



Industrial Consultancy & Sponsored Research (IC&SR)

A Smart Primary Pad with Integrated TMR Sensors for Wirelessly Charged EVs

IITM Technology Available for Licensing

PROBLEM STATEMENT

- In prior art literature survey, it is noted that Wireless power transfer(WPT) using an inductive power transfer (IPT) technique has been finding its application in the EV.
- One of the **main challenges** faced in the **lumped Inductive power transfer (IPT), highway design** is the **detection of EVs** as they travel over the IPT highway.
- Only that primary coil with sufficient coupling with the secondary coil on the **EV needs to be energized**. To mitigate the above challenge, a **suitable sensing mechanism** is **required**. Hence, there is a need to address said issues effectively in efficiently.

INTELLECTUAL PROPERTY

IITM IDF Ref. 2189; IN Patent No: 511503

TECHNOLOGY CATEGORY/ MARKET

Technology: Smart Primary Pad with Integrated TMR Sensors;

Industry & Application: Electric Vehicle (EVs);

Market: The global TMR sensor market is projected to grow at a **CAGR** of **3.5%** during **2024-2029**.

TRL (TECHNOLOGY READINESS LEVEL)

TRL-4, Proof of Concept ready, tested in lab.

TECHNOLOGY

- Present invention describes a simple **method** and a **IPT system** to **detect EVs' secondary coil** on IPT highways, & further said IPT system **enables charging the vehicle** while moving on the road.
- The **IPT system** includes one or more primary coil; secondary coil, installed on a body part of the vehicle; the IPT highway path, **one or more sensor** are placed over the **trailing edge** of the primary coil, & the **leading edge** of the primary coil to measure a **magnetic field** generated by the detection coil.

The method comprises a few steps shown in the smart chart herein:

1. Providing at least one primary coil under an IPT highway path;

2. Providing , at least two sensors over a trailing edge of the primary coil & a leading edge of the primary coil to measure a magnetic field generated by a detection coil;

3. Processing an output of the at least two sensors, based on the measured magnetic field, therefore, to determine one of the energization and de-energization point of the primary coil, when vehicle travels over the one primary coil.

- In this instant, a tunneling magneto-resistance (TMR) sensor based EV detection method on an IPT highway is proposed where in a **detection coil** is wound around an outer boundary of the secondary coil.
- TMR sensors **sense the magnetic field** generated by the detection coil.
- The **TMR sensors** are placed over the **leading & trailing edges** (in the direction of EV travel) of the primary coil, & from the leading edge TMR sensor outputs, the **energization point** of that primary coil to **begin IPT, is decided**.
- Similarly, from the trailing edge TMR sensor outputs, the **de-energization point** to **stop IPT from that primary coil, is decided**.

RESEARCH LAB

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KEY FEATURES / VALUE PROPOSITION

❖ Technical Perspective:

- The detection coil is wound around an outer boundary of the secondary coil & the **detection coil** is excited at **400 kHz**.
- The **duration** of the energizing the primary coil is **determined** from the **TMR sensor outputs**, & the **duration** for which there is an area of overlap between the primary & secondary coils of **at least 50%**.
- Claimed system enables the driver of the EV in **correcting the lateral misalignment** so that **efficient charging is possible** from the subsequent primary pads.
- There was **negligible error** introduced in the **final output** due to **angular misalignment** between **the charging lane & the vehicle**.
- The **sensor system** could **detect** the presence of **metallic plates lying on the road** in such a way that some of the sensors on the sensor pad are covered.
- The **response time** was found out to be around **7.5µs** & with this response time, the system works for the usual vehicle speeds encountered.
- The proposed system is based on **magnetic sensing**, its **performance is not affected** due to **dust, snow, oil and humidity**.

❖ Industry Perspective:

- Applicable in the area of **Electric vehicles**, usage in **commercial vehicle, Public vehicle & etc.**

Images

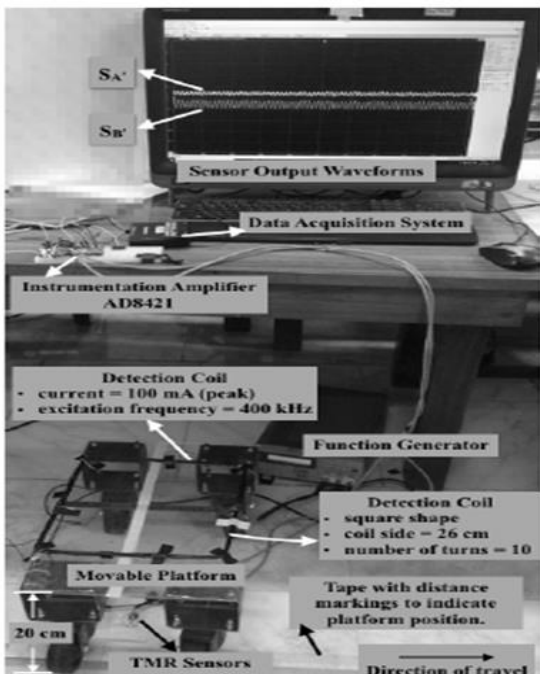


Fig. 1: Depicts represents a photograph of an experimental set-up of the lumped IPT highway.

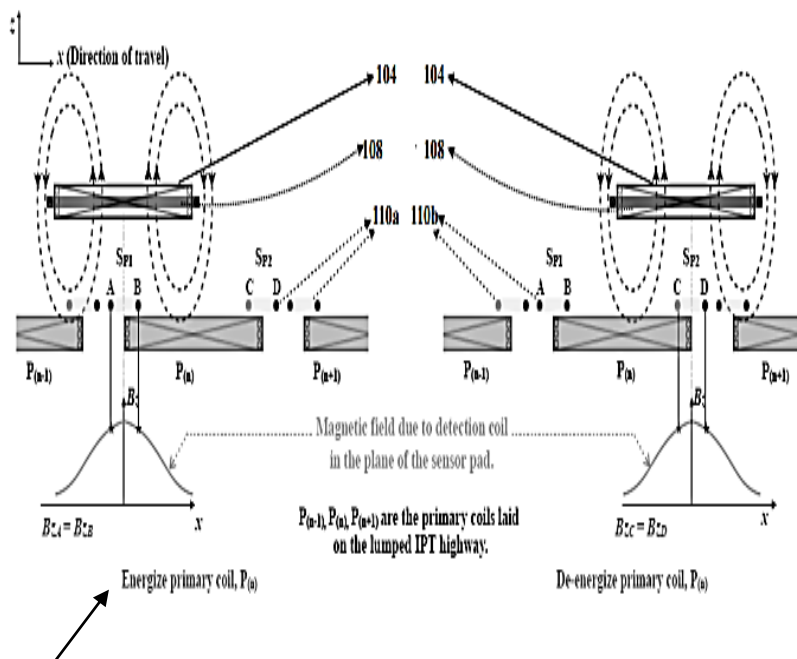


FIG. 2: Depicts an example graphical illustration in which a point of energization & de-energization of a primary pad in the lumped IPT highway.

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