

# AN OVERVIEW OF TWO WHEELER AIRBAG SYSTEM

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## Abstract

Automotive airbag system has augmented occupant safety through the incorporation of increasingly sophisticated features. An airbag is an automotive safety restraint system consisting of a cushion, designed to inflate rapidly during collision. It absorbs the shock and reduces the number the casualty rate. The success of this safety system heavily depends on its correct implementation and timing of its inflation.

The objective of this study is to present front air bag defects and its adverse effects on the occupants. It is important to understand how failures occur and which mechanism is responsible for injuries. This study shows the importance of using the seat belts alongwith airbag to provide adequate safety to the occupants.

**KEYWORDS:** Airbag, collision, failure and automobile.

## Introduction

The Airbag system was first introduced in 4-wheelers. This paper gives information about the introduction of the airbag system can be used in the two wheelers(bikes). This paper shows the working, construction, installation of this system and problems that can occur in this system.

The concept of this airbag system is "To reduce the injuries to a rider when impacting with an opposing vehicle and/or opposing object in frontal collisions by absorbing rider kinetic energy and by reducing rider separation velocity from motorcycle in the forward direction." With the help of the ANGLE sensor with an angle indicator and sense of the collision and the large frequency vibration for to open the air bag.

## Design with required instruments

The following instruments are used for the 2 wheeler Airbag system —

1. Air bag (leather material with grip technology)
2. Chemical cylinders for releasing the air or gas
3. Sensors (angle sensor and crash sensor)
4. Fitting cage
5. Inflator

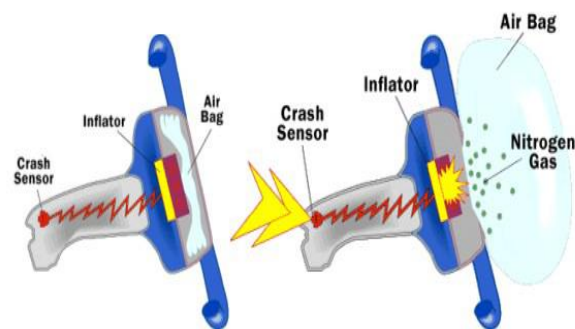
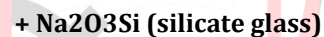
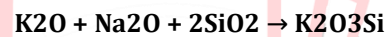
## Air bag (leather material with grip technology)

Airbags are stretchable fabrics or other materials that are tightly packed in various locations throughout your vehicle. These bags are compressed and kept in a small area. When there is an accident, the airbags fill up with air very quickly to provide a cushioning system for the people on the motorcycle so that they are not thrown around in the event of a crash. While this does not necessarily prevent total injury or death, it can be very helpful in cushioning the passengers in many cases.[6]

## Chemical reaction behind opening of airbag

Actual opening of air bag is due to the chemical reaction occurred in between two chemical cylinders

which are fit at the bottom of bike. When an external force or collision of two objects with bike occur then the chemicals in those two chemical cylinders mix with each other and the chemical reaction takes place inside the cylinder.



During collision, a mechanical switch is flipped and an electrical contact takes place. Sensors send an electric current to the inflation system. Inflation system contains sodium azide and potassium nitrate. Electric current heats the filament which ignites the capsule containing Nitrogen gas. The gas expands quickly and inflation of air bags takes place, which literally bursts from its storage site.[3]

## Sensors (angle sensor and crash sensor)

The most important parts behind the success of the airbag system are the sensors. These are small pieces of electronics that are designed to tell when the vehicle has been damaged in an accident. They respond to several different sets of stimuli, including sudden stopping, increased pressure as pieces of the motorcycle are moved due to the force of the collision, and angle between road surface and tires of motorcycle. Different types of sensors measuring

wheel speed, seat occupant status, brake pressure and impact, and other vehicle status indicators are monitored by the airbag control unit located in the front portion of the cabin.[6]

### Fitting cage

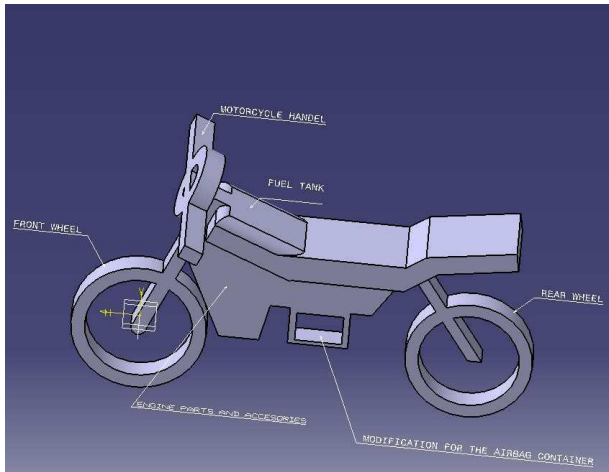


Figure 1 - Modification for the airbag container

Figure 1 shows that the modification is required for the storage of airbag. This cage is made up of metal strips with two openings for airbag.[1]

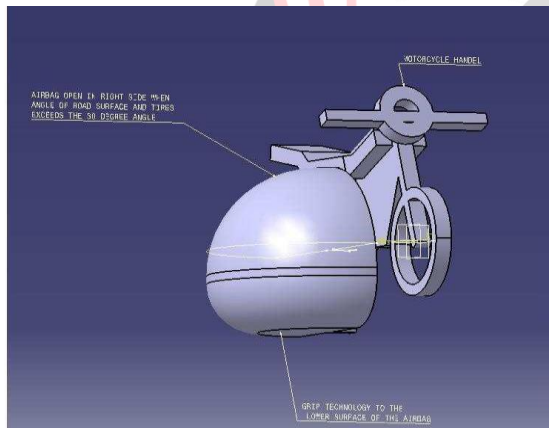


Figure 2 -Airbag opens up on the right side of bike as the angle exceeds 30 degrees.

From figure 2 The angle between road surface and motorcycle tyres exceeding 30 degrees is detected by using an angle sensor, hence as given above chemical reaction takes place and airbag opens up on right side of the motorcycle. In this figure 2 shows that the airbag contains Grips to the lower surface of it.[1]

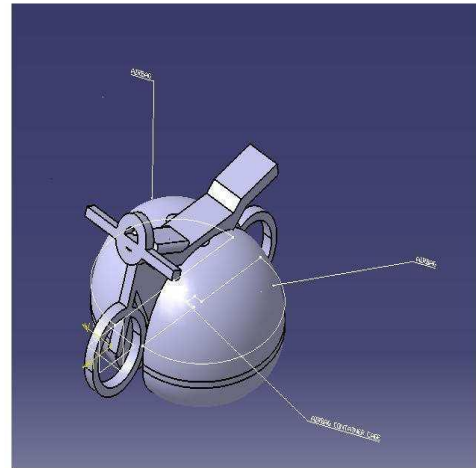


Figure 3-airbag opens up in both directions when any object collapses to the motorcycle.

When any object collides with the motorcycle ,at that time the airbag opens up in both directions to protect the passenger who is riding.[1]

### Inflator

Once the control unit determines there is an accident, it sends a signal to the inflator system. The inflator sets off a chemical charge, producing an explosion of nitrogen gas, filling up the airbag. As the airbag fills up, it bursts through the paneling that contains it in order to protect you.

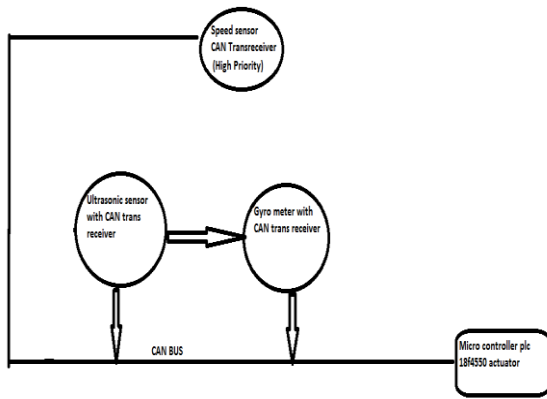
All this happens in an instant, usually within 25 or 50 milliseconds. That translates to almost 200 miles per hour. The airbag then will deflate itself on its own once it gets deployed.[6]

### How air bag system protects the human body parts ?

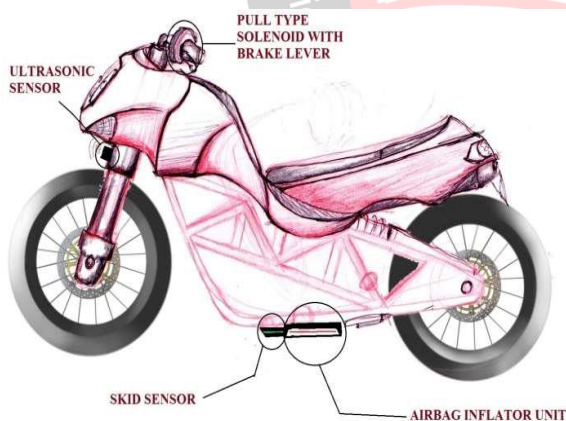
The provision of air bags on motorcycles is more complex than installation in cars, because the dynamics of a motorcycle crash are more difficult to predict . But we discussed the following points on accident. These characteristics leads to act with very short reaction time and fast inflation but only if the motorcycle is involved in the accident . Limitation of this system is that they work properly only under particular conditions , especially the rider must remain on the motorcycle during the accident and the impact dynamics must lead him to hit exactly the part of his vehicle protected by airbags.[2]

Normally, following kinds of bodily harms occur in the accident

- Hand/leg Cracks or fractures
- Head injury
- Bleeding from body parts
- Getting thrown from bike



An ultrasonic sensor will keep on monitoring the distance between the obstacle & the motorist. The ultrasonic sensor is provided with a least message priority through programming. It sends signals to the Micro controller unit through the CAN bus. The ultrasonic sensor will sense for obstacles up to 180 degrees. When the distance between the motorist and the obstacle is very less and the speed is above 30km/hr the brakes are applied automatically. This is done by placing a pull type solenoid over the piston near the front brake lever. This pull type solenoid gets energized and automatically pulls the piston back and applies the brake. After the brakes are applied automatically, the driver is prevented from hitting the obstacle. [5] Application of Brakes causes the driver to wobble and fall down, the Gyro meter which keeps monitoring the vertical axis of the vehicle, when gone beyond a set value of angle it will inflate the airbag longitudinally on the side depending on where the driver falls. [4]



### Recent Advancements

Starting the 2018 season, it will be compulsory, in all classes within the FIM MotoGP World Championship, for riders' race suits to feature airbag systems. The suits with these airbag systems must be worn in every session, by every permanent rider, and must be functional on track at all times. Wildcard riders and replacement riders are exempt for the first two events that they are competing in, after which they will need

to use suits that are of the same specification as those of permanent riders



The rules specify that the airbag should cover and protect at least the shoulders and the collarbone. Full, or central, back protection is meant to be optional. However, should a manufacturer choose to offer back protection, it's meant to cover the whole spine. Changes are allowed, based on the specifications of each system, and the measurements of each rider. [7]

The airbag systems are also meant to pass a series of tests to prove it complies with regulations. The areas in which the airbags are being tested include battery, electronics, deployment and inflation time, and the possibility of accidental deployment of the airbags (accidental deployment of the airbags must not cause a rider to crash or impair their ability to control their motorcycle). The airbags must also be triggered irrespective of whether the rider is on or off the motorcycle. [7]

### Conclusion

By providing total safety to the motorcycle rider by implanting the airbags on both sides of the motorcycle as mentioned in this article, we will reduce the fatality rate by 20% to 30%. By using this technology there is not only a reduction in death rate but also gives the total protection to the rider as well as motorcycle.

### References

1. Bayerische Motorenwerke Aktiengesellschaft, "Everything you need to know about the airbag" service product support, D-80788 Munich, Germany Editorial office: Horner Weiland, Gewerbepark 13, D-83502 Bruckmühl, Germany.
2. Moskal, Mullin, B., Jackson, R., Langley, J. and Norton, R., 2000. Increasing age and experience: are both protective against motorcycle injury? A case control study. *Inj Prev* 6 (1), 32-35.
3. Rishikesh H. Tike, Prog. Mukesh C. Chaudhari, "The airbag system for 2-wheeler vehicle system" *, International Journal Of Research In Aeronautical And Medical Engineering, Year 2014, Volume 2, Issue 2.*
4. Peek, C., Braver, E.R., Shen, H. and Kraus, J.F., 1994. Lower extremity injuries from motorcycle crashes: a common cause of preventable injury. *J Trauma* 37 (3), 358-364.

5. Quddus, M.A., Noland, R.B. and Chin, H.C., 2002. An analysis of motorcycle injury and Vehicle damage severity using ordered probit models. *J Safety Res* 33 (4), 445-462.
6. Published by Infineon Technologies AG 81726 Munich, Germany 2011 Infineon Technologies AG All Rights Reserved. Edition 2011-06
7. "Airbags suits to be made mandatory for Moto GP Riders" by Sameer Contractor published on 14 Jan 2018

