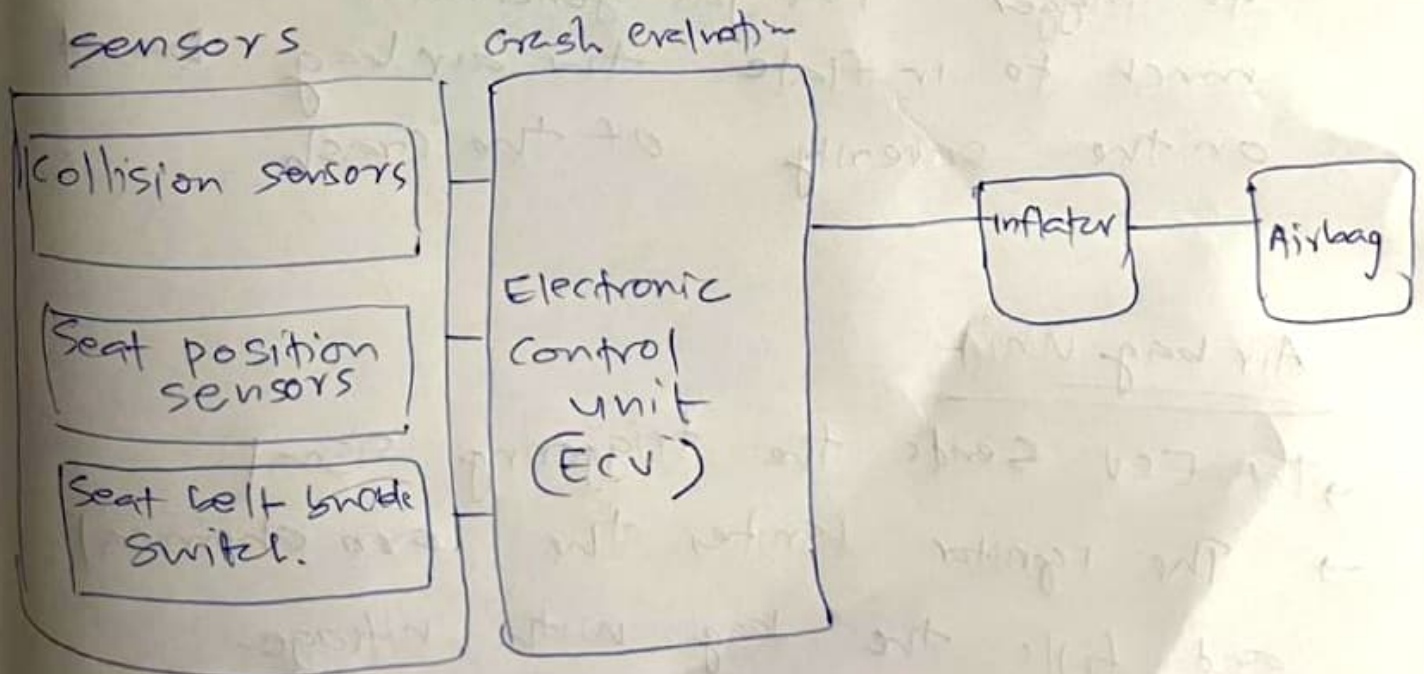# Using V-model for Airbags

Requirement

- Bring human body to rest from an high speed within time duration 100ms.

→ not much harm to the human

→ must work with seat belts.

→ must be able to reprogram and replace the airbag after collision

→ To avoid airbag related injuries.

High level design

① Crash sensors

② ECU

③ Airbag unit

sensors   Crash evaluation

```
┌──────────────────┐     ┌──────────────┐                    ┌─────────┐
│Collision sensors │     │              │     ┌─────────┐    │         │
└──────────────────┘     │              │─────│Inflater │────│ Airbag  │
                         │  Electronic  │     └─────────┘    │         │
┌──────────────────┐     │   Control    │                    └─────────┘
│  Seat position   │─────│    unit      │
│    sensors       │     │    (ECU)     │
└──────────────────┘     │              │
                         │              │
┌──────────────────┐     │              │
│ Seat belt buckle │─────│              │
│    Switch.       │     │              │
└──────────────────┘     └──────────────┘
```

Low level design

sensors

- we are using MEMS sensor with advanced capacitance based method. So severity of the crash can be easily determined

  - Using gyroscopes to detect the orientation of car.

  - All these sensors sens the situation send signals to ECU.

  - Also using seat occupancy sensor.

ECU

→ ECU take input from all the sensors.

→ Then the algorithm determines when to trigger the gas generator & how much to inflate the air bag based on the severity of the crash.

Air bag unit

→ The ECU sends the triggering signal

→ The igniter ignites the chemical and fills the bag with nitrogen within 20 to 30 milli seconds.

→ The chemical is guanidine nitrate

→ There will be 2 air vents in airbags
to slow down the body

Implementation (Coding)

→ Implement a code that generate the
ignition & how much when the crash go beyond
the threshold value

unit testing

→ This testing carried out by developer during
programming

Integration testing

- Check the sensors are working properly
checking the value correctly.
→ check ECU is accurate to give correct
response at the correct time
→ The time frame should be accurate &
→ for check the airbag is filled at
the correct time
→ check for any issue

System testing

- check all the system using LHLS method
real time situations.