

# Smart Suspension System

Brijmohan Singh

Uttarakhand Technical University  
District pauri garhwal kotdwar, State Uttarakhand, India, Mobile-+91 7895534324;8273379515  
*brijmohan.singhnegi54@gmail.com, brijmohan54@outlook.com*

**Abstract:** The object of this project is to keep the equal distance called “C” between the road surface and vehicle body lower surface in every conditions. If any irregularities will come, smart suspension system will eliminate it effectively. Here the smart suspension is designed in such a way that it keep equal distance between road surface and vehicle lower surface. Hence if a person sitting in a smart suspension vehicle then he will feel that there is no jerk as compared to the normal suspension system.

## 1. Introduction

With the growing technology in automotive sector, there is a need of smart suspension. Because normal suspension system is only have one feature that is reducing the effects of jerk coming from road irregularities. When vehicle having normal suspension goes in road irregularities the whole vehicle and passengers suffer from it. If a vehicle tyre goes in a down irregularities, the upper part from that tyre tilt downward and if vehicle tyre goes in up irregularities, the upper part from that tyre tilt upward. Smart suspension mechanism eliminate this tilting of vehicles. Here a linear actuator is used in smart suspension in the place of shock absorber in normal vehicle. When a down irregularities come linear actuator expand and when up irregularities come linear actuator compress.

## 2. Theory

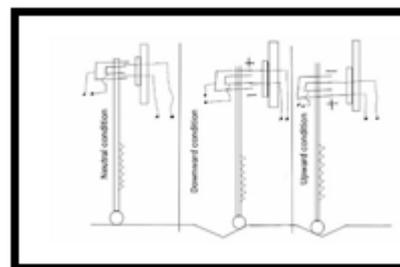
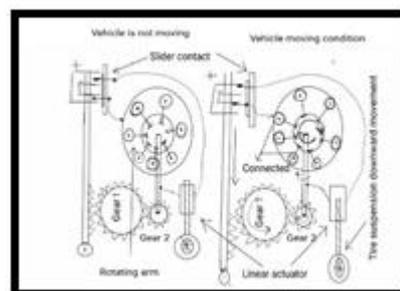
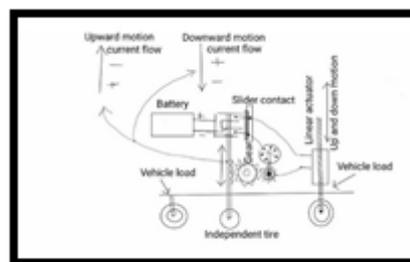
The theory of this project is based on linear actuator motion that give controlled up and down motion. Here a system is provided to linear actuator that give a signal for moving upward or downward.

## 3. Material required

Linear actuator  
Slider  
Gear mechanism  
Battery system  
Independent tyre  
Connecting pins

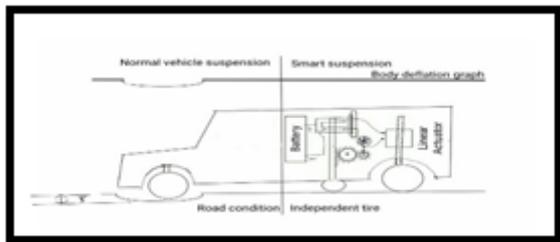
## 4. Construction

In this setup independent tyre is having gear and connecting pins. Connecting pin is able to transfer charge from battery and also provide a motion to gear 1, This motion is further transfer in rotating system through gear 2. Rotating system is able to transfer charge in vehicle moving condition and cut that charge when vehicle is not moving by expanding or compressing it's rotating arm. A slider is provided to the connecting road. The slider is able to change polarity of charge so that linear actuator is able to move in desire direction. Linear actuator is further connected to the tyre. Charge from slider come in linear actuator and controlled by the rotating system. The whole setup is shown in figures below:

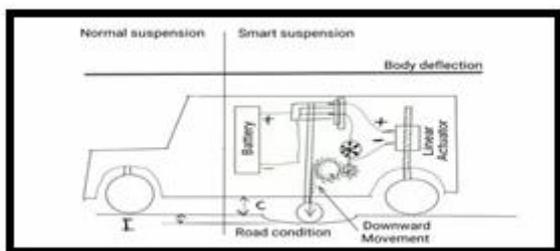


## 5. Process

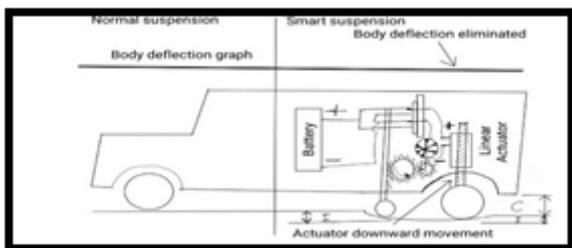
When vehicle is goes in any irregularity first of all independent tyre goes in that irregularity ( down irregularity figure shown below ) and measure the irregularity gap and convert it in motion. This motion is further transfer in gear 1 and also in connecting pin. Connecting pin transfer charge from battery to slider. Gear 1 transfer motion from independent tyre to gear 2 with very high quality. Gear 2 transfer this motion in rotating system. Rotating system rotates it's arm so it's arm expand and give charge flow to the linear actuator. Then linear actuator move either upward or downward according to polarity provided by the connecting pin and slider. The whole process is shown in figures below. Here the front tyre is having normal suspension and rear tyre is having smart suspension. The difference between these suspension is described by the vehicle deflection graph.



In this figure the front tyre goes in down irregularity. Hence due to having normal suspension the body of vehicles tilted down. So this deflection come in vehicle deflection graph. Here the gap between road surface and vehicle body lower surface reduced by “I”. Clearance near the front tyre will be = C-I



In this figure when independent tyre goes in down irregularity. It measures all the gap point distance and convert it in motion. Here it expand further “I” distance.



In this figure when rear tyre or smart suspension tyre reached to that down irregularity. It start expand due to signal provide by independent tyre and fill the gap that come through down irregularity. After that it come in its initial position. This tyre follow the path of independent tyre. Here no deflection come in vehicle body. Vehicle body deflection graph show straight line. Here rear tyre expand by “I” distance so it maintain distance “C” in every conditions between the vehicle lower surface and road surface.

I = irregularity gap  
C = clearance gap

Irregularity	Normal suspension	Smart suspension
Down	C - I	C
Up	C + I	C

### 6. Factors affecting

- Vehicle speed
- Linear actuator speed
- Time interval between input signal and response time.

### 7. Reference

Google search – working of linear actuator; gear system; rotating system.

### 8. Author Profile



**Brijmohan Singh-** I received the B.Tech. degrees in Mechanical Engineering from Uttarakhand Technical University in 2014.. During 2014 to 2015,, i worked in Mahindra and Mahindra Ltd Haridwar automotive sector.