Project Report

On

**“Design of Automotive Power Window for Car”**

Presented By

**Pranali Sanjay Ambekar**

**B. Tech (Electronics & Telecommunication Engineering.)**

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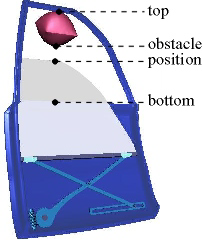
**CHAPTER 1**

**Introduction**

* 1. **Introduction**:

Power windows  are automobile windows which can be raised and lowered by pressing a switch or button . Power windows mostly work on the principle of electricity or battery that is controlled by switches and a number of wires. Power windows work only when the car is on start mode.Power window also consist anti trap operation If there is resistance of 100 N while the window is operating with the auto up function, the window is lowered approx. 150~180 mm to prevent personal injury.

**Fig 1 Power Window System Diagram**

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**Fig 2 Anti pinch System**

**1.2 Increasing Adoption of Antipinch Technology In Power Window System:**

The major factors driving its growth in automatic segment in the automotive anti-pinch power window system market is rise in vehicle electrification and growing awareness toward advanced safety features. Passenger cars were the largest user of automotive anti-pinch power window systems due to rapidly growing automotive industry, especially in emerging countries including India, China, Brazil and South Africa, which are generating significant demand for anti-pinch power window. Europe and North America collectively accounted for more than 69% in the global automotive anti-pinch power window system market in 2016, owing to increase in manufacturing of passenger cars in countries, such as China, India, U.S. and Mexico. Rise in passenger car export in developing countries such as India, Brazil and South Africa is driving the growth of market. Stringent government regulations towards vehicle safety in these regions are expected to further drive its market. Europe was the largest market for automotive anti-pinch power window systems in 2016 and is further expected to witness an increase in demand due to rising demand of luxury passenger cars.

**1.3.2 TOP VENDORS LEADING THE MARKET**

* AISIN SEIKI
* Bosch
* Continental
* DENSO
* Valeo

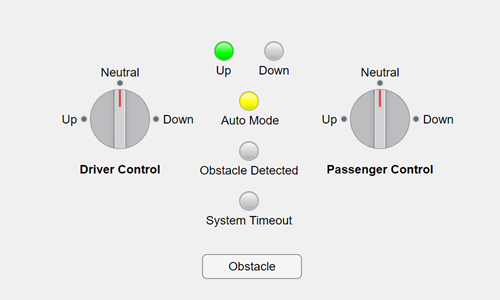
**Chapter 2**

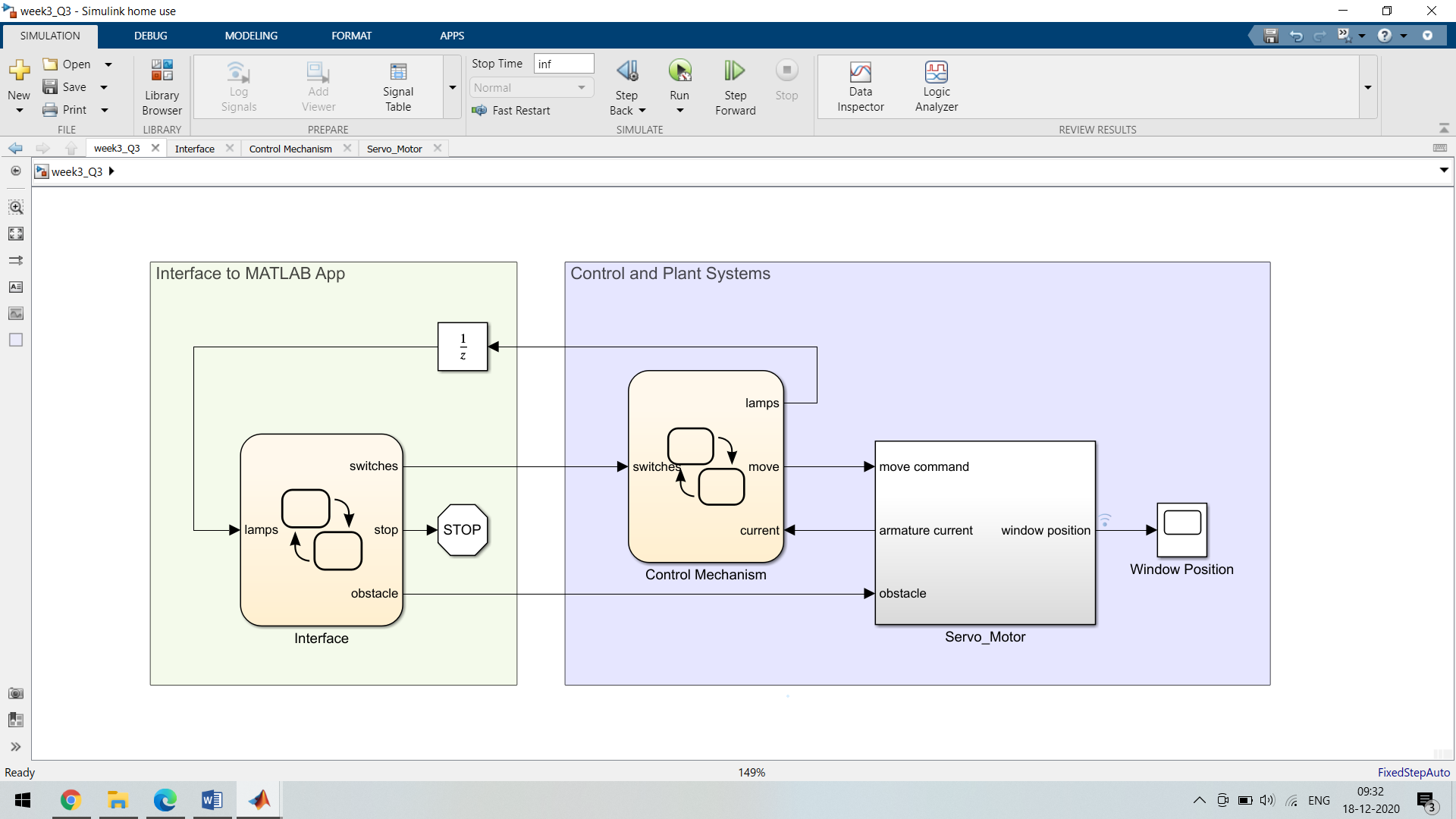
**System Design:**

In this model, an automotive power window system raises and lowers the passenger-side window in response to a pair of window control switches.

The switches in the MATLAB app represent the controls on the driver and passenger doors. The app also contains several indicator lamps that monitor the status of the power window system and a button for introducing an obstacle in the path of the window.

When you point a switch in the app to a new position, the chart sends a corresponding "Up," "Down," or "Neutral" command to the power window control system. Conversely, when the control system changes state, the chart enables or disables the corresponding status lamps in the app.





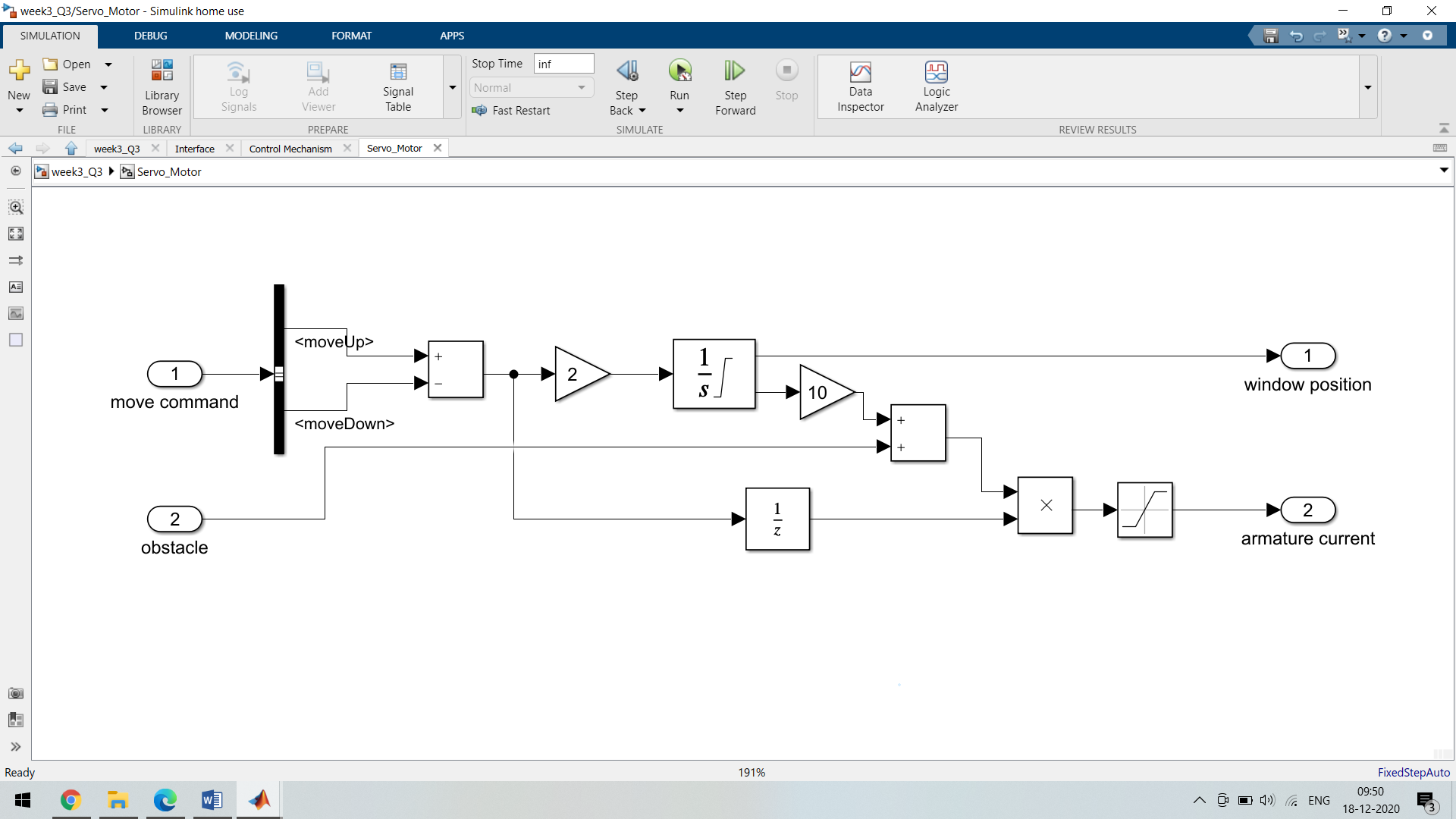
**Detect Obstacles:**

When the window encounters an obstacle, the applied force on the window increases the load on the servo motor and causes a rise in the armature current.

By monitoring for sharp increases in the armature current, the system detects obstacles in the path of the window.

Here, Simulink subsystem simulates the servo motor. And the position of the window is computed by an Integrator block with saturation limits of fully opened and fully closed. Because the input to this block has a gain of 2, the window opens and closes completely in 5 seconds, as specified by requirement 1. When the Integrator block reaches a saturation point, the system output armature current increases to 10. This value indicates that the window is fully open or fully closed.

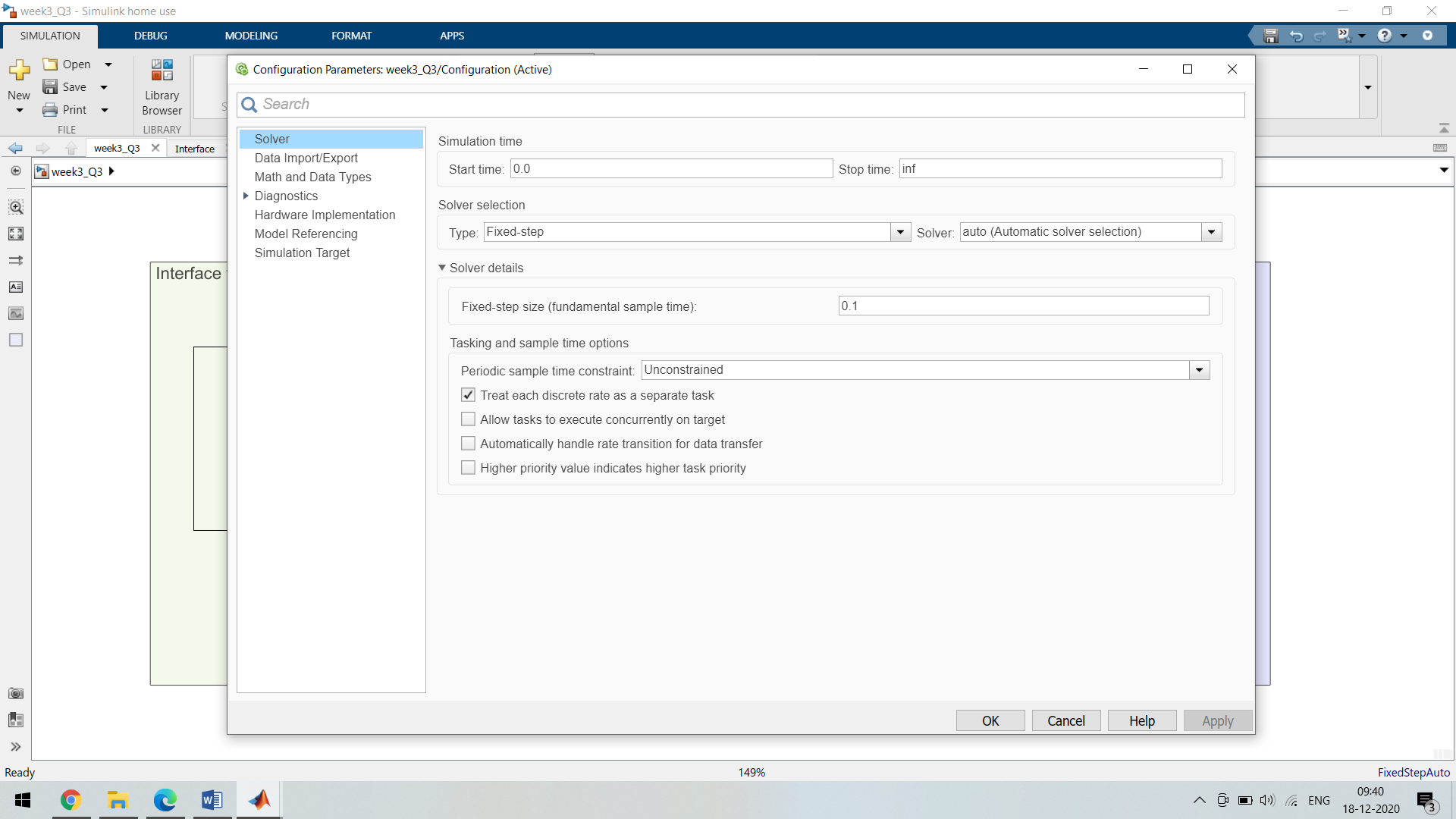
The picture below is the system designed for obstacle detection.



**Action Table:**

|  |  |  |
| --- | --- | --- |
| **Sr No** | **Description** | **Action** |
| **1.** | Move Upword | send(UP,Logic); |
| **2.** | Move Down | send(Down,Logic); |
| **3.** | Stay Neutral | send(Neutral,Logic); |

**Solver Selected:**



**Test Cases Table/Truth Table:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sr No** | **Test Cases** | **D1** | **D2** | **D3** | **D4** | **D5** |
| **1** | If Driver moves window Upside | **1** | **0** | **0** | **0** | **-** |
| **2** | If Driver moves window Downside | **0** | **1** | **0** | **0** | **-** |
| **3** | If Passenger moves window Upside | **-** | **-** | **1** | **0** | **-** |
| **4** | If Passenger moves window Downside | **-** | **-** | **0** | **1** | **-** |

**CHAPTER 3**

**Requirements Analysis**

* Power window circuit is classified into five main parts :

• OFF board Power Supply

• ON board power supply

• Atmega 16 Board

• Motor Circuitry Board

• Sensors interfacing

**3.1.2 System Requirement:**

|  |  |  |
| --- | --- | --- |
| **Sr.No** | **Parameter** | **Value** |
| 1 | Weight of Window | 5 Kg |
| 2 | Voltage Rating | 12 V Max |
| 3 | Rated Torque | 5kg-m |
| 4 | No Load Current | 2.5 A |
| 5 | No Load Speed | 50-100 rpm |
| 6 | rpm Rated Current | 5 A |

**3.1.3 Electric Specification:**

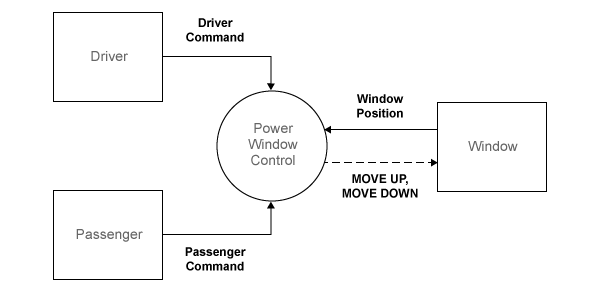
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| --- | --- | --- |
| **Item** | **Specific Value** | **Remark** |
| Rated voltage | DC 12 V | Operated normally within this range |
| Operating voltage range | DC 9 V ~ DC 16V | Auto up function is inactive within 9 V ~ 10 V |
| Operating temperature range | -35°C ~ +75°C | Data storage and manual operation is possible within 7 V ~ 9 V |
| Storage temperature range | -40°C ~ +85°C | Stops motor if exceeding 16 V |
| Max. humidity | 95% RH | **-** |
| Power consumption | 33 mA - | No load included |
| Current in slip mode | **Max 1mA** | **-** |

**CHAPTER 4**

**Diagrams**

**4.1 Structural Diagram:**

#### 4.1.1. Context Diagram: Power Window System



Power Window Functional Module:

