Automated Traffic-Dependent Movable Barriers

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Situation

Figure1: Congestion on only one side of the road [1]

- Congestion on highways has become a serious problem in recent years. It is due to the increase in population and the increasing number of cars per household.
- There is one car for every two residents in the United Arab Emirates which is causing traffic congestion on a daily basis [2].
- Congestion wastes time, energy and increases economic costs.

Problems

•Bottleneck

Bottleneck is a narrow section of a road or a junction that impedes traffic flow. This occurs when the traffic coming from three or more directions converge into two lanes.

•Lack of Exits

The lack of alternative road entries and exits will cause traffic snarl-up and extreme traffic congestion so that vehicles may be stationary for long periods of time.

• Peak Hours

During specific peak hours, demand approaches the road capacity causing traffic jams generally caused by motorists heading to the same destination and increasing the volume of traffic.

•Construction Work

Construction work and road narrowing are mainly caused by the development of new road infrastructure and the maintenance of old ones.

Solution

•Automated Traffic-Dependent Moving Barriers

A self automated machine takes one lane from the non congested direction and adds it to the congested one in order to decrease traffic congestion.

Figure 2: A zipper machine adjusting the lane [3]

•Level Of Service (LOS)

There are six conditions of the road that are determined according to the spacing between cars ranging from the least congested condition (LOS A) to the most congested condition (LOS F). The barrier process occurs at (LOS D).

Figure 3: Different Levels of Service

•F - Shape Barriers

Figure 4 : F- Shape Barrier

450-500 kg/m
T-top
High Speed Safety
Reinforced
Battery Bank

•Harvesting Kinetic Energy

The triboelectric generator (TEG) is fabricated by stacking two polymer sheets made of materials having distinctly different triboelectric characteristics, with metal films deposited on the inner sides of the assembled structure. Once subjected to mechanical deformation, caused by the moving vehicles running over it on the road, an electric potential difference is generated and then stored in the high capacity battery.

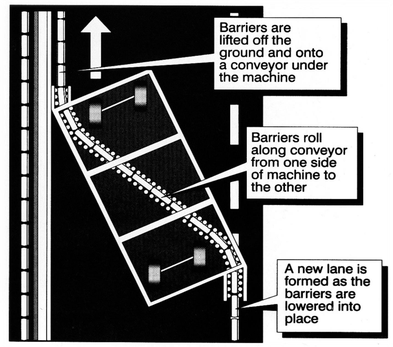

Figure 5: Mechanism of a zipper machine [4]

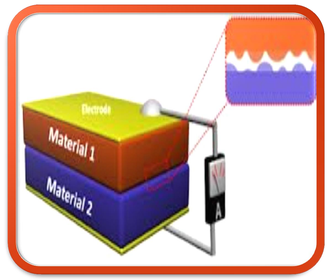

Figure 6: Flexible triboelectric generator [5]

•Traffic Detection

We will use the pre-existing technology of the speed detection camera and accordingly measure the speed of passing cars as well as the distance between them. If traffic is heavy the system will alert the UGV to add a lane to the road.

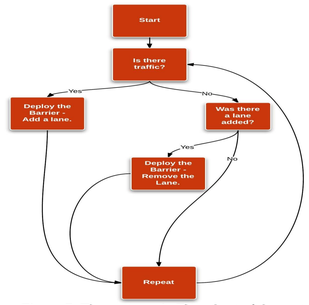

Figure 7: The systematic Flowchart of the system

Evaluation

The proposed solution combines several existing technologies into one effective system and has not been implemented yet.

Triboelectric Nano-generators offer an effective solution to the energy problem outlined earlier for several reasons:

- They are embedded in the road and hence, do not affect barrier infrastructure.
- Unlike wind turbines, these generators are not affected by seasonal change.

Cost is likewise an essential aspect in choosing the most efficient system design.

References

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