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Vehicle Classification and Speed Measurement using IR Sensors

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Abstract:

Wireless Sensor network is a looming technology and has great potential to be employed in critical situations. The development of wireless sensor networks was originally motivated by military applications like battlefield surveillance. Wireless Sensor Networks are used in different areas such as Civilian, Health, Industrial, Habitat Monitoring, Environmental, Military, Home and Office applications. Detection and tracking of targets (e.g. animal, vehicle) as they move through a sensor network has become an increasingly important application. This project deals with the Vehicle classification and speed measurement using IR technology. Vehicle classification is done based on the length of the object (e.g. Vehicle). When Heavy vehicle is detected it is not allowed to take right turn if it turns right then sensor indicates that vehicle had entered into a restricted region. The device is interfaced with ARM Microcontroller and Keil uvision4 software is used. Modeling can be done with other software's.

INTRODUCTION:

Traffic congestion and associated effects such as air pollution pose major concerns to the public. Congestion has increased dramatically during the past 20 years in the major cities of India (Mumbai, Delhi, and Kolkata). During this time, the number of hours lost each year by a driver to congestion has increased by 300 percent. In the larger cities, drivers now spend almost eight working days each year stuck in traffic [1, 2]. Increasing the capacity of the roadways is expensive and, in some areas where land is small, is not possible. Improving the efficiency of the transportation system through the implementation of advanced technologies may ease traffic congestion and decrease the vehicle crash-related rate. One of the most important components of this approach in Real-time is traffic surveillance.Traffic congestion may become ease by improving the efficiency of the current transportation

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system through the implementation of advanced technologies. Emergency management agencies such as police, ambulance, and fire stations may also benefit from realtime traffic information in routing the vehicles through the transportation network to save the lives of people. Safety in roadways and efficiency will be significantly enhanced by employing communication technologies capable of providing scalable,low-cost, and distributed data acquisition of road conditions and remote sensing. Such Intelligent Transportation System applications require distributed acquisition of different traffic metrics such as traffic density,speed, and volume.

As transportation system has become intelligent with the rapid rise in traffic demand in these years, applying ITS technology becomes the fundamental measures to make use of the existing transportation infrastructures scientifically and reasonably. Vehicle detection and classification technology is an important component of ITS, which provides initial and required information of the traffic for ITS. Current researches on vehicle detection systems mainly focus on the video camera and the induction coil sensor.

However, compared with these devices the magnetic sensor has better prospects owing to its advantages such as convenient installation, weatherproof working ability and easy maintenance etc. In this research, a single-point magnetic sensor which integrates double detection unit is put into use because of its small size, good detection capacity and low cost. In recent times many scholars at home and abroad have carried on researches about vehicle classification and speed measurement based on magnetic sensor. Currently, research on vehicle classification using magnetic sensor has been developing a little slower because of low classification accuracy and immature application on vehicle identification.

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BLOCK DIAGRAM OF THE PROPOSED SYSTEM:



Hardware Components and their working LCD:

Liquid crystal display is used for displaying the data provided when interfaced with the micro-controller. The data can be sent to LCD in two ways. One way is transmitting the data in 4 bit mode and other is in 8 bit mode. For this project i have used the LCD in 4 bit mode. LCD used here is a 16X2 display which means 2 lines and 16 characters for each line. The first line of LCD starts at an address 0X80 and for each character entered the address is incremented and similarly second line starts with an address 0xc0 and here also for each character the address is incremented. LCD is having modes, one is command mode for informing to it that it is an instruction and the other is a data mode for data to be displayed. Similarly many instructions or commands are required for interfacing LCD in a suitable manner. For this project i have used the LCD in 2 lines with 4 bit data mode. In the first line, first character i.e; at address 0X80 the sensor at Point is indicated by P1 and at address 0X85 the sensor at Point is indicated by P2. Points P1 and P2 are used for vehicle classification. Similarly at address 0X8D the count of number of vehicles will be displayed.

ZIGBEE:

Zigbee is mainly required for transmitting the data over long distances. In Real time applications, that is in traffic monitoring a camera is fixed at the top of signal indicator to check who is skipping the signal and the one who is monitoring in another location.

Volume No: 3 (2016), Issue No: 5 (May) www.ijmetmr.com So taking this as an example i had taken the zigbee to get the data from the microcontroller and display on the monitoring screen.

IR SENSOR:

Infrared region is next to visible light in the electromagnetic spectrum which is having a wavelength range from 2,500 to 16,000 nm, and frequency range is from 1.9*1013 to 1.2*1014 Hz.Infrared sensor is an electronic device, that emits light in order to detect the presence of some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion of the object. These type of sensors measures only infrared radiation, rather than emitting it. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, which can be detected by an infrared sensor. The emitter contains an IR Light Emitting Diode and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When Infrared light falls on the photodiode or detector, output voltage and the resistance changes in proportion to the magnitude of the IR light received.In this project an IR Sensor is used whose range is up to 2feet. A total of 6 IR Sensors(transmitter and Receiver) are used,two for classifying the type of vehicle and two for detecting whether it has taken a lefty turn or a right turn and finally the remaining two are used for measuring the speed of a vehicle. The voltage provided for IR Sensors here is a 5v to the transmitter. When Vehicle is not detected the voltage across the receiver is 0v and when vehicle moves over the sensors the signal is reflected back on to the receiver and as a result the voltage across the receiver increases to 3v.

KIT WORKING:

Initially when power is supplied to the sensor circuit, the LCD is ON and the required supply will be provided to the IR Sensors. Two Points P1 and P2 are used to detect the Vehicles and classify them. When Vehicle passes through the IR Sensors at P1 it detects them and when the Vehicle crosses the IR Sensors at P2 it checks the status at P1 and if Vehicle is still present at P1 it indicates that the vehicle is Heavy Vehicle. If it is not present at P1 it indicates that it is a normal Vehicle and their corresponding data is available at the microcontroller. Using ARM lpc2148 data it is displayed on LCD.

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Again IR Sensors used at turns are used to indicate whether the Vehicle has taken Right Turn or Left Turn. If the Vehicle is detected at LT then IR Sensors indicates that the Vehicle has taken Left Turn, if it is detected at RT then IR Sensors indicates that Vehicle has taken Right Turn. The Normal Vehicle can take any one of the two directions but the Heavy Vehicle cannot take right turn else a warning message will be displayed.

Flowchart for implementing the proposed pa-



The values read at both points of transmitter and receiver when no vehicle is detected is:

S.no	Time(in	Volt	tage	Voltage	
	Sec)	acr	oss	across	
		Transn	nitters	Receivers	
		(in	V)	(in V)	
		P1	P2	P1	P2
1	0	3.64	3.64	0	0
2	10	3.64	3.64	0	0
3	20	3.64	3.64	0	0
4	30	3.64	3.64	0	0
5	40	3.64	3.64	0	0

The values read at both points of transmitter and receiver when no vehicle is detected is:

S.no	Tim	Voltage		Voltage		Total	Speed
	e(in	across		across		Voltage	Measured(
	Sec	Transmitter		Receive		(in V)	in m/sec)
)	s (in V)		rs (in			
					V)		
		P1	P2	Р	P2		
				1			
1	0	3.64	3.64	0	0	7.28	0
2	10	3.64	3.64	3	0	10.28	95
3	20	3.64	3.64	3	3	13.28	70
4	30	3.64	3.64	0	3	10.28	80
5	40	3.64	3.64	0	0	7.28	0

Graph plotted from the values taken from then above tabular form using matlab in 3D is as follows:



CONCLUSION:

Since number of vehicles increases day by day it is required to monitor those vehicles i.e.; detect the vehicle, classify the vehicle and finally measure the speed of the vehicle to avoid road accidents. Vehicle classification is performed based on the length of the vehicle. Vehicle Classification is done by using two IR Sensors and speed measurement is done using two IR Sensors placed apart from each other.

FUTURE SCOPE:

A number of wireless sensors can be used for the detection of vehicles, classification and speed measurement. The above project is designed using IR Sensors and future work includes the use of different sensors like AMR (Anisotropic magneto resistive) sensor, Inductive loops etc. Image Processing can even be done for better results. New Software's can be used to obtain precise outputs.



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