Report on Airbag

- Anant Singh

Table of Contents-

Contents

1. Overview of Air Bags 3
1.1 What is an Airbag? 3
1.2 Airbag Deployment 3
1.3 Types of Airbags: - 3
1.3.1 Side Air Bags- 3
1.3.2 Front Air Bags- 3
2 Table of Requirements – 4
2.1 High Level Requirements- 4
2.2 Low Level Requirements- 4
3 Block Diagram – 6
3.1 Block Diagram Explanation – 6
4. System Benefits – 7

1. Overview of Air Bags

1.1 What is an Airbag?

An airbag is a pillow-like safety device that inflates during the events of a frontal crash of an automobile. The purpose of employing the air-bag is to provide a cushion for bodies of the occupants. Thus, it prevents their direct collision with the inner objects such as the steering wheel or dashboard. It is one of the most vital safety features of a modern-day car. Air bags are supplemental protection and are designed to work best in combination with seat belts. Both frontal and side-impact air bags are generally designed to deploy in moderate to severe crashes and may deploy in even a minor crash. Air bags reduce the chance that your upper body or head will strike the vehicle's interior during a crash. To avoid an air-bag-related injury, make sure you are properly seated and remember—air bags are designed to work with seat belts, not replace them. And children under 13 should sit in the back seat.

1.2 Airbag Deployment

Generally, when there is a moderate to severe crash, a signal is sent from the air bag system's electronic control unit to an inflator within the air bag module. An igniter in the inflator starts a chemical reaction that produces a harmless gas, which inflates the air bag within the blink of an eye – or less than 1/20th of a second. Because air bags deploy very rapidly, serious or sometimes fatal injuries can occur if the driver or passenger is too close to – or comes in direct contact with – the air bag when it first begins to deploy.

1.3 Types of Airbags: -

- **SIDE AIR BAGS-**
- **FRONT AIR BAGS-**

1.3.1 Side Air Bags-

Side-impact air bags inflate even more quickly since there is less space between the driver or passengers and the striking object, whether the interior of the vehicle, another vehicle, a tree, or a pole.

1.3.2 Front Air Bags-

Sitting as far back from the steering wheel or dashboard as possible and using seat belts help prevent drivers and passengers from being "too close" to a deploying frontal air bag. This is why rear-facing car seats should not be placed in front of an active air bag, and children under 13 should be seated in the back seat.

2 Table of Requirements –

2.1 High Level Requirements-

Requirement Id	Design Consideration
HL01	It Shall have Control Sensor
HL02	It Shall have Seat Position Sensor
HL03	It Shall have Occupant Classification System
HL04	It Shall have Airbag Control Unit
HL05	It Shall have Passenger Airbag OFF Indicator
HL06	It Shall have Clock Spring
HL07	It Shall have Wiring Connector
HL08	It Shall have Inflator
HL09	It Shall have Airbag

2.2 Low Level Requirements-

Requirement Id	Low Level Requirement ID	Design Consideration
HL01	LL01	Inherent flaw- Incompatible sensor with self-diagnostic software
HL01	LL02	Failure instance - Unstable electrical signal from driver's SPS
HL02	LL03	Incorrect boundary - Head injury criteria
HL03	LL04	Incorrect boundary - OCS suppress airbag to deploy for certain small adults or children seating manner
HL03	LL05	Failure instance - right-side roof-rail airbag are programmed to turn off if OCS senses right front seat is not occupied
HL03	LL06	Interference between Components - Damaged flexible printed cable due to contact with rear floor mat or other objects

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Requirement Id	Low Level Requirement ID	Design Consideration
HL03	LL07	Fatigue - cracking in printed circuit due to repeated flexing of OCS mat
HL03	LL08	Liquid contaminated electrical connector of OCS weight sensor
HL04	LL09	Failure Instance – ACU contains fault codes ACU reset itself after a hard-braking event
HL04	LL10	Inherent Flaw - Leak path between upper and lower electrodes
HL04	LL11	Conductivity – higher resistance rating metal capacitor damage the ACU
HL04	LL12	Incorrect Positioning of ACU capacitors on circuit board
HL05	LL13	Wrong Components
HL06	LL14	Conductivity - High resistance on electrical circuit
HL06	LL15	Interference between Components - Steering wheel flutter
HL06	LL16	Damaged during installation - Improper assembly tool
HL06	LL17	Contamination - Grease with dust applied on the flexible conductor
HL07	LL18	Incorrect mounting position of intermediate connector allow movement of the connector pins against female contacts
HL08	LL19	Chemical Stability - Incorrect propellant used for airbag inflator initiator. Welding defect cause closure cap weld fracture
HL09	LL20	Incorrect Position - Curtain airbag not situated in the channel between the door frame edge and the body guide bracket

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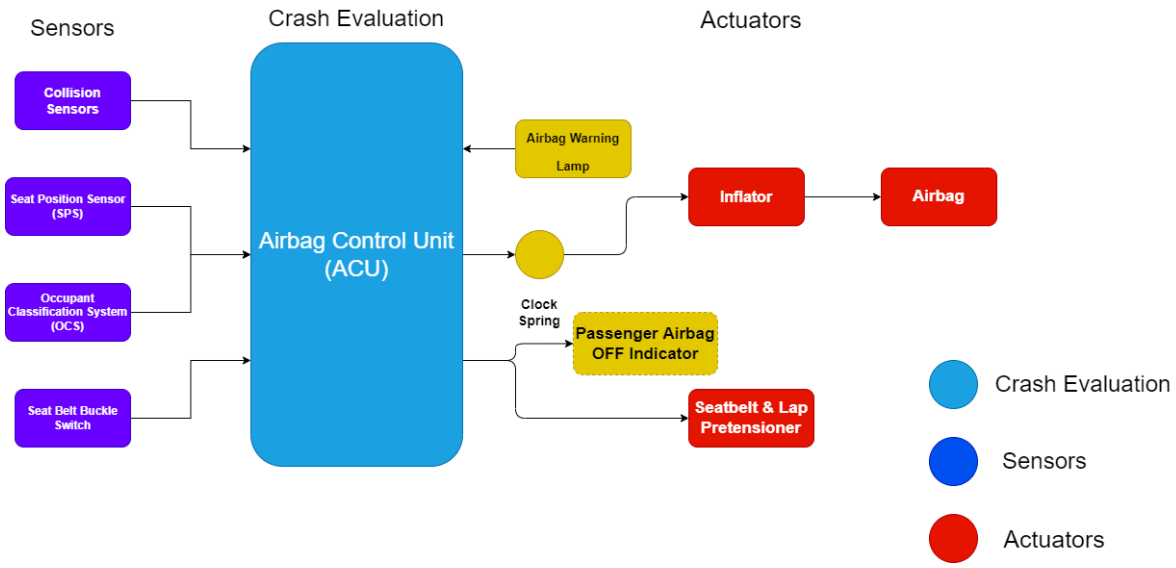
3 Block Diagram –



3.1 Block Diagram Explanation –

- **Collision Sensor** - Detect and transmit collision signal to ACU.
- **Seat Position Sensor (SPS) -** Detect the sliding position of the driver and front passenger seat.
- **Occupant Classification System (OCS)-** Sensor detect front passenger seat occupant and transmit signal to OCS to classify whether front passenger seat is an adult or child or is unoccupied then transmits the passenger seat status to ACU.
- **Seat Belt Buckle Switch -**Indicates Whether the passenger has worn the seat belt.
- **Airbag Control Unit (ACU)-** Detect a collision and supply power to airbag deployment and pre-tensioner seat belt.
- **Passenger Airbag OFF**- Indicator Indicate functional status.
- **Clock Spring-** Connect and maintain electrical circuits contact between ACU and driver airbag located in steering wheel.
- **Wiring Connector-** Maintain electrical contact between ACU and other components.
- **Inflator-** Ignite propellants to inflate the airbag according to ACU signal.

4. System Benefits –

- Airbag systems are standard in most cars and are mandatory equipment in many countries, saving thousands of lives
- Full range of airbag ASSPs ranging from pressure sensors for side crash detection to driver and transceiver ICs
- The parts are optimized in terms of both system interoperability and the best price-performance ratio
- These systems are mandatory in order to achieve the highest possible scores in the various “New Car Assessment Programs” (NCAP) throughout the world