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Automatic Seat Adjustment

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Abstract

The following project deals with the design made to overcome the wastage of time, mental stress by the person incurred in adjusting the seat or chair to suit the best comfort of the person by using the principles of automation and ergonomics techniques. The aim of the project is to eliminate the steps involved in adjusting the seat using various buttons. Instead of pressing and holding the switches and levers for a longer time, the user can complete the task in a very simple way by just entering his height. In addition to this automated system, this project also comes with a mode feature in which, the driver will have 2 mode options (Drive mode and rest mode). In drive mode, the seat will suit to fit the driver position to drive the vehicle and in rest mode the seat back will incline at the maximum angle allowing the driver to take rest. To enhance the safety system, rest mode will come into operation only when the vehicle is at rest.

1. Introduction

Automation is the fastest emerging field in the latest era of technology. The problems faced by the society till 21st century has now been vanished with the help of automation. Automation has played a major role in bringing the hardworking lifestyle of society into an executive and simple working condition with its aesthetic working systems. For almost all the industrial or domestic purpose, people depend upon automated systems. Self operating devices are available for many applications but still there are some exceptions. One of these exceptions has been taken into consideration and an automated system has been designed for the self adjustment of a seat.

The automatic seat adjustment is a technique of self adjustment of a seat according to the consumer comfort. According to this design, the seat will get adjusted when the person enters his height as an input. Based on the ergonomics of human body, the

microprocessor is coded. The microcontroller controls the actions related to adjustment. In addition to the self adjustment, a rest mode is also provided which can be used when the long driving vehicle driver needs a brake. In rest mode the seat will go to maximum inclination so that the driver can take a little nap. To enhance the safety microcontroller is coded to keep the vehicle still when this rest mode is on. Only when the drive mode is on, the vehicle will move. If a person still finds any discomfort he/she can alter the settings manually and save the seat position as 1. When using the seat next time, that person can just press than button and restore his/her settings.

2. Working process

2.1 Components

The working of this automatic system is completely based upon the microcontroller. The microcontroller controls the sequential operations performed by the direct current drives. Based on the input data, the microcontroller performs operations as per the coding fed in its memory. The data is processed into information in the microcontroller and the result is the activation of drives. The adjustment system comes into action when the input value is entered in the input panel. The input device is located right behind the window controls. The input device can be easily handled by the passenger sitting on the corresponding seat. The input values are sent to the microcontroller which consists of an Arithmetic and Logic Unit, a feedback circuit and a storage device. Then the feedback circuits enable the microcontroller to know the current position of the seat. Then the microcontroller performs logical operations in order to set the position of the seat. When the seat position is set, the electrical signals are sent from the microcontroller to the transformer and from transformer to the direct current series electrical drives. Based upon the electrical power output, the DC electrical drives will operate in forward or reverse direction. If the current provided by the microcontroller is positive the drives will operate in clockwise and vice-versa.

If the seat is still found uncomfortable, the person can manually adjust the seat by using the power seat adjustment buttons. These adjustments include front-back movement, seat height raise-lower, inclination adjustment and headrest adjustment. Once these adjustments are done manually, the user can save the settings by pressing the “save/restore” button for 3 seconds. When this is done, the seat position will be stored in the storage unit of microcontroller. Next time when the same person arrives, this setting can be restored just by pressing “save/restore” button from the adjustment console.

For long drive passengers or drivers, a special mode is featured along with automatic setting. This special mode is a “rest mode” with the help of which the driver can take rest by parking the car in a safe place. To ensure the safety, parking brakes will get automatically engaged when this rest mode is turned on for the driver of the vehicle. To activate this mode, “rest mode” button should be activated from the adjustment panel. When this button is pressed the seat is inclined at the maximum

possible angle. The seat moves to rear end so that the driver's legs can be stretched. The headrest will lower its height and decline at a small angle to like a pillow.

Electrical drives are the direct current electrical motors which are connected to the driving gears of the seat with the help of a shaft. These electrical drives receive electrical input from the microcontroller.

2.2 Motion arrangements

The motions for all parts of the seat are done using a rack and pinion, gear and pinion. For base movement of the seat in forward or reverse direction, a rack and pinion is used. Rack is fixed at the bottom and acts like a bed for the seat. A pair of pinion as spur gear is aligned with the rank and the gears are locked with the shaft of the electrical drives. The electrical drive is fixed at the bottom of movable seat. When the drive works, it makes the gear to rotate in any one particular direction. The gear will move from one place to another by rolling on the rack. By this process the seat will take its forward and reverse motion. For inclination of the seat, a kinematic pair of pinion and gear is used. The pinion is locked with the shaft of the drive. The Large diameter gear is fixed to the seat. Both the gear and pinion are aligned and perfectly mated. When the electrical drive is operated, the pinion with smaller diameter will rotate at a particular speed and for particular time. This rotational movement of pinion will drive the larger diameter gear. The angular distance covered by larger diameter gear is equal to the change of angle made by the seat. The change in the angular distance of the larger diameter gear depends upon the gear ratio and the speed of pinion. The ratio of number of teeth on pinion to the number of teeth on gear is known as gear ratio and is designed based upon the load and speed required. Let the gear ratio be 1:3.4 then, 3.4 rotations of the pinion will make the gear complete one 360^0 revolution. If the inclination angle is required to change from 75^0 to 60^0, the angle changed is 15^0. For 15^0 of rotation of the large diameter gear, 3.4 should be divided into 24 parts and one part of the result should be the value of angle of rotation. As a result we get 0.141 i.e. the pinion should rotate 0.141 times to change the inclination angle by 15^0.

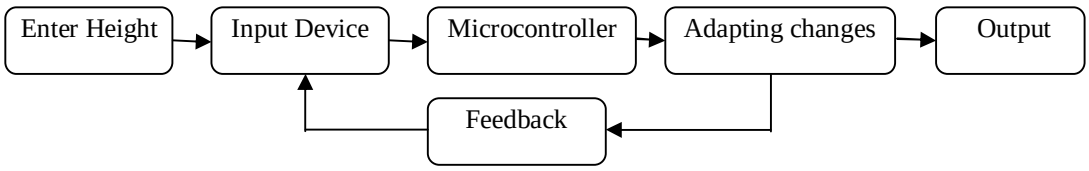

Figure 1: A block diagram representing the working sequence of the adjustment.

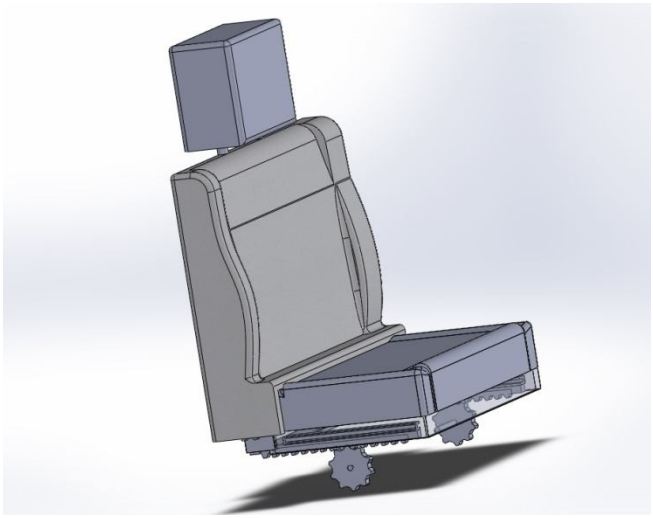

Figure 2: A final seat assembly representing the seat with rack and pinion attachments at the bottom.

3. Conclusion

To eliminate the work, time, energy and stress consumed while adjusting the driving seat this work was done. Instead of adjusting the seat manually, the seat adjusts automatically by the help of a closed loop electronics circuit. The only task meant for the driver is to enter his height and the rest of the work is done by the electrical drives controlled by the microcontroller. The accuracy of the microcontroller is improved by using a feedback circuit.

The height entered in the console is sent to the microcontroller. After processing the data, the microcontroller operates the electrical drives which adjust the various positions of the seat.

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