IoT BASED WIRELESS EV CHARGING AND BATTERY MONITORING SYSTEM

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College ***:*** *Sri Taralabalu Jagadguru Institute of Technology, Haveri*
Branch ***:*** *Department of Electrical and Electronics Engineering*
Guide(s) ***:*** *Mr. Santhosh Raikar M*
Student(S) ***:*** *Ms. Bhavana D B*
Mr. Darshan Naik
Mr. Raviraj
Ms. Roopa Gubbiyavar

Keywords:
WPT, IoT, Ev's, WCS, BMS

Introduction:

Considering a future scenario in which a driverless Electric Vehicle (EV) needs an automatic charging system without human intervention Wireless Charging Systems (WCS) can be applied. WCS have been proposed in high-power applications, including EVs [1], in stationary applications. In comparison with plug-in charging systems, WCS can bring more advantages in the form of simplicity, reliability, and user friendliness [2]. only be utilised when the car is parked or in stationary modes, such as in car parks, garages, or at traffic signals. In addition, stationary WCS have some challenges, such as electromagnetic compatibility (EMC) issues, limited power transfer, bulky structures, shorter range, and higher efficiency [3], [4], [5].Most EVs used rechargeable battery which is lithium ion battery. It is smaller to be compared with lead acid. In fact, it has a constant power, and energy's life cycle is 6 to 10 times greate compared with lead acid battery. Now, an important reason that limits the application of EV isthe safety of existing battery technology [6]. For example, overcharging battery not only could significantly shorten the life of the battery, but also cause a serious safety accidents such as fire [7-9]. Therefore, a battery monitoring system for EV that can notify the user about battery condition is necessary to prevent the stated problems. Previous battery monitoring system only monitor and detect the condition of the battery and alarmed the user via battery indicator inside the vehicle. Due to the advancement of the design of notification system, internet of things (IoT) technology can be used to notify the manufacturer and users regarding the battery status. IoT utilizes internet connectivity beyond traditional application, where diverse range of devices and everyday things can be connected via the internet, making the world is at the user's finger tips. Motivating by the stated problems, in this work, the design and development of wireless EV charging and battery monitoring system using IoT technology is proposed.

Objectives:

- To eliminate the use of cable in the charging process thus making it simpler and easier tocharge the battery of an electric vehicle.
- As different charging ports are available for different models it is difficult to find thespecific charging station, but WPT allows to reduce the human effort.
- Battery Monitoring System using conventional technique/ optimization technique.
- The main function of Battery Management System (BMS) is to ensure that the battery isprotected and any operation out of its safety limit is prevented.

Methodology:

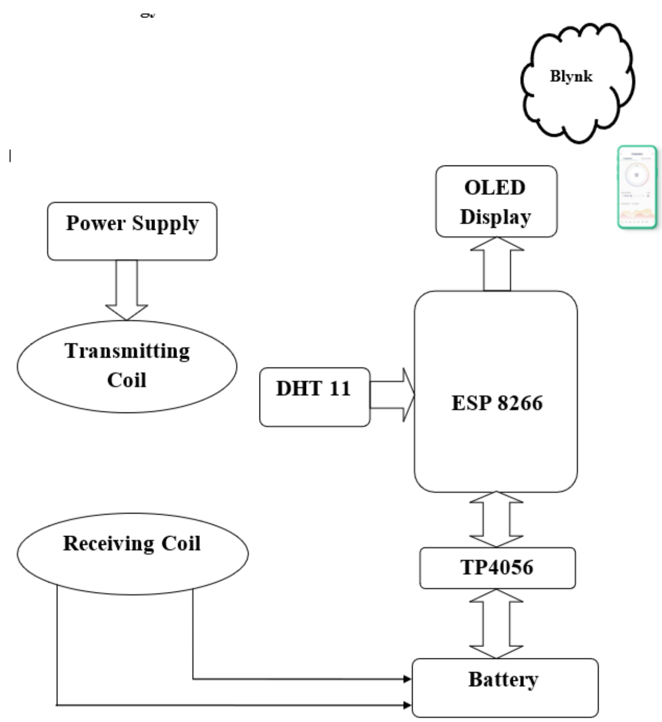


Fig 1. Overview of the proposed system

Schematic diagram:

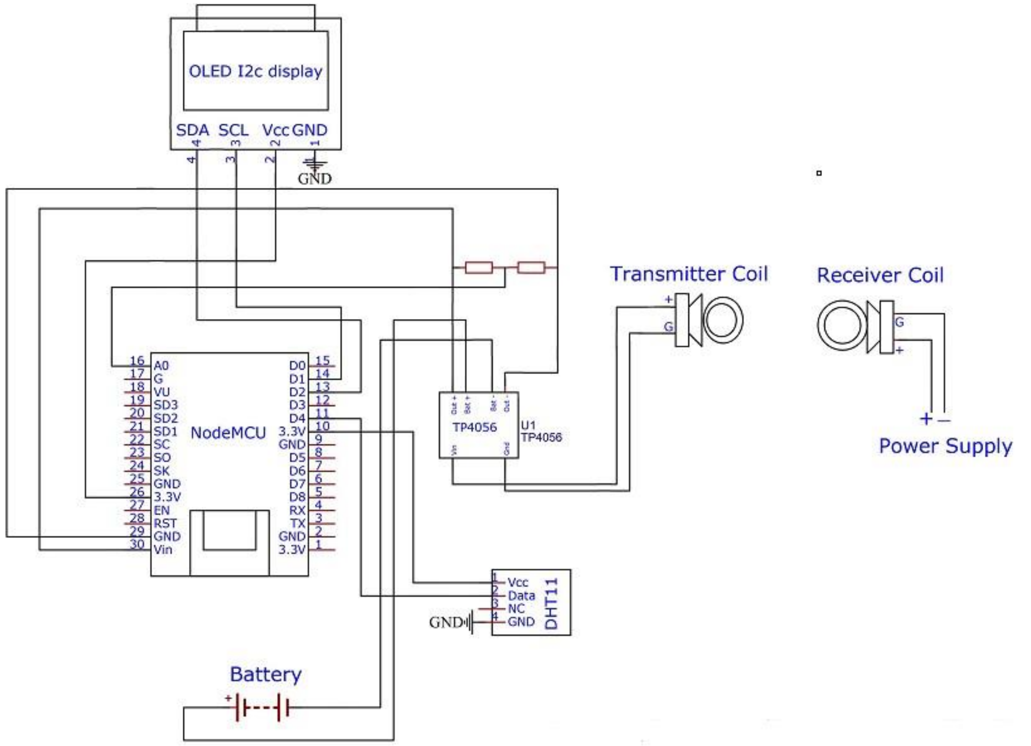


Fig 2. Schematic Diagram

Hardware component:

Transmitter coil, Receiver coil, Battery, Node MCU, TP 4056, OLED display, DHT 11, Relay module, Supply

Software Used:

Arduino IDE Software (Blynk server)

Table 1: Various efficiency of topologies

Topology					
Topic	**ref**	**p[W]**	**η[%]**	**f[MHz]**	**d[cm]**
1-D slab	[10]	-	47	6.78	20
	[12]	40	47	27	50
	[13],[14]	15	40	6.78	60
2-D slab	[11]	80	34	27.12	50
	[12]	40	47	27	50
	[14]	15	40	6.78	60
3-D slab	[14]	15	40	6.78	60
	[14]	-	33	6.5	100/150
	[16]	-	80	23.2	150

Table 2: Efficiency at various positions of coils

Position					
	Ref	**P[W]**	**η**	**F[MHZ]**	**D[cm]**
Middle of path	[11]	80	34	27.12	50
	[13,14]	15	40	6.78	60
	[15]	-	33	6.5	100
Front of Colis	[14]	15	36.7	6.78	60
	[15]	15	40	6.78	60
	[16]	-	80	23.2	150
Back of coils	[17]	80	34	27.12	50

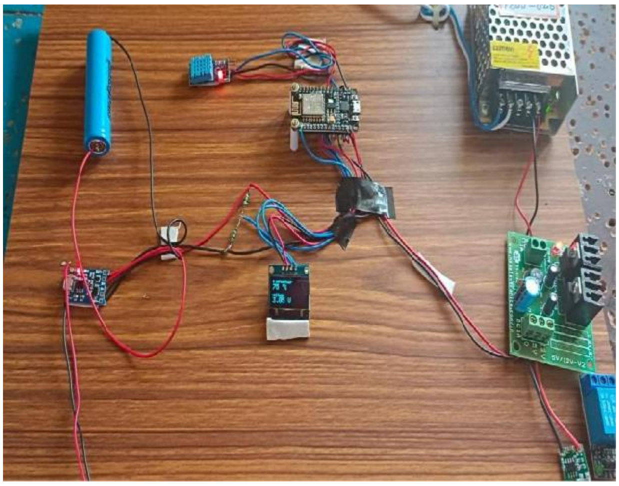
Working:

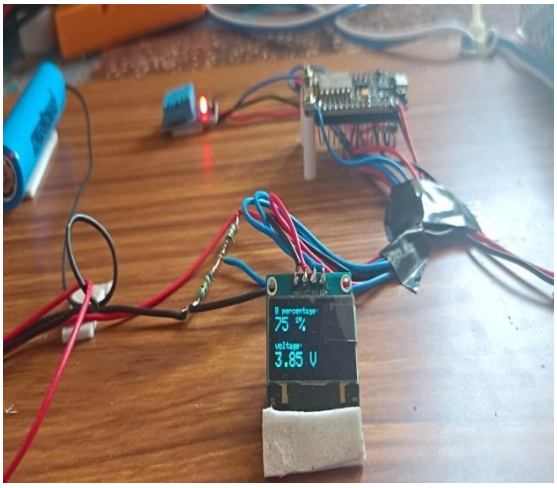
Figure 1 depicts the overview of the proposed system. Here the wireless charging is based on the principle of electromagnetic induction. When an electric current is sent through a coil (a wound- up cable), it creates a magnetic field whose action generates another electric current in a second coil that's some distance away. This way electricity can be transferred from one device to another without physical contact. Regular applications for induction charging still need the charger and receiving device to be nearto each other. That's why these charging systems are sometimes called "near field". Then the output is received by TP4056 chip, which is a lithium Ion battery charger for a single cell battery, protecting the battery from over and under charging. It's input voltage ranges from 4.5 – 5.5 V and gives the output of 5V. It has two status outputs indicating charging in progress, and charging complete. It also has a programmable charge current of up to 1A.

So it is then connected to battery which charges a battery and then collects to the its status like voltage, percentage of charging and temperature with the help of DHT 22. It sends the collected data to ESP82266 Wi-Fi module, which analyses it and delivers it to the OLED display as wellas our smartphone via the Blynk server. Blynk shows all the parameters on your android, so that you can know your EV's battery statusat the tip of your fingertip and also notifies whenever required. We can see the various efficiency of topologies mentioned in Table 1, and the efficiency at various positions of coils are given in Table 2.

Result:

Here we have found out an innovative technology to charge electric vehicles wirelessly through inductive coupling. In this prototype, when we gave an input voltage of 12V DC we were able to get an output voltage of 5V with 2 A at a distance of 20mm. The prototype we made is of lower efficiency because the power input given to the prototype is used for meeting the constant loss aswell as magnetic leakage. But we are sure that as the power rating of the prototype increases the overall efficiency of the system also gets improved as better, since the power required for the constant loss and the magnetic leakage will almost remain the same.





Conclusion:

In addition to minimize greenhouse gas emissions and air pollution, the advantages of EVs can be attributed to reduce oil consumption, which increases network security. As the Ev's are emerging in the market, we switch over to wireless charging system to charge our vehicles. This system shows the efficiency and implementation of the charging station in future technology. Through this system we can monitor the battery condition through the IOT using android phone. A BMS enhances the life span of the battery cell in EVs. It monitors the battery constantly to avoid the occurrence of failure or explosion. It provides stability and reliability.

Scope for future work:

In order to improve the two areas of range and sufficient volume of battery storage, dynamic mode of operation of the WCS for EVs can be done. This method allows charging of battery storage devices while the vehicle is in motion. However, a dynamic WCS has to face two main hurdles, large air-gap and coil misalignment. The power transfer efficiency depends on the coil alignment and air-gap distance between the source and receiver. The average air-gap distance varies from 150 to 300 mm for small passenger vehicles, while it may increase for larger vehicles. Aligning the optimal driving position on the transmitter coil can be performed easily because the car is driven automatically in the dynamic mode.

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