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Review of Improvement of Vision through Windshield Window of a Vehicle in a Rainy Season

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ABSTRACT-

Road visibility in vehicles of major concern for the manufacturer and safety design engineers. Water film (Fog) that forms on a windshield during the winter times would reduce and disturb the driver's visibility. Extreme weather condition can make a difference while driving, the factor which mostly affect the visibility can be rain, fog, snow, dust etc. in this paper we studied research reviews conducted in improving existing design of fog removal techniques using experimental and numerical methods. The cause of fog formation in vehicle is also investigated by various researches is also studied.

Keywords: - Windshield, Sensor, Defogging, visibility index.

1.INTRODUCTION

Fogging on a vehicle's windshield is a well-known safety issue. Fog on the windshield glass lowers or completely blocks the driver's field of vision. A driver who is distracted or dazzled puts himself and other drivers on the road in danger.

When the glass temperature dips below the dew point of air, fogging happens on the windshield. This can happen due to a rise in humidity in the passenger compartment, which raises the dew point, or a drop in the temperature of the windshield glass. The following are some of the most prevalent vehicle fogging scenarios.

- Fogging that happens prior to the engine starting due to retained moisture in the passenger compartment and a dip in outside temperature.
- Due to pre-existing evaporator condensate from the prior AC operation, there is flash fogging at the start of the engine.
- Fogging that occurs after engine start as a result of excessive moisture introduced by passengers who have recently showered, been wet, stepped through snow, and so on.
- Sudden drops in windshield temperature while driving, such as those generated by heavy rain on hot days.
- Fogging caused by the passenger's constant vapour stream creation while driving in a cold environment.
- The air is saturated with 100 percent humidity, making it extremely humid.

Different researcher give their theory of removing and stopping the fog of windshield. In this paper we discuss some researcher's theory and their effectiveness.

2.LITERATURE REVIEW

R.Ahila Priyadharshni, S.Aruna the Dark Channel Prior technique is used to build an effective visibility enhancement technique for single image de-hazing in this paper. Estimate the low-intensity dark pixels in any of the RGB channels, and this dark channel will provide exact estimation for the transmission map. The bilateral filter is used to preserve the edge of the transmission map. The Laplacian distribution value is utilised to obtain the gamma correction approach and to estimate the precise colour of the blurry input image.

The gamma correction approach is also used to evaluate the sufficient transmission map. Performance metrics like as PSNR, e metric, and metric are used to measure the quality of the improved image. [1]

Fazle Elahi to improve human comfort and flexibility, a full windshield regulating system was designed. The wiper is controlled by a water level sensor, which senses the level of water or rain and regulates the wiper motor accordingly. A dust sensor has been included to splash water on the

windshield and then wipe it clean. It detects when the screen has gathered a specific amount of dust. He works on enhancing human comfort in the present system so that the driver can focus fully on driving in all weather, including dusty, rainy, and summer conditions. [2]

Peter A.R. The clear vision auto defog system achieved the goal of defogging the windshield when it is fogged and preventing fogging when it is not fogged by improving the design of the IGBT (Integrated dew point & glass temperature) fog sensor, which is basically known as auto defog system design. Even in intense misting conditions, the system's performance is good. [3]

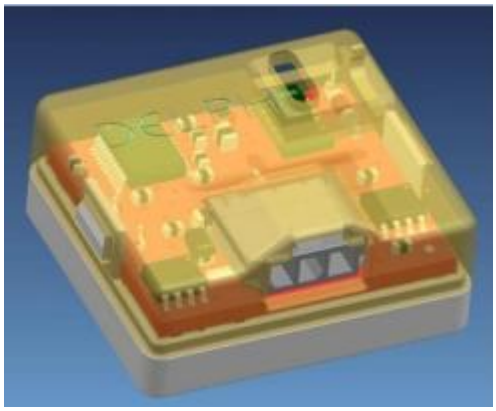

Fig.1 – IGBT SENSOR [3]

Romain Gallen they created two algorithms, each of which is tailored to a specific situation. The goal was to create a method for fog detection that could be used with a typical camera with automated exposure settings. There has been no change for the express purpose of detecting fog at night. This decision was made in order to preserve the normal operation of another camera-based ADAS. This method necessitated the creation of a dual algorithm that accounts for scenarios in which the vehicle's headlights are the only source of illumination and situations in which the environment is illuminated by several light sources. Fog detection is therefore an inescapable instrument that can be used to negate or modify the outcomes of other algorithms. [4]

Zhao, Jianwei Gong, Guoliang Fan. offered a local Extrema-based defogging and dehazing approach there are three stages to the procedure. White balance was utilized to estimate skylight in a color image, an atmospheric scattering model was used to detect atmospheric veil, and a multi-scale time manipulation approach was employed to improve visibility. The goal of this research was to increase visibility in both clear and foggy environments. In thick foggy and haze scene photos, the proposed method did not give good results. 66 hazy photos were chosen at random for the experiment. Edge preserving index was utilized to measure edges in the suggested approach (EPI s), which calculates the gradient sum pixel of the restored image and original image. Four performance metrics, e, r, and h, were utilized to calculate the image restoration rate. The color retention degree in the defogging image was determined using the indicator h. [5]

Troy and sharma rajiv related to a defogging air conditioning system for a side view mirror and side glass this is a vehicle heating system that uses a vehicle rear view mirror outer cover to define a cavity in which a mirror is located. The air can enter the rear view mirror inner case through a rear view mirror intake tube that passes through the outer and inner cases. A rear view mirror outlet tube that runs through the outer and inner cases may allow air to escape the inner case of the rear view mirror. An HVAC unit is also connected to the rear view mirror inlet, which blows air into the outer or inner case of the rear view mirror. [6]

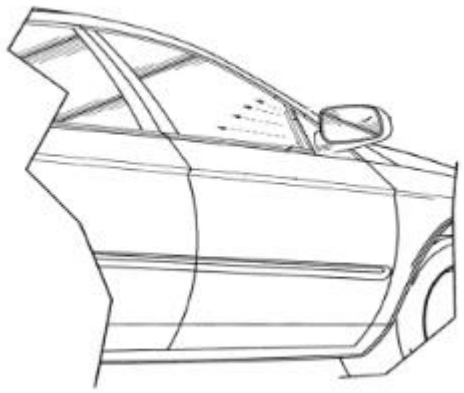

Fig.2 Exterior view of inner view glass

Selveraj a/l subramaniam the new wiper retractor system was devised to lessen the weariness of the wiper rubber, which cleans the windscreen from moisture and grime. The wiper retractor will expand and move the wiper blade away from the windscreen as the driver puts the car to a halt and turns off the ignition switch, according to the new system design. When the ignition key is turned on, the retractor operation is reversed. Almost all car wipers are retracted by hand, which might be inconvenient at times. [7]

Fig.3 Wiper Blade [7]

B. Vengadaesvaran In comparison to the naked glass substrate, the developed superhydrophilic coating on glass substrate was found to have excellent antifog properties. Even at 130° C in a hot boiling water for 10 minutes, superhydrophilic surfaces displayed free small droplets and were totally dry after 1 minute. After impacting with hard water spraying for 5 minutes, the superhydrophilic coating surfaces showed no free water streak, indicating that the superhydrophilic coating on glass substrate is anti-water streak. [8]

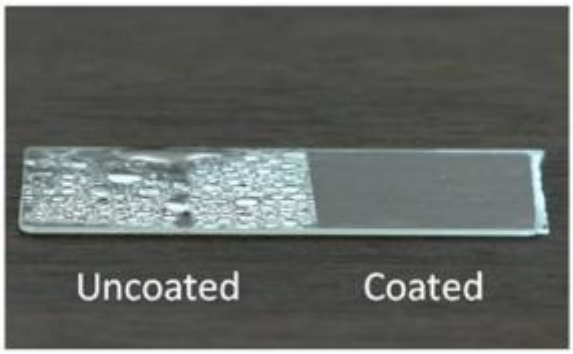

Fig.4 Uncoated Vs. Coated [8]

Mehran Kamyar to detect the presence of water, the sensors reflect infrared rays in the windscreen. It is extremely prone to erroneous data caused by grit or other particles in the windshield imitating rain. Another reason to avoid employing optical sensors is their big size, which may detract from the aesthetic appeal of premium vehicles. Capacitive sensors are more effective for this purpose than optical sensors. It has a larger sensing area and is less likely to be false-positive. The sensor detects water in the windshield and sends a signal to the body control module. [9]

Jeong – Hoon Lee et. al. outline the process of creating and validating an automatic system control system. By reducing the occurrence of window fogging, the auto defog technology improves system visibility. An auto defog sensor, an independently actuated defrost door flap towards the windshield glass, and a control head make up this system. This technique allows drivers to retain their eyes on the road through the clear window, while the regulated humidity level improves overall passenger comfort.

This research describes the specific requirements of an auto defog sensor, and a fog probability model is offered to more precisely specify anti-fog action. Furthermore, the defog control was created and confirmed by a field test that included the worst case scenario — a fast fog situation. [10]

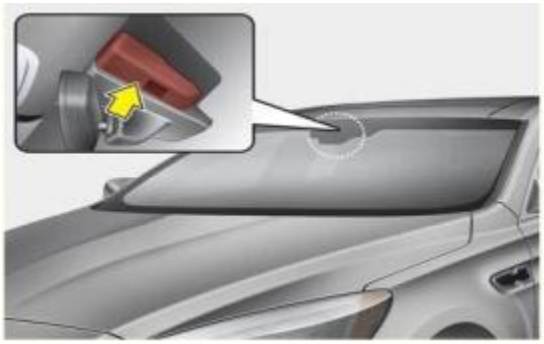

Fig.5 Automatic defog system [10]

Warn-Gyu Park et. al. Mist frequently forms on automobile windscreen glass in cold humid weather. The present paper describes the development of a control device for automatically demisting windscreen glass. Automatic demisting control is initiated when the surface temperature of the glass is lower than the dew point temperature at a given relative humidity and temperature of the cabin inside. It was decided to attach the sensors measuring surface temperature and humidity on the bottom right of the glass and on the back of the rear-view mirror respectively, based on the observation of experiments. The demisting control strategy was originally designed to increase blower speed, change mode, mix hot and cold air, and turn on/off the air conditioner as the mist formed increases. The automatic device was operated with the automatic temperature controller of a heating, ventilation, and air conditioning (HVAC) system and successfully demonstrated in a vehicle test in a cold chamber by following the designed control strategy. [11]

Aroussi et. al This paper describes an investigation into the fluid flow and heat transfer on the windshield as well the effect of the air discharge from the defroster vents on passenger comfort. The investigation is both experimental and computational. Full-scale tests are conducted on a current vehicle model using non-intrusive diagnostic methods. The results presented are from numerical simulations validated by experimental measurements. The numerical predictions compare well with the experimental measurements. The locations of maximum velocity and pressure, as well as width and length of recirculation regions, are correctly predicted. [12]

A.H.M Fazle Elahi Windshield control is a vital operation of driver during driving. The mountings fitted in the windscreen or also called windshield are essential to use for smooth driving. These can be automated by using sensors and microcontroller. A complete windshield controlling system has been developed here to increase human comfort and flexibility. The wiper has been controlled by a water level sensor which regulate the wiper motor through sensing the level of water or rain. A dust sensors has been integrated to spill some water in the windscreen and then wipe it. It senses when a certain level of dust get accumulated in the screen. The sun visor which is mounted inside the car to shade the driver's eye from sun would be easier to control by a servo motor. Here an automatic sun visor has been designed to be controlled through a light sensor which is used to measure the light intensity and send the signal to the main control unit. This project focuses on improving human comfort in the existing system so that the driver can pay full attention in driving at all weather even in dusty, rainy or summer. [13]

Matthew Bartos Connected vehicles are poised to transform the field of environmental sensing by enabling acquisition of scientific data at unprecedented scales. Drawing on a real-world dataset collected from almost 70 connected vehicles, this study generates improved rainfall estimates by combining weather radar with windshield wiper observations. Existing methods for measuring precipitation are subject to spatial and temporal uncertainties that compromise high-precision applications like flash food forecasting. Windshield wiper measurements from connected vehicles correct these uncertainties by providing precise information about the timing and location of rainfall. Using co-located vehicle dashboard camera footage, we fund that wiper measurements are a stronger predictor of binary rainfall state than traditional stationary gages or radar-based measurements. We introduce a Bayesian filtering framework that generates improved rainfall estimates by updating radar rainfall fields with windshield wiper observations. We fund that the resulting rainfall field estimate captures rainfall events that would otherwise be missed by conventional measurements. We discuss how these enhanced rainfall maps can be used to improve food warnings and facilitate real-time operation of storm water infrastructure. [14]

Monkova the design of a machine or a mechanism or any moving mechanical system always starts with a consideration of kinematics because kinematics is the study of the geometry of motion. That is, kinematics deals with the functional relationships between the parts interconnected, and how those parts move relative to each other. Only after choices have been made regarding those three factors can matters such as strengths, materials, fabrication techniques, and costs be seriously addressed. Failure to devote the proper attention to kinematics up front can, and often does, result in the design of a system with substandard or no optimum performance and/or with unsatisfactory reliability. Even though the virtual simulation of a mechanism has a firm place in engineering practice, it seldom conforms to real conditions, due to outside and inside influences, which can be difficult to predict and define. Therefore it is necessary to consider random influences and to multiply the results by surety factor. [15]

3.GAPS IN LITERATURE

Techniques for removing fog are becoming more useful in a variety of optical applications. The majority of previous research has given their fog removal approaches, it has been discovered. The following are some of the research gaps identified through the literature review:-

- The presented methods have neglected the techniques to reduce the noise issue, which comes inside even all the glass closed.
- Not much effort has focused on the cost issue.
- All techniques required external element of device that take excess vehicle space.

4.CONCLUSION

The majority of scientific studies have disregarded key concerns, such as the fact that no technique is preferable for diverse types of conditions, as this research analyses. The approaches' effectiveness, as well as several qualitative assessments, are assessed, and the experimental results reveal that the methods used produce good outcomes for fog-degraded pictures. This research aids in the development of new and improved fog removal strategies.

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