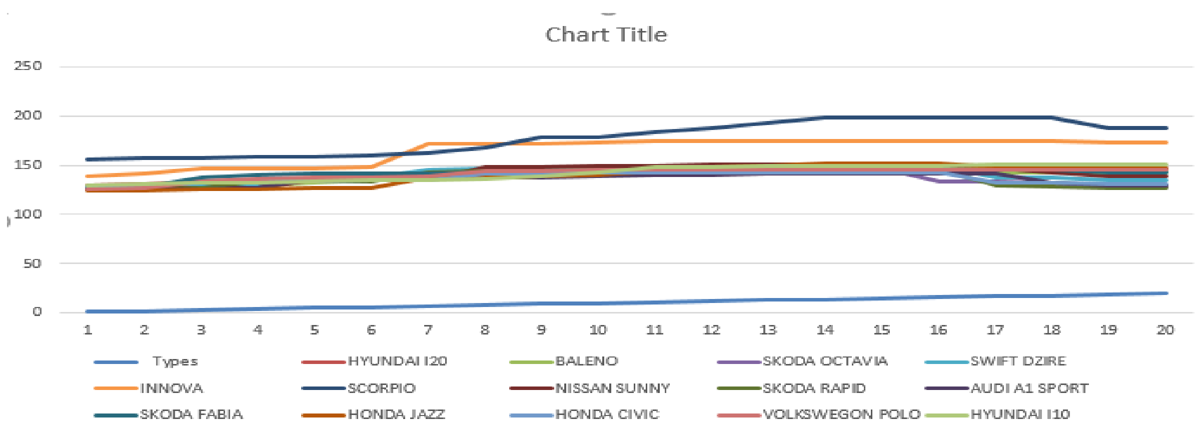


Figure 28: Waveform Generation

Advantages:

- The developed sensor system is
  - Compact,
  - Portable,
  - Wireless.

Applications:

- Used to monitor the number of vehicles passing in the road which can be used for the survey.
- Used to determine the density of vehicle and helps to control traffic problems and it can be used as a reference to the Government for building Bridges.
- Used to measure the speed of the vehicle in order to avoid accidents. By using smoke sensor traffic light control system can also be included

CONCLUSION:

This paper has proposed a portable and low-cost sensing system based on an ultrasonic sensor that can be placed adjacent to the height of the road and be used for traffic speed measurement, and vehicle classification in the lane adjacent to the sensors. The vehicle classification and speed measurement in this paper are enabled using multiple sensors are used. Through experimental data from 188 vehicles, it is shown that the traffic levels accuracy of the system is 99%.

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