International Journal of Transportation
Vol.6, No.3 (2018), pp.1-10
http://dx.doi.org/10.14257/ijt.2018.6.3.01

Sensor Based Traffic Monitoring System on Indian City Roads

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Abstract

In the current article, an exhaustive introduction of the created transport framework was discussed and clarified. The present framework was created and executed with the assistance of tally sensors, microcontroller and different units important to prompt the drivers whoever utilizing the bustling streets. The present framework works by handling the information that was being gathered from the sensors that were put in the ground of the streets. The essential objective of building up this traffic observing framework was to gather the development of vehicles that were proceeding onward a chosen occupied street over some time and recommend the drivers take other accessible courses in the city with the end goal that to diminish the blockage on the city streets. In light of the quantity of vehicles that were being gone towards the street by intersection the sensor units were determined and the proposal was given to drivers whoever utilizing such streets with respect to overwhelming traffic, moderate traffic and light traffic to the drivers. The information from the sensors will be gathered by a framework that was put along the edge of the street and the checking framework will process the information and three conceivable fitting choices will be given to the traffic flag that were put at the different flag indicates before the genuine busiest flag point. In view of the traffic flag lights of the observing framework, the drivers can take the choice of occupying the vehicle to other conceivable courses with the end goal that the clog in the substantial rush hour gridlock streets can be maintained a strategic distance to such an extent that the time travelling time of the travellers can be decreased. The present framework was conveyed on streets and gathered the outcomes at different timeslots and the signs were being tried with the different arrangement of results that were developed with different schedule vacancies. The outcomes were organized in the outcomes segment and the future extent of the traffic observing framework was likewise talked about in the end area.

Keywords*: 8051 Microcontroller, IR Sensors, Traffic Monitoring, Congestion avoidance in traffic, India city roads, drivers driving time, driving time, collision avoidance*

1. Introduction

Management board of traffic issues in reality condition is the most recent research issues on the planet. A few applications were being created in the creating nations to make the traffic basic and make the travellers simple and solace in the city for driving of vehicles [1, 2]. Traffic observing frameworks will help a great deal in the organization of the traffic at different dimensions, and furthermore maintain a strategic distance from the traffic issues to drivers who were going in the substantial rush hour gridlock streets with tremendous traffic [4, 5]. By utilizing this kind of observing frameworks, transportation in

Received (June 10, 2017), Review Result (August 26, 2018), Accepted (November 29, 2018)

ISSN: 2287-7940 IJT

urban areas can be overseen as far as more intelligent traffic and more secure traffic for individuals to go on the streets in urban areas. The ID of the traffic issues on the specific streets in the city with substantial traffic streets was done and the answer for such kind of issues can be maintained a strategic distance from which makes the drivers and the general population who were going on the city streets will be made simple [7]. It is in every case better to distinguish the traffic issues before to the correct purpose of automobile overload and propose alternate vehicles on a similar street to maintain a strategic distance from the car influx streets with the end goal that to lessen the heap on similar streets which will take care of the issues to some degree.

A few sensors were accessible in the market for various purposes. The essential sensors were planned to use in our everyday life and for different applications in the different fields of the examination and different regions of this present reality applications [1, 2, 4, 6]. The kind of the sensor that we need to use in our application will fundamentally rely upon the point of our application or the maxim for which we are creating or executing our application. Distinctive sensors will give different qualities, and they are planned for different utilization dependent on their temperament of the structure that they proposed to work. A few sensors or different sensors have different or distinctive in our everyday life we utilize a wide range of sensors. Distinctive sensors have diverse conclusions for work and furthermore to help for the working of different gadgets. By utilizing the sensors, we can distinguish or recognize or measure the accompanying parameters or qualities like temperature, thickness, power, speed and body circulatory strain. A few parameters were contemplated and watched for choosing the sensor from different accessible sensors in the market. A portion of those parameters are the precision of the sensor, the working scope of the sensor, the cost of the sensor and furthermore to watch the physical ecological conditions.

1.1. IR Sensors

In the currently proposed model of the traffic monitoring system, we had used the Hy-g12 load cell sensor for measuring the number of vehicles being crossed the point of placement of the sensors for various intervals of time. Based on the vehicles touches the place of the sensor placed under the ground, the sensor will count the number of vehicles being crossing the place or the junction. The sensor will work for a maximum number of verification intervals were 2000. The sensor was used for a various set of applications to measure the number of vehicles at various intervals of time at various capacities like 300, 500, 1000 *etc*.

1.2. Microcontrollers

A Microcontroller is a small, low cost and self-contained computer-on-a-chip that can be used as an embedded system. The power consumption of these devices should always be at the level of very minimum. As the power consumption was very less, the other devices which were placed in the same device should also work so that the device should work in a reasonable fashion or stable condition. Since the devices that were working with these microcontrollers are battery operated, and the devices will work with a very less amount of energy. The capacity of batteries will always be in a limited capacity as it is compared with the other sources of energy or the power supply to the devices.

These units are highly used in various devices and other units like consumer electronics like washing machines, micro Owens and other electronic devices, car engines for accessing and analysing the various parameters of the vehicles, various computer devices which include for saving and processing the data at various levels of devices. These devices highly suited several applications and devices which will work for long battery usage and other applications which work for very less energy consumption. These devices are characterised on the bases of a number of bits, instruction set, memory /devices,

memory architecture. The microcontroller devices or units in the microcontroller are classified on the base of various bits size. The bits in microcontroller are 8-bits, 16-bits and 32-bits microcontroller. In an 8-bit microcontroller, the size or the capacity of the internal bus is 8-bit. As the size of the internal bus was 8-bit, the Arithmetic and Logical Unit completes arithmetic and logic operations. Some of the examples of 8-bit microcontrollers used in various devices and applications are Intel 8031/8051, PICIx and Motorola MC68HC11.

The 16-bit microcontroller was much higher and good in working when compared to another set of 8-bit devices. The 16-bit microcontroller devices accomplish better accuracy and performance as compared to 8-bit microcontrollers. It can be better explained with an example as follows, 8-bit microcontroller can only use 8 bits, resulting in a final range of 0x00 – 0xFF(0-255) for every cycle. However, in 16-bit microcontrollers with its 16-bit data width has a range of 0x0000 – 0Xffff (0-65535) for every cycle.

Similarly, the working condition and the performance of the 32-bit microcontroller were better when compared with the previous both the controllers. The 32-bit instructions will be well executed and implemented in the case of performing arithmetic and logical operations. These microcontrollers are highly used in mechanically controlled devices, including implantable medical devices and embedded systems. Some of the examples of the 32-bit microcontroller devices and units are Intel/Atmel 251, PIC3x. The microcontroller devices are classified into two types based on the memory that they use whenever these units are used in several gadgets. They are,

i. Embedded memory microcontroller.

ii. External memory microcontroller.

i. Embedded Memory Microcontroller: Whenever a microcontroller unit was fixed on an embedded unit which was having all the functional blocks that were available on a single chip is called an embedded microcontroller. The example for an embedded memory microcontroller was 8051 microcontroller having a program and data memory, I/O ports, serial communication, counters and timers and interrupts on the chip is an embedded microcontroller.

ii. External Memory Microcontroller: whenever a microcontroller unit was not built on a single chip and also on the single device or single board, and the unit was fixed with all functional units not on the same device or on the same unit such devices are called or known as the external memory microcontroller. The best example of this type of memory units or the functioning points of the unit is the 8031 microcontroller unit which was having no program memory on the chip.

1.3. Classification According To Instruction Set

The instruction set was the most essential concept of the microcontrollers for operating the devices in which the unit was developed and embedded in it. To make the instructions, the following are the set of instructions. They are as follows,

CISC: CISC is Complex Instruction Set Computer. It permits the programmer and the user to use one instruction in place of much simpler instruction.

RISC: The RISC stands for Reduced Instruction Set Computer, this type of instruction sets lessens the strategy of the microprocessor for engineering, commerce and industrial standards. It allows each instruction to operate on any register or use any addressing mode and simultaneous access of program and data.

1.4. Microcontrollers Used in the Traffic Monitoring Unit

8051 Microcontroller is one of the mostly used microcontrollers that were available in the market today for the usage of various types of users for a various set of applications. Due to the more applications size and heavy usage and various set of instructions and furthermore sizes that supported by the microcontroller was the reason. This microcontroller was available in three sizes in the market today. Those sizes are Short, Standard, Extended. It has 4 KB chip program memory. It has 128 bytes RAM, four register banks, 16-bit address bus, 16-bit timers, four 8-bit ports and 16-bit program counter and data pointer.

2. Literature Review

Mahendra Dharma *et al.*, had discussed the movement familiarity with the driver is one of the prime concentration as far as a person on foot and street security. Driver encounter assumes a noteworthy part and driving requires careful consideration regarding changing conditions both inside and outside the vehicle. Any slip by in driver consideration from the essential errand of driving could conceivably prompt a mishap. It is watched that, the absence of consideration on the continuous movement and uninformed about the activity data, for example, activity lights, street signs, activity tenets and directions are the real reason for the vehicle crash. Movement signals and signage are the most appropriate decision of activity control for the crossing point, guarantee that driver can see the data far from the convergence with the goal that he/she can stop securely after survey the yellow and red show. At that point, after survey the flag operations and conditions the driver can stop his/her vehicle effectively before entering the convergence.

From the above literature review and the various previous works, it is observed that the use of sensors for identifying the movement of vehicles was important on roads such that to reduce the congestion on busy city roads. However, counting the number of vehicles being crossing a particular point of location on roads for counting the vehicles was not observed. Hence, we took this problem and considered the count sensors to be used to count the number of vehicles being crossing the particular signal point over some time. By counting the number of vehicles, we will display the drivers on the same road to take necessary steps such that to avoid the traffic congestion on busy city roads at peak hours of the time.

3. Design of the Traffic Monitoring Model

The plan of the traffic display was put as pursues. The fundamental model was the format planned so that the two sensors were put in the two paths on the streets. Every sensor was set on every path, and the sensor distinguishes the development of the vehicle with respect to the thickness that is the check of the vehicle. The check of the vehicle was taken as the base dimension. The essential tally of every vehicle was taken as the 800 Kgs. The sensor will distinguish the tally of the vehicle just those vehicles whose tally is more than the 800 Kgs. Every sensor will distinguishes the check of the vehicle for a specific timeframe and the tally of the vehicles were made and the information being sent to the sensor organize that was set up close to the side of a street and the system will send the information to the following purpose of the traffic flag with the end goal, that to illuminate the status of traffic. In light of the traffic level, the vehicles were proceeded on a similar street or a similar bearing of the street or the course of the vehicles were coordinated to different streets or another arrangement of streets for the further decrease of traffic in the current streets in the city.

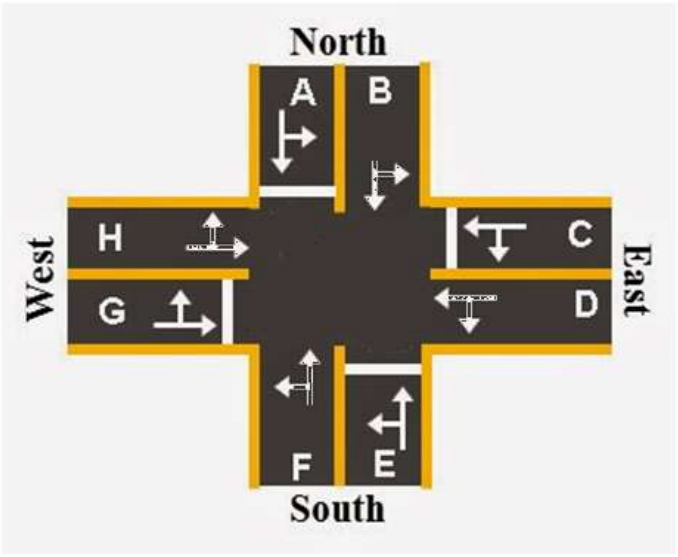

Figure 1. The Circuit Layout of the Traffic Monitoring System

The design model of layout engineering of the traffic observing the framework was given in the beneath Figure 2. The check of the vehicles will be determined regarding the thickness of the vehicles. The thickness can be determined as the quantity of vehicles were going through these sensors over a point of time, or it might likewise be considered with respect to a specific period. The thickness of the vehicle development can be determined by utilizing an Infra-Red sensor. There are a few sensors accessible in the market for the count of the thickness of the vehicles.

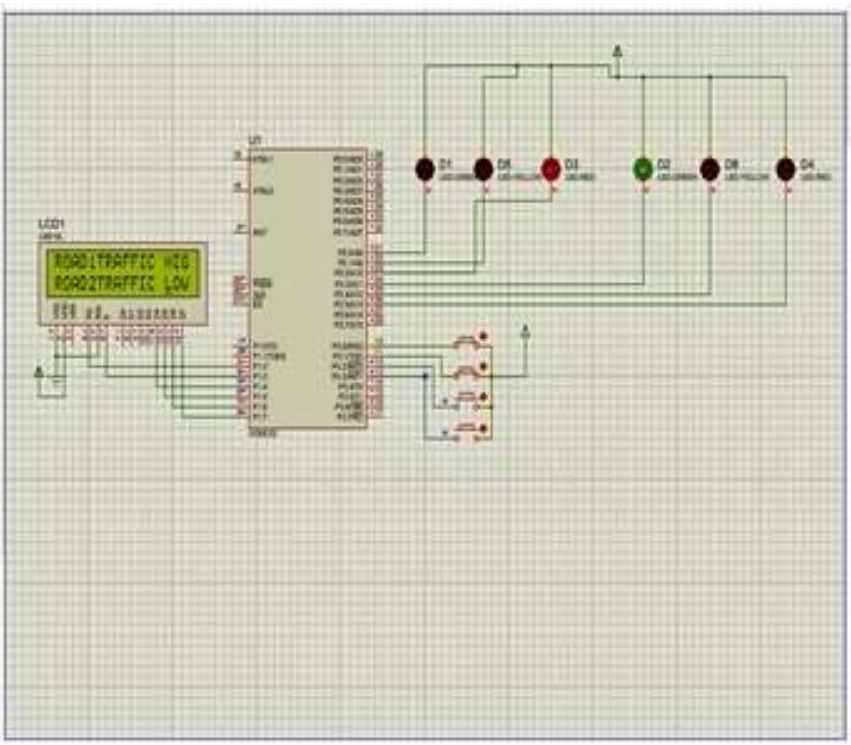

Figure 2. Layout Model of the Traffic Monitoring System

For the current proposed framework, four sensors were being utilized for which every one of the sensors was settled at two streets with two paths in every street. The

microcontroller unit that was orchestrated in the pack of the framework was the 8051 microcontroller unit. To flag the vehicles that were being gone on the streets, around six LEDs were gathered with the end goal that the two lights are green in shading, two lights are in red and the other two lights are in yellow colour. So as to work with the framework and to work the framework without the impedance of individuals, a computerized program was being created to such an extent that the machine will work the framework without the interference of the person. The writing computer programs was created to such an extent that the complete hardware and the absolute pack of the framework was being produced in both the microcontroller programming for the working of the 8051 microcontroller and furthermore the C programming with interface demonstrate and the other interfacing unit for clients and administrators to mediate with the framework to make revisions if any required in the current framework or in the coming future. The UI that was being created in the framework was clear to utilize and can be seen effectively by any representatives who were working in a constant situation. For the microcontroller, four transports for the information exchange, and furthermore for the preparing of the information and furthermore to supply directions to alternate units was done through the programming method of the microcontroller 8051.

The information that was being gathered from the sensors which were put on the streets will be specifically sent to the framework that was put in favour of the street. The framework will check the vehicles with the measure of tally the vehicles are being crossed through these sensors for a point of time. The time taken to tally the check of the vehicles was not static, it is dynamic. The time will be viewed as dependent on the timings of the, i.e., the quantity of vehicles that were being crossed through these sensors was gathered and determined. The yield of the traffic checking framework LED lights were set at the flag focuses that were situated before 3 to 4 kilometres from the present flag point at where the genuine observing framework was found. At the point when the information was being gathered, the sensors will gather information in regards to the tally of the vehicle. We had expected the underlying check that could be evaluated as the overwhelming traffic was about 200 to 450 vehicles, however amid the substantial traffic timings, the number was diminished further from 100 to 180 vehicles with the end goal that to diminish the over traffic load on the streets by early forecast of the traffic.

All in all, the customary traffic timings will be viewed as the quantity of vehicles ought to be 200 to 450. In the event that the thickness of vehicles information increments from the sensors, the checking framework will give as a yield as ordinary traffic. The traffic levels that were taken as three sorts of portrayal to the drivers on streets who were utilizing the street. In the event that the tally determined from the sensors was as standard case, at that point the green light will be spoken to the drivers at the before flag point with the end goal that the drivers will have the decision to work the vehicle in the conceivable different courses whenever required. On the off chance that the tally thickness was substantial, the checking framework would show the drivers that the lights were in red and the drivers whoever driving in a similar street may take their very own choices and may decide to some other conceivable courses. At a few times the time taken for ascertaining the tally of the vehicles was in some cases it was static, and at in some cases it was in powerful nature. In light of the prerequisites of the client, the settings in the framework can be produced using time to time. The thickness computation range may likewise be conceivable to change now and again dependent on the prerequisites of the client.

The handling of the system was a critical to point in the working of this traffic monitoring system. The step by step working mechanism of the system was explained in detail here as follows,

Step 1: Log into System
Step 2: Select control type

Step 3: If Automatic mode select then go to step 4th else go to step 8
Step 4: If Automatic control activated
Step 5: Assign period for the green, yellow signal
Step 6: If an emergency vehicle is over then go to step 4
Step 7: If rally come then go to step 8
Step 8: Manual control activated
Step 9: Assign period for green, a yellow signal according to that particular road
Step 10: If emergency over then go to step 4

A vehicle driver can utilize the data that was gathered from different sensors do achieve the goal in a quicker and more astute way. We put sensors out and about. Each sensor has a transmitter and a recipient. The signs between the transmitter and collector are utilized to recognize the traffic thickness. At whatever point a vehicle passes out and about the signs among transmitter and collector will get irritated, and thickness will be noted. We put these sensors on the streets which have two paths. We consider both the paths independently. We consider the beginning stage for every path and our endpoints are 600 meters from our beginning stage. This 600 meters remove is isolated into three locales of 200 meters each. 0-200 meters is the primary division, and one sensor is set in this district. 200-400 meters is the second division and the second sensor is put in this area. 400-600 meters is the third division. We use LEDs to show the traffic status in a specific path. As a matter of course, we have green LEDs gleaming this speaks to that the path has low traffic thickness. At whatever point thickness is recorded in the third division, and just as in our second division this speaks to medium thickness. Green drove will quit gleaming and yellow drove begins sparkling. Besides, in the event that at whatever point thickness is recorded in all first, second and third divisions, it speaks to high thickness. For this situation, red drove begins sparkling and other two LEDs will be halted. As per this, the vehicle driver can decide on any path to achieve his goal.

4. Results

The traffic checking framework was being actualized with various sensors at better places out and about at different schedule vacancies. In view of the check of the vehicles, the IR sensor will figure the quantity of vehicles that were crossing the sensors and the information will be provided to the framework which was associated with it for further preparing. When the information was being gathered from the sensors, the choices will be given by the framework in the wake of handling the information that was gotten from the sensors. The information that was recovered from the sensors at different schedule vacancies and the choices that were being guided by the framework dependent on the information was organized as pursues,

Table 1. Results Observed from the Proposed System at Various Time Intervals

Timeslots	Duration of the slot	Count of the Vehicles (Vehicles)	The decision for the driver
01	12 seconds	110	Green
02	18 seconds	125	Green
03	22 seconds	400	Red
04	18 seconds	452	Red
05	12 seconds	125	Green
06	16 seconds	129	Yellow
07	17 seconds	412	Red

08	14 seconds	130	Green
09	29 seconds	189	Yellow
10	42 seconds	389	Red
11	36 seconds	255	Yellow
12	31 seconds	212	Yellow

Here from the above Table 1, the outcomes for different timeslots with different loads of the vehicles were watched and arranged. Diverse timeslots for figuring the vehicle development at various dimensions of traffic on the streets were watched and determined. The information was gathered at different dimensions at the general recreation time of the streets and the substantial traffic time of the streets and during the evening times after 10 PM additionally recorded the qualities and was organized. In view of the qualities saw from the sensors, fitting choices were taken and the outcomes and the choices were passed to the flag focuses which were set before the purpose of the flag intersection with the goal that the clog in street traffic can be maintained a strategic distance from.

5. Conclusions

In the current article, the traffic monitoring system which was developed and tested in various cases and results were noted. The testing of the system was done by implementing it on the road, and the results were taken to display the LED lights that were placed on the roads at a distance of 3 to 4 kilometres away from the actual place of the monitoring system. As a result, drivers whoever is driving in the same road might identify the signals that were being placed in the form of green, red and yellow and the drivers will have a choice to choose the other available routes to reach the destination smoothly. In the present system, the count of the vehicles will be calculated, but the extension can be made to calculate the number of vehicles with their weights by increasing the capacity of the sensors and also the capacity to store the data at the system. However, the system was being implemented by writing C and microcontroller programming, and in the future, these can be upgraded to some more fixed or some new languages or software's which were exclusively for this monitoring system. The goal of the current proposed system can be solved much more precisely in the future by using more number of sensors and more devices with the latest software technologies such that the traffic problems on the Indian roads can be reduced to some extent.

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