Technical Specifications for Two-wheeler Simulator

The two-wheeler simulator will include the following components:

1. Hardware for simulator
2. Motion platform
3. Software
4. Visual display
5. Integration

1. Hardware for simulator:

The simulator should consist of the following hardware components:

- Fully instrumented geared motorcycle frame with steering handlebar including brake, clutch, gear shift lever, acceleration throttle, switches for turn indication, horn and ignition key socket providing maximum possible realism and accuracy with respect to the locations of controls, driver visibility and feel of driving.
- Virtual / digital instrument panel with speedometer, rev counter, gear indicator, low/hi beam indicator, and turn indicator. Option to show / hide any of the above.
- A high-fidelity force feedback bike handle/braking system that can emulate realistic force cues depending on steering angle, driver weight, and vehicle speed.
- A synchronized audio feedback system should also be enabled with this simulator. The audio system should emulate wind, tire, engine, surrounding traffic sounds and other sounds in the environment. A surround sound system emulating the distance of sound source especially for honking of horns and traffic noise is preferred to provide a more immersive experience.
- This system should have very low inertia, zero cogging, and tight coupling with the vehicle dynamics allowing for good steering feel to provide increased vehicle control and transfer of training.
- An integrated simulator workstation with advanced graphics cards and operator system for scenario control.

2. Motion Platform:
   The following four options for motion platform to be quoted separately:

- Static system that is fixed.
- Fully electric 2 DOF system capable of carrying payload of minimum 150 kg with pitch and roll displacement of minimum ±8 degrees each.
- Fully electric 3 DOF system capable of carrying payload of minimum 150 kg with pitch and roll displacement of minimum ±10 degrees each and heave of min 50 mm.
- Fully electric 6 DOF system capable of carrying payload of minimum 150 kg with pitch, roll, and yaw displacement of minimum ±20 degrees each and heave, surge, sway of 150mm.

The supply should include:

- Motion platform including required number of electric servo actuators, motion platform frame including floor mounting plates
- Complete system including controllers and power and associated cables for connecting

- Workstation with appropriate communication interface
- Motion control software with interface for communicating with simulator software.
- Detailed documentation for operating the system

3. Software specifications:

- The software should have a graphical user interface (GUI) for design of various driving scenarios with different road conditions (number of lanes, road geometry, median and shoulder types), terrains, traffic levels, land-use type (urban, rural, commercial, residential etc) and time of day.
- Traffic facilities such as signs, signals, road markings, ramps must be allowed and the configuration of such facilities must be possible based on user needs through easy to use GUI.
- Scenario control should include ambient traffic simulation, scriptable events, relational behaviours and environmental controls.
- The simulator software should have a GUI based easy to edit vehicle data files with rich category of vehicle types (bicycle, scooter, motorbike, auto-rickshaw, sedans, SUV, LCV, HMV, bus, truck with trailer, tractor with trailer etc.) to represent Indian traffic conditions. Additionally, it must be possible to create new vehicle types interface for user defined vehicles for Indian road conditions.
- The software should allow non-lane based driving of vehicles (multiple vehicles in same lane) to mirror Indian traffic behaviour.
- The software should be equipped with user-defined events such as pedestrian crossing, lane changing, congestion formation, work zone and weather (such as clear daylight, rain, fog, mist and snow)
- Capable of displaying vehicle telematics unit, navigation map and speedometer
- The software should be compatible with latest version of MS Windows based operating system. The software and OS should be capable of integrating with other similar simulators in future to form a network of simulators.
- Extensive and comprehensive data collection/performance measurement functions with capability of providing output in multiple formats (such as video, standard CSV/Excel file, text file etc.) for the following parameters at a minimum of 5 hertz:
  Simulation time § Subject vehicle: Engine RPM, Gear, Brake pedal force & Steering position. § Subject vehicle: Acceleration, Lateral acceleration, Speed, Velocity, Lateral velocity & Vertical velocity. § Subject vehicle: Heading, Heading error, Slip front, Slip rear, Head-way distance, Head-way time, Tail-way distance & Tail-way time. § Subject vehicle: X position, Y position, Z position, Yaw, Pitch, Roll & Lane number. § At conflict points - Each Subject Vehicle and Autonomous Vehicle: • Speed of the vehicle • Time instant at which the vehicle enters the junction / intersection / conflict zone • Distance between subject vehicle & autonomous vehicle

4. Visual display

The following two options for visual display to be quoted separately:

a. A VR Headset to make up a 360-degree view of virtual environment including high resolution with high refresh rates for smooth graphics updates that mirror realism

i. The VR headset should interface with simulator to authentically reproduce all traffic scenarios as envisioned.
ii. The VR headset needs to have an eye tracker integrated to understand the driver's vision focus
iii. The VR headset should be light weight and comfortable to wear

b. A minimum of 170 degree curved screen projection for visual display with high resolution and smooth graphics updates

5. Integration:

- All the hardware, software, motion platform, and visual display should be integrated and work seamlessly with no perceptible lags
- The simulator should be capable to be integrated with 3rd party vehicle dynamics software such as BikeSim and MotorcycleMaker.
- The system should be possible to be integrated with motion-based platform with either 2, 3 or 6 DOF (degrees of freedom).
- The system should be capable of being integrated with 180 degree curved screen projection or VR based headset for visual display.
- The system should be capable of being integrated with 3rd party traffic simulation software such as PTV Vissim or SUMO.
- The simulator must be capable of working in future with other similar simulators to form a network of simulators over the Internet
- Capable of supporting import/export of simulation models to MATLAB, UNITY 3D, etc.

Additional Requirements:

- All the instructions and controls of the simulator should be in English language.
- The vendor must provide a warranty of minimum 3 years and support for maintenance after 3 years may be quoted separately as both a fee for a period and as fee for every contact.