STEP 1: Understand and define the problem

An alarm is activated when the driver and or passenger seats are occupied, the car is started, but the seatbelts are not fastened.

STEP 2: Organise and describe the data

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Meaning** | **Types** | **Active Logic** |
| DRIV | Driver is present in seat. | INPUT | High (1 = present) |
| PASS | Passenger is present in seat. | INPUT | High (1 = present) |
| IGN | The car’s ignition is on. | INPUT | High (1 = on) |
| BELTD | The driver’s seatbelt is on. | INPUT | Low (0 = unfastened) |
| BELTP | The passenger’s seatbelt is on. | INPUT | Low (0 = unfastened) |
| ALARM | The alarm is activated | OUTPUT | Low = on |

Step 3: Plan the solution

3.1 Algorithm

Monitor ignition status IGN must be HIGH.

Check if driver is Seated and driver’s belt is not fastened.

DRIV = 1 AND BELTD = 0

Check if passengers is seated and passengers’ belt is not fastened.

PASS = 1 and BELTP = 0

If either condition above is TRUE and IGN, the alarm activates (LOW)

3.2 Truth Table

* P1 is the driver’s occupation of the car seat.
* P2 is the passenger’s occupation of the car seat.
* Q is the ignition switch
* R is the seatbelt of the driver
* R is the seatbelt of the passengers
* Alarm is only activated if the seats are occupied, the ignition is on, but the seatbelt is not fastened.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| P1 | P2 | Q | R1 | R2 | Alarm |
| T | T | T | T | T | F |
| T | T | T | T | F | T |
| T | T | T | F | T | T |
| T | T | T | F | F | T |
| T | T | F | T | T | F |
| T | T | F | T | F | F |
| T | T | F | F | T | F |
| T | T | F | F | F | F |
| T | F | T | T | T | F |
| T | F | T | T | F | F |
| T | F | T | F | T | T |
| T | F | T | F | F | T |
| T | F | F | T | T | F |
| T | F | F | T | F | F |
| T | F | F | F | T | F |
| T | F | F | F | F | F |
| F | T | T | T | T | F |
| F | T | T | T | F | T |
| F | T | T | F | T | F |
| F | T | T | F | F | T |
| F | T | F | T | T | F |
| F | T | F | T | F | F |
| F | T | F | F | T | F |
| F | T | F | F | F | F |
| F | F | T | T | T | F |
| F | F | T | T | F | F |
| F | F | T | F | T | F |
| F | F | T | F | F | F |
| F | F | F | T | T | F |
| F | F | F | T | F | F |
| F | F | F | F | T | F |
| F | F | F | F | F | F |

3.3 Boolean Expressions

ALARM = IGN \* ((DRIV \* ) + (PASS \* ))

3.4 Pseudocode

IF ((DRIV \* (PASS) + (BELTD) + (BELTP) + IGN) OR

((DRIV \* (PASS) + (BELTD) + BELTP \* IGN) OR

(DRIV \* PASS \* (BELTD) + (BELTP) + IGN) OR

(DRIV \* PASS \* (BELTD) + BELTP \* IGN) OR

THEN ALARM = 0 # ON

ELSE ALARM = 1 # OFF

3.4 Flowchart

Step 4: Implement the solution

4.1 Logic circuit (see attached in file)