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Anti-pinch Car Sunroof system

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ABSTRACT

Systems and methods are provided for a vehicle roof closure that can prevent pinching of obstructions within a roof opening. Example vehicles include a roof having an opening, a panel disposed adjacent to the opening and moveable by a first motor, a shade disposed below the panel and moveable by a second motor having a lower output than the first motor, and a controller configured to close the shade before closing the panel during a close panel operation, and stop the shade if an obstruction is detected within the opening. Example methods include upon receiving a command to close a panel over an opening, causing a shade motor to start closing a shade disposed below the panel by unrolling the shade; stopping the shade motor upon detection of an obstruction within the opening; and causing a panel motor to start closing the panel upon receiving a shade closed signal.

INTRODUCTION

Automotive anti-pinch is a safety system used in the power windows and sunroof of a car. The technology prevents the winding up of the window of roof if it senses any obstacle in the path of the sliding glass. The electric motor is fitted with a sensor that can sense the resistive force acting against the motion of the glass. Commercially available vehicles can include a sunroof or sunroof with one or more moveable elements for exposing or covering an opening in the roof of the vehicle. Additionally, conventional sunroof or sunroof assemblies include an anti-pinch sensor for detecting an obstruction or obstacle in the closing path of the moveable element, in accordance with federal regulations. As will be appreciated, the terms sunroof and sunroof are interchangeable and any reference herein to one of the terms is intended to apply to the other as well.

Example embodiment provides a method of controlling a vehicle roof closure using a processor, the method including upon receiving, at the processor, a command to close a panel over an opening, causing a shade motor to start closing a shade disposed below the panel by unrolling the shade. The method further includes stopping the shade motor upon detection of an obstruction within the opening and causing a panel motor to start closing the panel upon receiving a shade closed signal.

At present, almost all the power window anti-pinch products in the automobile pre-assembling market adopt the sensing art by using resistor or Hall element to measure the current through the lifting motor, so that it indirectly measures the pressure. Such art adopts the principle when facing obstacles during the power window rising process, the pressure increases, and causing the motor current increase; thus, such art achieves the anti-pinch purpose by measuring the motor current change and indirectly calculating the pressure change. Since the frictional resistance caused by the rubber sealing strip to the window during the window rising process is related with the rising position of the window, the current power window anti-pinch products usually use additional Hall or IR sensors to determine the position of window thus assisting to calculate the normal pressure value in the window rising/lowering process.

PROBLEM STATEMENT

The Pressure sensor anti-pinch system has the following drawbacks:

1. While testing the products, the testing vehicles can be calibrated meticulously to meet the anti pinch force requirement of 100 N. However, during mass production, it is difficult to guarantee the conformance of the anti-pinch force with regulation requirements due to the inconsistency of motor parameters, friction force of the rubber sealing strip, production of window frames and lifting mechanism.
2. After the products being delivered, two categories of misjudgment faults can easily happen to the anti-pinch system;

3. If the normal friction force or pressure reduces, when the pinch force reaches or exceeds 100N after the encountered obstacles, the anti-pinch device may still consider the pinch force has not reached 100N and will not perform the reverse action, which causing damage to the human bodies; and
4. when there are no obstacles, but the normal friction force or pressure has increased over 100N required by the laws and regulations, the anti-pinch device may perform the wrong operation, and the window cannot rise normally. These two faults are due to change in normal friction force or pressure, which can be changed by various factors, including, the hardness of the rubber sealing strip changing due to environmental temperature changes, aging and deformation of rubber sealing strip, wearing and deformation of lifting mechanism, deformation of window frames, etc

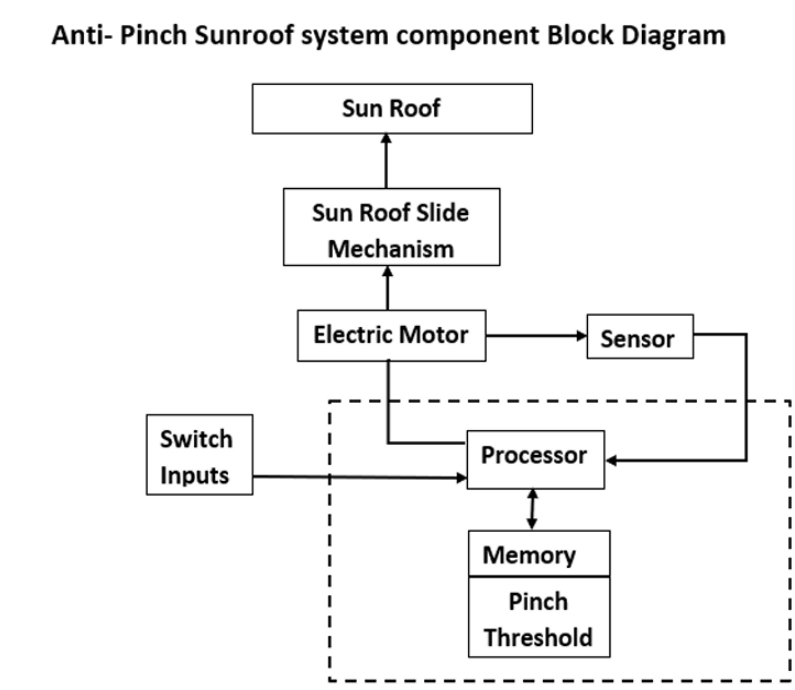
Existing Methods:

1. Sensing by indirectly measuring the pressure
2. Sensing by directly measuring the pressure

LETRATURE REVIEW

- Prawoto, Y et al. discussed the common failures of the power window mechanism and explains manufacturing process and another finding is since gear is coupled to the linkages and generally stall torque is higher in magnitude leads to cracks on the linkage and finally with respect to time failure of the system. This paper outlines simplified manufacturing process and common failures of the mechanism.
- Sameer M. Prabhu et al. This paper outlines the conceptualization and implementation process of the electromechanical system using a model-based design and development approach in combination with modern tools. Another key finding is embedded systems development process through mathematical modeling and auto code techniques from conceptualization to implementation stage.
- M.A. Dehghani et al.This paper proposes hardware in the loop simulation testbed using airborne seekers (an onboard visual tracking system) as a relative measurement sensor in the leader-follower formation flight. The projected system explains uncertainties in the camera processing delay and various measurement noises.

PROPOSED METHODOLOGY AND OPERATING PRINCIPLE

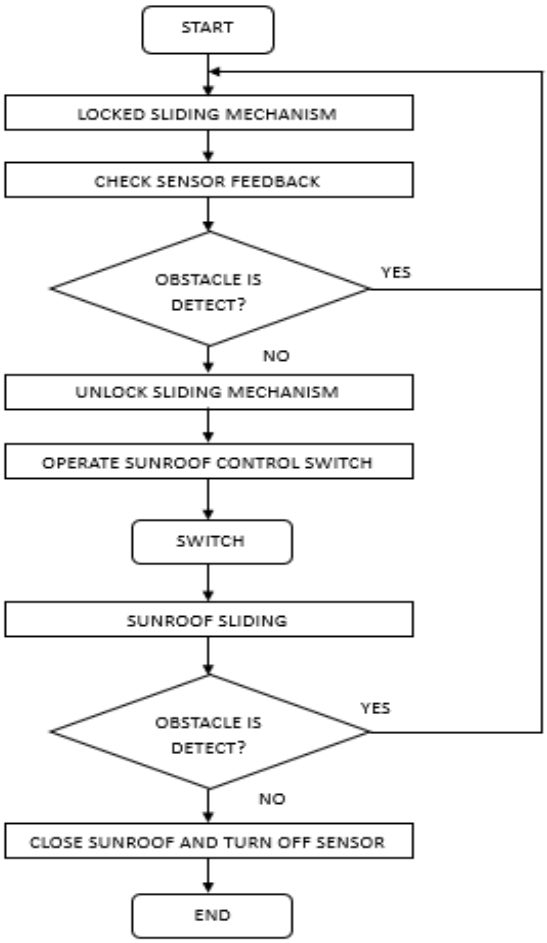


IR type obstacle detecting Sensor Using infrared light to form an infrared light curtain within the scope the sunroof frame. When the obstacles cover the infrared light curtain, the infrared light received will change, thus achieving a non-contact anti-pinch mechanism. One of the flaws is that the infrared light can be easily affected by the heavy weather, such as rain, frog, dust, etc. Furthermore, several pairs of infrared transmitting and receiving devices are required to form the infrared light curtain. The installation is difficult and the cost is high. Therefore, although there are standards for the infrared light sensors in European and United States, even till now, such art has not been applied in the automobile pre-installation market.

WORKING PRINCIPLE

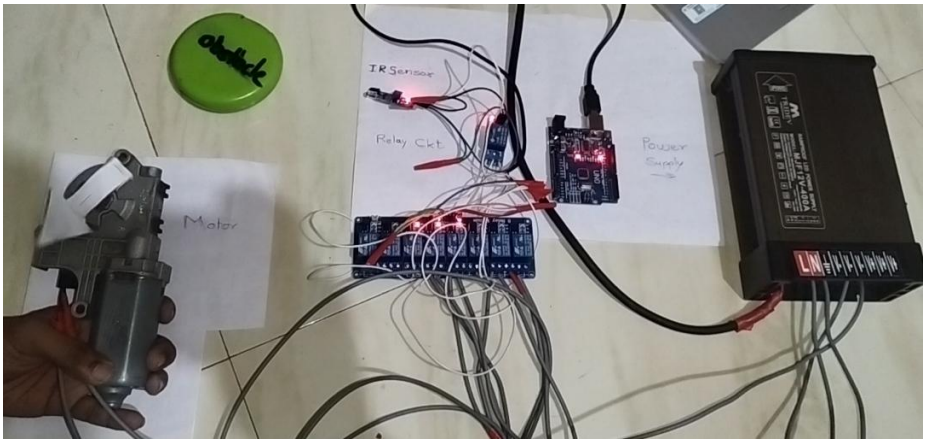
First of all, Sunroof are getting very popular nowadays. As the popularity of these system started increasing, some of the fatal safety concerns regarding their use came under focus. It all started with a number of cases of child suffocation because of the use of Sunroof. Generally, children prefer to watch out through sunroof of the vehicle and hence they try to take their neck or hands out through the sunroof. So In such a case, if anyone operates the sunroof switch accidentally; the sunroof starts closing causing suffocation or injuries to the child. The risk also arises in earlier case of sunroof which are programmed to operate by using Pressure sensor anti pinch system without even the need to press the switch. The glass of sunroof is reverse after touches to hand or body part and after small pinch pressure sense by sensor it operate reversing of sunroof but in this operation there is chances of injury because the rubber edge cover is expand or wear after some period so chances of risk of pinch hazard. To avoid such mishaps, we invent the IR based anti-pinch technology.

FLOWCHART OF ANTI PINCH SUNROOF SYSTEM



Hence In the case of sunroof equipped with IR based anti-pinch technology, the electric motor is fitted with a IR sensor which can sense the obstacle in the motion of the glass from safe distance. As soon as the motor detects the obstacle, the winding action stops immediately and it starts operating in reverse direction. As a result, the sunroof comes open; and it avoid any injury to the occupant.

RESULT AND DISCUSSION



CONCLUSION

- In the case of sunroof equipped with IR anti-pinch technology.
- the electric motor is fitted with a IR sensor which can sense the obstacle in the motion of the glass from safe distance.
- As soon as the motor detects the obstacle, the winding action stops immediately
- it starts operating in reverse direction. As a result, the sunroof comes open and it avoid any injury to the occupant
- IR based Anti -pinch Car Sunroof system is prevents possible injuries to the occupants

FUTURE SCOPE

- In future scope it can apply for window glass for operating system in any vehicle
- It can be use emergency sunroof as window

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