

# AUTOMATED STEERING RACK CENTERING SYSTEM FOR AUTOMOBILES

IITM Technology Available for Licensing

### Problem Statement

- In the automobile manufacturing process the **steering column rack is centered** prior to installation of the steering wheel to ensure that it is positioned in a neutral rotary orientation when the vehicle is travelling straight.
- Currently the centering of the **steering rack is done manually by operators** based on a combination of estimated number of turns and visual references. This process is **prone to operator error and risks damaging the clock spring unit**.
- There is a need for an **automated steering centering system** that aids the operators, reduces process time and meets the process requirements

### Intellectual Property

- IITM IDF Ref.1401
- IN 383113 Patent Granted**

### TRL (Technology Readiness Level)

**TRL 5 Technology Validated in Relevant environment**

### Technology Category/ Market

Category- Automobile & Transportation/ Robotics & Automation

### Industry Classification:

- NIC (2008)- 29101** Manufacture of passenger cars;
- 29102** Manufacture of commercial vehicles such as vans, lorries, over-the-road tractors for semi-trailers etc.
- 29301** Manufacture of diverse parts and accessories for motor vehicles such as .... steering wheels, steering columns and steering boxes etc.
- 28180** Manufacture of power-driven hand tools

### Applications:

Steering rack centering in cars, can be modified for use in other applications such as heavy duty automobiles, off-road vehicles, ships, airplanes where centering of a symmetric steering mechanism is needed.

### Market drivers:

Automobile Industry In India is estimated at USD 126.67 billion in 2024, and is expected to reach USD 187.85 billion by 2029, growing at a CAGR of 8.20% during the forecast period.

### Research Lab

**Prof. P V Manivannan**

Dept of Mechanical Engineering

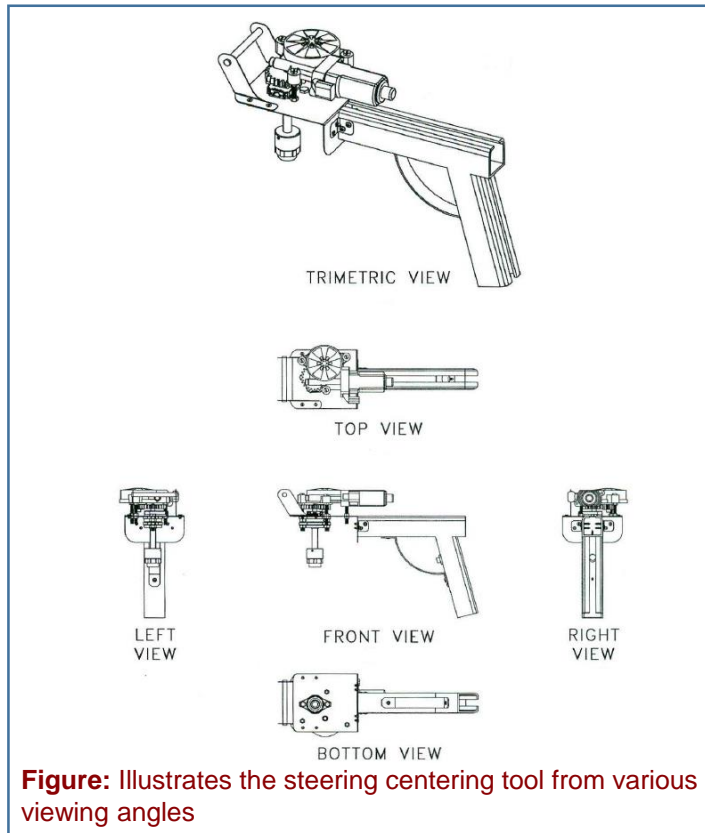


Figure: Illustrates the steering centering tool from various viewing angles

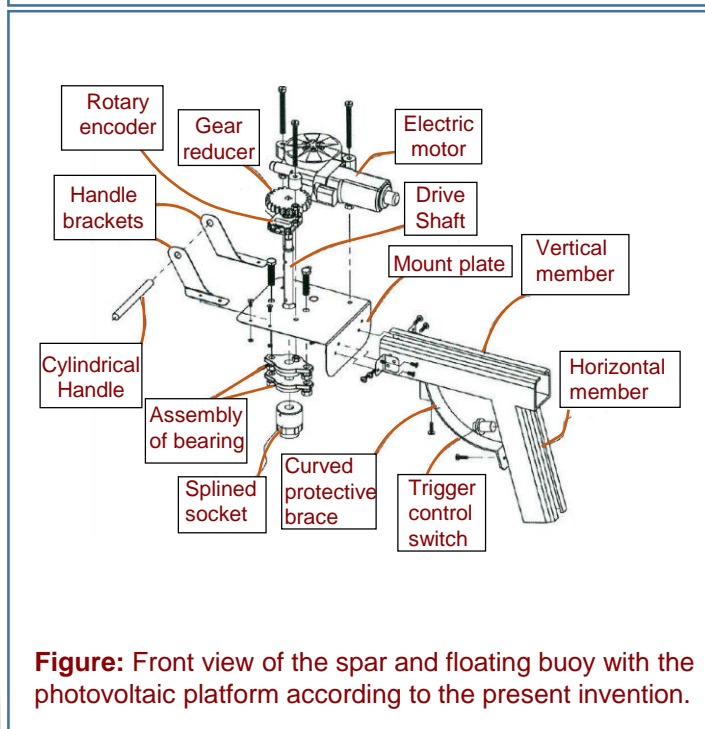


Figure: Front view of the spar and floating buoy with the photovoltaic platform according to the present invention.

### CONTACT US

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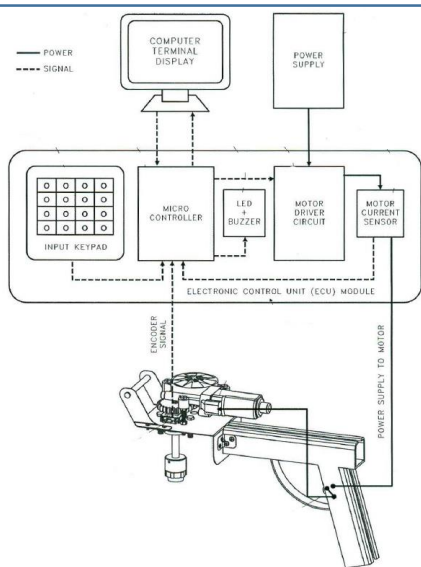


Figure: Schematic layout of the electronic control unit (ECU) module

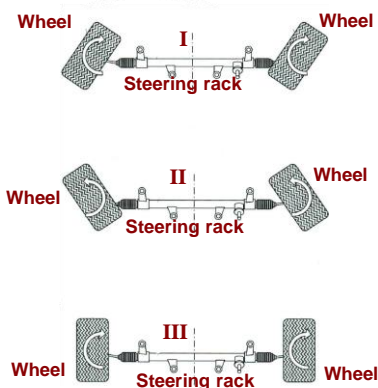


Figure: In the centering process the electric motor of the automated steering centering system rotates the steering column to move the steering rack through a full right (I) followed by full left turn (II) so as to position it at the extreme end of its strokes. One half of the total stroke is stored in the microcontroller as the "TARGET" encoder count to orient vehicle in neutral straight ahead position (III).

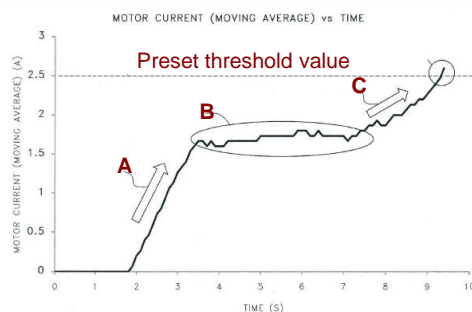


Figure: The variation in the magnitude of current drawn by the electric motor characterized by an initial steep rise, represented in region (A) followed by a plateau region (B) which corresponds to the rotation of the steering column at a constant speed. When the steering rack reaches an end, the motor stalls, causing the current drawn to rise considerably from the plateau level as seen in region C

### Technology

The invention relates to an automated steering rack centering system comprising a sophisticated handheld tool which brings the steering column into the centre or neutral or zero rotary orientation from any other angular position by single push button operation.

An electronic control unit (ECU) consisting of sensors and a microcontroller for running a steering centering program. The steering strokes the steering column to move the steering rack from a first end (right or left) to a second end (left or right) representative of a full stroke of the steering rack is measured by electronic control unit (ECU) through rotary encoder. The ends of steering rack are detected, when the current drawn by the electric motor reaches a predetermined Level.

The total stroke is measured by an ECU module through the rotary encoder and subsequently the steering column is rotated towards the center to a position that is one half of the steering rack stroke measured between the first and second ends.

The vehicle-specific, user selectable steering centering process includes the capability to select the vehicle model at the start of the centering process by entering the model code using an input device interfaced with the ECU module.

### Key Features / Value Proposition

- Compared to the conventional manual process of steering rack centering the invented automated process reduces scope of error as it less dependent on operator skill thus nearly eliminating operator error.
- The known steering rack stroke corresponding to a particular vehicle model is already stored in the program in the form of encoder counts, thereby eliminating the need to sweep the steering rack through an entire stroke during the centering process.
- The automated method avoids damage to the clock-spring unit that is coaxially installed between the steering wheel and steering column. Whereas, the conventional method of manual centering may result in damage of the clock-spring unit due to the random asymmetry in the position of the front axles prior to the centering process.

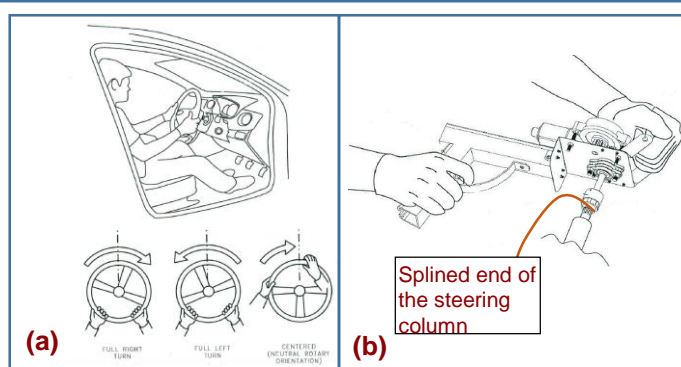


Figure: Compared to the (a) conventional manual process of steering rack centering the (b) invented automated process reduces scope of error as it less dependent on operator skill

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