Revolutionizing Smart Road Reflectors to Clean the Roads of Tomorrow

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Abstract: Road dust is a significant hazard to road safety, visibility, and public health, necessitating innovative solutions for effective mitigation. This abstract presents a proposal for the implementation of smart road reflectors equipped with automated road cleaning systems to address the challenges posed by road dust accumulation. The envisioned Smart Reflector System integrates high-pressure water jets into conventional road reflectors, allowing for the efficient removal of roadside dust without disrupting traffic flow. By enhancing visibility and controlling road dust, this system aims to mitigate the risk of accidents and respiratory issues associated with prolonged exposure to road dust. Embracing innovative solutions like the Smart Reflector System is essential for ensuring the safety and well-being of road users while promoting sustainable road management practices.

Keywords: concrete roads, Bituminous roads, Smart Road Reflector, Dust Sensor

I. INTRODUCTION

In India mostly two types of roads are constructed bituminous and concrete roads. Bituminous roads are cheap to construct compare to concrete roads. The load carrying capacity of Bituminous is less comparatively. One of the major reasons for it is variation in temperature. In India temperature varies with different time span even high temperature in afternoon and low at night. Concrete roads are fails mainly because of cracks.

We see that there are lot of accidents causes due to various reasons such as over speed, drunken driving, using mobiles, rash driving, failure to understand signs, crossing at wrong places moving on carriage way etc. Dust is also one of the main reason to cause the accidents. Dust developed due to the fast moving vehicles and it causes health problems in humans and causes air pollution. To avoid this problem, water is the best solution on it. Our solution for this kind of problem is that we provided water sprayer inside the road stud. The purpose of water spraying is to clean the dirt and dry the road quickly. Pipes will provide water to the road studs.

This concept can be used for smaller length of road and if possible it can be used to longer distance also. Road maintenance is one of the important of the entire road system. To solve this problem dust sensor is used. The dust sensor activate when the dust increased on the road and water sprays on the road.

The presence of mud and dust on roadways poses significant hazards to road safety, visibility, and public health. These issues are further exacerbated by the reduced visibility of road reflectors due to dust accumulation and the shrinking width of roads. While various cleaning machines exist, they often disrupt traffic flow and require significant space, leading to further inconvenience. In response to these challenges, the concept of smart road reflectors with integrated cleaning systems has emerged.

Smart road reflectors offer a promising solution to enhance road safety and cleanliness by efficiently addressing the accumulation of dust and debris. By integrating high pressure water jets into traditional road reflectors, this innovative system aims to remove roadside dust without causing traffic disruptions. This not only improves visibility for drivers but also reduces the likelihood of accidents and respiratory issues associated with dust exposure.

II.OBJECTIVES

- Design and model preparation of Smart Road Reflector.
- To Determine the Technical and Economic feasibility of implementing Smart Road Reflector with Automated Road cleaning system.
- To reduce the Environmental Impact of roadways by pollutants through automated Road cleaning system trigged by Smart Reflector Data.
- Cost Estimation of Smart Road Reflector.

III. METHODOLOGY

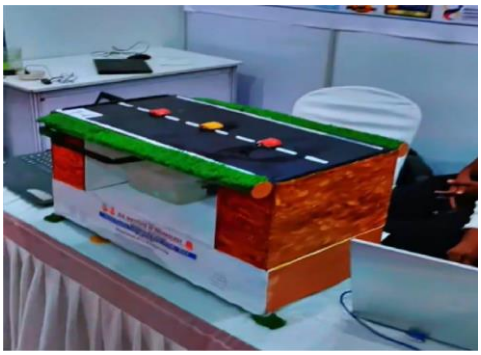

Fig. 1 Model of Smart Road Reflector

A. Design of Model

The construction of self cleaning roads is simple. The spraying nozzles are fitted on the top of road stud. The construction is not much difficult. The road studs are available in market of various sizes. The nozzles are inserted into the road studs. The water is supply to the nozzles according to the convince. The best way of provision of water to long distance is supplying water through pipes through road dividers. So, the water can be carried to longer distances.

In advance cleaning and treatment of road pavement, The HDPE pipes are installed under the road surface which is the connected with the supply chamber and a sub pipes also connected with the main pipe and sub pipes attached with the a high intensity water pressure release from the road studs which wash the road and nasty material and wastage flow with water pressure and makes road clean.

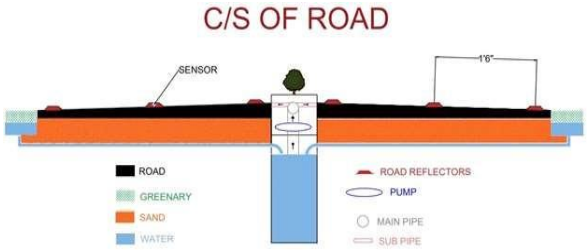

Fig. 2 C/S of road

This process can be use according to area where's the city is more nasty after few times it can reduces the dust and toxic material from road surfce and also maintain the road temperature. According to this system it can also reduce the lots of problems of peoples.

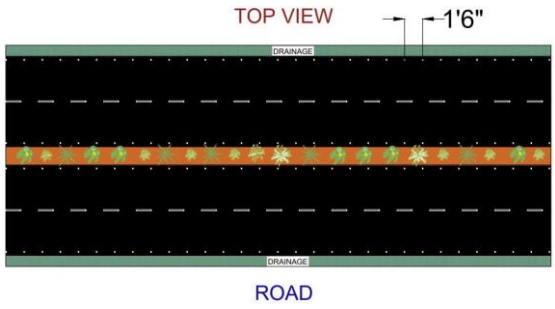

Fig. 3 Top view of road

The water from the drains is collected in the underground tank. so that the rain water which was only runoff and flows in the drainage was used in a proper work.

As the dust sensor detects the dust the pump automatically get started and the water from the underground tank is pumped up to the main pipe and the same is supplied to sub pipe. The sub pipe is connected to all the road studs.

The high pressure water jet is released from the nozzles which is placed in the road reflectors resulting in the cleaning of road dust as well as other materials.

This water is again drain off to the drainage and it is reused again in the same manner when ever the dust increases.

B. Testing of Sensor

A dust sensor is a device designed to measure and detect the concentration of particulate matter (PM) or dust particles in the air. These sensors are commonly used in various applications, including air quality monitoring, industrial settings, and smart home devices. The primary function of a dust sensor is to provide real time data on the levels of particulate matter in the surrounding air.

Model Number **GP2Y1014AU0F Dust Sensor**

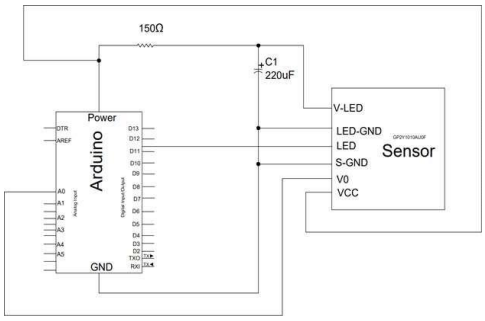

Fig. 4 Line diagram of sensor model

Fig. 5 Testing of sensor

C. COST ESTIMATION

Table 1 Cost Estimation

No.	Particulars of Item	No.	Length (m)	Bredth (m)	Depth	Quantity (m^3)	Rate	Amount
	Trench Excavation							
1.	Excavation		L X B X D = 1000 x 0.6 x 0.9			540	371	2,00,340/-
2.	Refilling		L X B X D = 1000 x 0.6 x 0.9			540	122	65,880/-
	Total	2,66,220/-						
	Storage Tank							
3.	Excavation		L X B X D = 4 x 4 x 3			48	371	17,808/-
4.	Wall concreting		L X B X D =1 4 x 3 x 0.15			6.3	30,000	1,89,000/-
5.	Floor concreting		L X B X D = 4 x 3 x 0.15			1.8	30,000	54,000/-
6.	Roof concreting		L X B X D = 4 x 3 x 0.15			1.8	30,000	54,000/-
	Man hole deduction (-)		L X B X D = 0.6 x 0.6 x 0.15			-0.054	30,000	-1,620/-
	Total	3,13,188/-						

No.	Particulars of Item	No.	Rate	Amount
1.	HDPE Pipe	1000m	169/m	1,69,000/-
2.	CPVC Pipe	136m	315/m	19,176/-
3.	Electro fussion saddles	223	167	37,241/-
4.	HDPE Gate valve	5	500	2,500/-
5.	HDPE fussion coupler	10	141	1,410/-
5	Nozzles	446	71	31,666/-
6.	Rain water filter	14	26500	3,71,000/-
7.	Miscellaneous			5,000/-
Total		6,36,993/-		
Total cost		2,66,220 + 3,13,188 + 6,36,993 =12,16,401/-		

IV.CONCLUSION

Road dust presents significant hazards to road safety, visibility, and public health, necessitating innovative solutions for mitigation. The Smart Reflector System, integrating high pressure water jets into road reflectors, offers a promising approach to address these challenges by efficiently removing dust without disrupting traffic flow. This system has the potential to reduce accidents and respiratory issues linked to road dust exposure, thereby safeguarding road users well being. Embracing such forward thinking solutions is essential for enhancing road safety and minimizing environmental impact. The integration of smart reflectors with automated cleaning systems presents opportunities to optimize road maintenance and promote sustainable roadways globally. Continued research, development, and implementation of innovative solutions like the Smart Reflector System are vital for ensuring safe and healthy road environments for all.

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