Smart Traffic Counter

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ABSTRACT

Transportation engineering always wants to achieve the safety of public and time efficient movement of passengers and goods on roads. These safety and time depended on the traffic flow on roads. The three main parameters of traffic flow are traffic volume, speed and density of vehicle. In absence of effective planning and traffic management of the city, it would be difficult to achieve safety and time efficiency. For that counting of traffic volume will be important step before planning.

Now a days methods used to count the vehicle on road is

- Manual method
- Automatic method
  - **Pneumatic tubes**
  - **Inductive loops**
  - **Weigh-in-Motion Sensor types**
  - **Micro-millimeter wave Radar detectors**
  - **Video Camera**

Manual method is accurate but it will be hectic work to stand beside of roads counting each vehicles and automatic method is not accurate enough to get prescribed PCU values instead it gives number of vehicles without any classifications. So we are discovering another method to escape from standing beside the road and to get accurate result using sensors and Arduino board. This machine automatically gives number of vehicles passed in road with differentiating into categories as defined. And it also gives PCU value in usage time. And it is recorded in micro SD card inserted into Arduino

Keywords: sensors, traffic volume, SD card, Arduino, PCU

1. INTRODUCTION

This project deals with Transportation engineering which is one of the major streams of civil engineering. Traffic data collection is basic requirement for the transportation planning. Traffic data forms an integral part of national economics and such knowledge is essential drawing up a national transport policy for movement of passengers and goods by both government and private sectors. The project is carried out to make counting work in the transportation field easier and effective than traditional method. This is achieved by linking the work with Internet of things. The objectives of the project are to solve the common problems which can occur in the counting of vehicles and it is cheaper than the other methods. The traffic volume count is very essential for the widening and design of roads. In India traffic volume counts are taken by` toll gates, giving contract to companies etc. These types of methods are uneconomical to solve these problems. Project embedded with ultrasonic sensors, memory card slot, and ARDUINO UNO board which are functions as to detect the motion of vehicles classifies the vehicle, and according to classification it counts the vehicles, calculates the PCU of vehicles. All these data are stored in an SD card and storage is carried up to 8GB. The file can be saved as excel sheet or a text file etc.

In the present world due to rising of the population at a rapid rate the vehicles in the roads are more so the traffic data collected changes time to time. So it is very difficult to depend on previous year traffic data. For the continuous tracking of data it is very uneconomical. By taking this in mind the project topic which was selected to work on this.

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded. For example, an intersection count may be conducted during the peak flow period. If so, manual count with 15-minute intervals could be used to obtain the traffic volume data.

2. NEED OF TRAFFIC COUNT

Traffic volume Survey is an essential part of town planning, especially for a town planner.

It includes counting the number of vehicles passing through a survey station. The study of classified Traffic Volume Count is to understand factors that form the basis of:

a) Checking the efficiency/saturation of the road network by comparing current traffic volume with the calculated capacity or by identifying level of service.
b) Establishing the use of the road network by vehicles of different categories, Traffic distribution PCU/vehicle
c) Need of median shifting or road widening .

3. WHY TRAFFIC COUNTER

An automated traffic counter reduces human efforts in obtaining traffic count. It is also accurate against human errors. There are many automated traffic counters are existing but our project gives solutions for the problems in the existing methods

4. EXISTING METHODS

Traffic Volume Count can be done by various methods depending upon various factors like manpower available, budget, technology/instrument available, magnitude of traffic data required or to be collected which will then determine quality and type of vehicle classification to be adopted. Traffic counting falls in two main categories, namely: manual count and automatic count. Traffic data collection forms the integral part of traffic volume study as it provides the raw data and includes primary survey. The various types and methods used to collect traffic data not only provide a good and valuable coverage of the required traffic information. Different methods of traffic volume count are as mentioned below –

a) Manual Count

The most common method of collecting traffic volume data is the manual method of traffic volume count, which involves a group of people recording number of vehicles passing, on a pre-determined location, using tally marks in inventories. Raw data from those inventories is then organized for compilation and analysis. This method of data collection can be expensive in terms of manpower, but it is nonetheless necessary in most cases where vehicles are to be classified with a number of movements recorded separately, such as at intersections also in case where automatic methods cannot be used due to lack of infrastructure, necessary authorization etc.

b) Automatic Count

This method is employed in cases where manual count method is not feasible. Various instruments are available for automatic count, which have their own merits and demerits. Some of the widely used instruments are pneumatic tubes, inductive loops, weigh-in-motion Sensor, micro-millimeter wave Radar detectors and video camera. Both types of count can be classified or unclassified. Classified traffic volume count gives a better understanding of the types of vehicles which uses the road and can be used for number of other purposes apart from the transportation surveys. It can also be used for calculating the modal split of vehicles on the road. Unclassified traffic volume count is done where sufficient manpower is not available or the budget for the survey is low. This type of volume count does not give good information about the road.

Some of the widely used instruments are –

i) Pneumatic tubes – These are tubes placed on the top of road surfaces at locations where traffic counting is required. As vehicles pass over the tube, the resulting compression sends a burst of air to an air switch.

ii) Inductive loops – Inductive loop detector consists of embedded turned wire. It includes an oscillator, and a cable, which allows signals to pass from the loop to the traffic counting device. Inductive loops are cheap, almost maintenance-free and are currently the most widely used equipment for vehicle counting and detection

iii) Weigh-in-Motion Sensor types – A variety of traffic sensors and loops are used to count, weigh and classify vehicles while in motion, and these are collectively known as Weigh In Motion (WIM) sensor systems. Some notable traffic sensors are:

iv) Micro-millimeter wave Radar detectors – Radar detectors actively emits radioactive signals at frequencies ranging from the ultra-high frequencies (UHF) of 100 MHz, to 100 GHz, and can register vehicular presence and speed and can be used determine vehicular volumes and classifications in both traffic directions.

v) Video Camera – Video image processing system utilize machine vision technology to detect vehicles and capture details about individual vehicles when necessary. The system is useful for traffic counting and give a +/- 3% tolerance, and is not appropriate for vehicular speed and their classification.

5. HARDWARE & SOFTWARE REQUIREMENT

- Arduino Uno
- Ultrasonic sensors HC-SR04
- Memory card module
- Memory card

6. WORKING

Main principle of volume count is to classify the various types of vehicles based on their width and count them. For the width calculations two ultrasonic sensors are used, Sensor1 and Sensor2. The sensors are placed oppositely and the distance between the two sensors are noted. The barricades are provided to allow the single vehicle to pass through the sensors. When a vehicle passes near the two sensors the following actions takes place.

- D = distance between the two sensors (Known distance)
- D1= distance given by the Sensor1 in cm
- D2= distance given by the Sensor2 in cm
- W= width of vehicle in cm

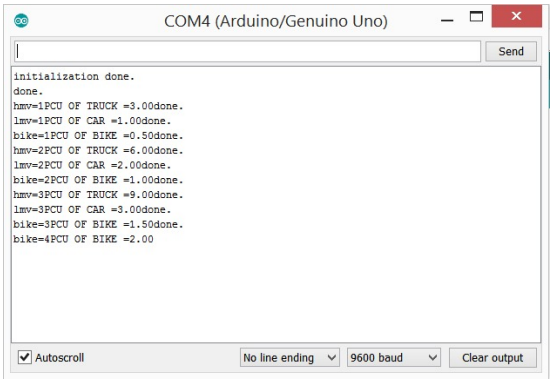
The following formula is used to calculate the width of vehicle

W = (D – (D1+D2));

After calculating the width of vehicles, it classifies the category of it. For example, if width is 150cm – 200cm the Arduino board classifies it as car and calculate the PCU value of it as well as saves the value in memory card in txt format. 8 GB memory card can save up to 7 days road data or more than that.

a. MODEL SPECIFICATION

FIG 4.0 Model Views



The above model is prepared to check the accuracy of the counter, the 3-different width model are made to classify the vehicle i.e. 1) truck 2) car 3) bike. The width of truck model is 9.0 cm car 6.0cm and bike 2.0 cm Respectively. Ultrasonic sonic sensors are placed oppositely with a distance of 34cm. When both the sensors senses the vehicles then only classification and counting takes place.

7. Passenger Car Unit (PCU)

Passenger car unit is a metric used in transportation engineering, to assess traffic-flow rate on a highway. A passenger Car unit is a measure of the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single standard passenger car. This is also known as passenger car equivalent.

CAR	**1.0**
MOTORCYCLE	**0.5**
BICYCLE	**0.2**
LCV	**2.2**
BUS, TRUCK	**3.5**
3-WHEELER	**0.8**

Table 1.0 PCU Values

8. ADVANTAGES

- Simple working.
- Best suited for small roads and one way.
- Low cost.
- Easy maintenance.
- Accurate.
- Rewritable program.
- Vehicle count and PCU values will be saved in SD card.

9. DISADVANTAGES

- At a time only one vehicle is recognized
- Barricades may be required in order safe guard sensor and to make sure not to pass more than one vehicle at a time

CONCLUSION

There are many types of counters available in market as mentioned above. That might be accurate in counting but not in counting according to classification. Some of methods like video camera method may give accurate results but installation cost is more, storing device are required, operating experts are required, or a special software, it cannot able to calculate the PCU values.

SMART TRAFFIC COUNTER eliminates all the disadvantages of other methods. Simple calculations, easy to fix, high accuracy, continues counting, cheaper but there are some disadvantages like barricades placing, not suitable for expressways. The smart counter idea is still in progression it may eliminate its own disadvantages in future.

12. REFERENCES

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