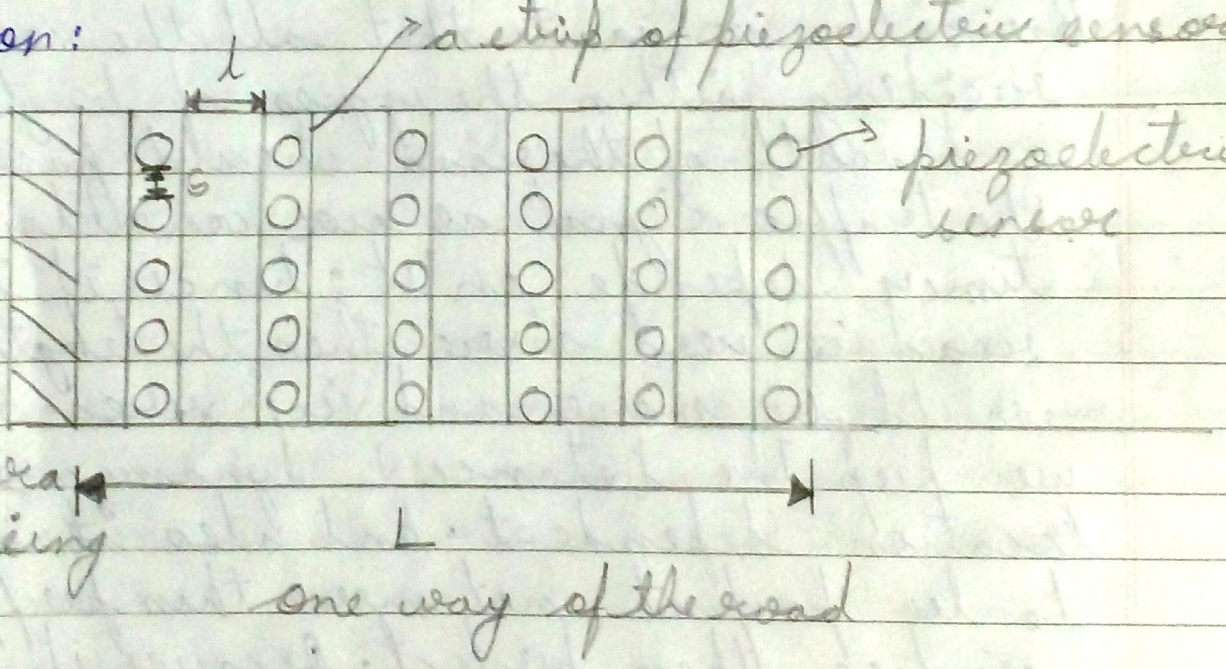
SMART ROADS
Brainstorming

Question: How would the sensors: pressure or piezoelectric, be installed on the road i.e. in which pattern the sensors would be installed or what is the arrangement of sensors; which would be the most efficient in determining the number of vehicles in that particular way of the road?

Most efficient solution:



→ S: It is the distance between two piezoelectric sensors in a single strip. Also to mention that it is the same for all other sensors.
The distance S is determined such that no vehicle can fit completely between any two piezoelectric sensors.

In general, the vehicle with the smallest width is a cycle. Hence s is choosen such that no cycle can fit between any two of the piezoelectric sensors. The distance s we will obtain by taking a survey or by consulting an expert for the same.

→ L: It is the distance upto which the strips of piezoelectric sensors would be installed. The distance L is decided based upon the location of the road i.e. whether the road is used more or less. Basically we want that all the vehicles residing within the region of length L and width of the road should pass through the traffic signal as our countdown timer depends on it; hence if the road is used more then the length L would be more and vice versa. Hence we keep the distance L dynamic and location dependent. And also it needs to be perfect; not more than perfect or less than perfect. Because if it is more than perfect, then traffic is low on that way but at the same time the other ways are affected and if it is less than perfect, traffic jam gradually occurs.

→ l : It is the distance between two ~~consecutive~~ consecutive stripe of piezo-electric sensors. Similar to how s is determined, l is determined such that no vehicle can reside in the area between two consecutive stripe of piezoelectric sensors. Hence in general l is the distance which is less than the ~~for~~ minimum length of all the vehicles present or used on daily basis.

~~a vehicle from~~

Suppose vehicle A ~~is~~ has the minimum length from the all the vehicle used on daily basis. Hence the distance l would be less than the length of vehicle A, which has the minimum length.

→ Hence by appropriately choosing s, l and L, we can gharantee ~~than~~ that no vehicle remains undetected when it is present in the area where piezoelectric sensors are installed.

Q) From the above arrangement, another question arises that due to a vehicle, let us suppose, a car ; four piezoelectric sensors would be activated or four four piezoelectric sensor would show deflection in voltage reading; as a

result, the counter goes up by 4 and not by 1 as it is a single car. Similarly for a motorcycle ~~he~~ two ~~pizo~~ piezoelectric sensors depicting two ~~veh~~ wheels of a motorcycle shows deflection and hence as a result the counter goes up by 2 instead of 1. This is a great error because then the system does not know the right amount of vehicle present ~~in~~ on the road.

Solution: ~~The solution is very time specific~~
Suppose at a particular instant of time t, the system sensed deflection in ~~is~~ four piezoelectric sensors named A, B, C and D. Now according to our problem, these sensors A, B, C & D ~~may~~ might be deflected by only one vehicle, ~~or~~ two vehicles, ~~or~~ three vehicles or else four different vehicles. Now, the system randomly chooses any one of the four piezoelectric sensors. Let it be C. The system knows how much voltage deflection has occured. Hence from the magnitude of voltage deflection, the system can determine whether the vehicle is a car, a truck, a motorcycle, a cycle or any other ~~mear~~ type of vehicle used in daily life. As a result let the voltage deflection in sensor C be due to a car which is known by the system.

Now the system has the knowledge of average dimensions (here only length and ~~breadth~~ width are needed) of all types of vehicles used in daily traffic. Hence the system knows the average dimensions of a car. Now the system knows that at sensor C, ~~a car is present~~ a particular wheel of a car is present; hence the system then searches if the other piezoelectric sensors A, B & D are present in the region of the car as it knows how much area a regular car would span on an average. Now if A, B and ~~or~~ D ~~all~~ all resides in that area, it eliminates their deflection and considers only the deflection at sensor C. In this way, the counter only increases by 1. And if not, the system goes to another sensor and repeats the same process but by eliminating sensor C as it has already been compared. After all the above, system proceeds to t+1 time.

→ A quick example:

1 → At time t;
M, N & O sensors are deflected
2 → System chooses M
3 → It knows by voltage deflection that at M, a truck is present.
4 → System loads average dimensions of a truck

5 → checks whether sensors N & O reside in the area covered by the touch
6 → Finds that, O resides in sensor
7 → Hence eliminates its contributions
8 → System then eliminates M & O from comparison
9 → Now only N is present hence it surely must have been deflected due to other vehicle than that of vehicle at M & O
10 → System increases counter by 2
11 → System moves to t+1 instant of time.

Q) How does the system know that the distance between any two sensors

Q) How does the system perform the step 5 in the above process?

Solution:

	11	12	13	...
	O	O	O	...
210	22	23		
	O	O		
310	32	33		
	O	O		
410	42	43		
	O	O		
510	52	53		
	O	O		
	:			
	:			
	.			

→ Computational Representation

Matrix

11	12	13	...
21	22	23	...
31	32	33	...
41	42	43	...
51	52	53	...
:	:	:	
:	:	:	
.	.	.	

→ For a system to perform step 5, it needs to know how far in length and how deep in width, a sensor is with respect to the reference sensor

→ The above can be accomplished by Matrix Representation as we know distance between two consecutive ~~rows~~ columns of matrix is 1 and between two consecutive rows is 6.

→ Hence we can know how far a particular sensor is with respect to reference sensor.

→ Eg:
Sensor 13 is at a distance 21 away from 31 and 2 higher than 31.