

## **Self-Balancing Two-Wheel Electric Vehicle (STEVE)**

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**Self-balancing Two-wheel Electric Vehicle (STEVE)** is an applied research project to design, analyze, and construct an electric vehicle with two parallel wheels similar to Segway. A rider holds the steering while standing. The vehicle through an onboard-control system will self balance itself as well as respond to commands implied by the movement of the rider. For example, if the rider leans forward, the vehicle will accelerate in the forward direction and vice versa. This vehicle can also turn to the right and to the left as commanded by the rider.

The project presents a challenge in both research and implementation. The vehicle must guarantee a self-balance in all riding conditions. As the system is naturally unstable and thus the rider tends to fall down as a result of the vehicle motion or due to external disturbances, the on-board control system with its relevant sensors and actuators counteracts the tendency towards falling down. A major challenge here is to find a suitable control algorithm that can be implemented in real time to guarantee ride stability and comfort. Further, the orientation of vehicle in space needs to be estimated from indirect orientation sensors as accelerometers and gyroscopes.

Finally, as STEVE contains a mechanical structure that is actuated by electrical motors and controlled by an embedded computer controller and since sensors provide relevant information to the controller, STEVE is qualified to be a mechatronic system. In this report, it is demonstrated that the mechatronic design approach is followed to make STEVE a true mechatronic system.