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Smart Parking with Wireless Charging for Electric-Vehicle

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ABSTRACT – Nowadays, There was rapid increase in vehicle's fuel cost and demand when we compared tolastdecade[1].Ifthissituationcontinuesfornextfewdecades,thereismorechanceinlackofvehicle'sfuel[2].So to avoid that worst scenorio in our world, our world is moving towards usage of electrical vehicle and all vehiclemanufacturers are encouraged to manufacture electrical vehicles[3].In this manufacturing of E-vehicles, thecharging of battery is done by two method: wired and wireless charging method[4].Due to more advantages andreliable operation, wireless charging is predominantly selected by E-vehicles manufacturers. This project "smartparking with wireless charging of e-vehicles" have it's wireless charging under the principle called “mutualinductance"[5]. And advance to our project, we added the facility of, “smart parking of electrical vehicles" itshappens when the electrical vehicle parked within range of IR sensor placed in charging point and stepper motorhelpsthissmart parking process ofourelectricalvehicles [6].

Keywords:E-Vehicle,ElectricAutomobile,MutualInductance,Infrared Sensor,CoilCharging,Wirelesstechnology.

I. INTRODUCTION

Normally, our world is moving towards usageof electrical vehicles in order to escape from thedanger of shortage of fuel like petrol, diesel, etc. inorder to achieve this electrical vehicle to be morereliable andaffordable,manyresearchersareinraceto show their best under above mentioned motive.One of the most important assets of the electricalvehicles is battery. This is the important thing thatshould be designed in reliable manner. The mainmotiveinthisbatteryshouldbedesignedlike,“charging speed should be high with large capacitybatteries too”, in order to achieve the situation thatwe can travel long distance by our electrical vehiclebyless charging time.Ifthis situationcomes inreality, then that day will be the remarked as thegreat success of electrical vehicle and this makesmore reliable to use by consumers. The productssuccessisdependsonreliableusageoftheconsumer. This should be the primary target for ourresearch teams in electrical vehicles. Then, the nexttarget is to make this charging by wirelessly by,“wireless charging method of electrical vehicles”.This wireless charging method comes with moreadvances side than the wired method of chargingelectricalvehicles.So,thechargingofelectricalvehicles wirelessly consist of more types like static,dynamic,capacitance,etc.Herewearechargingourelectricalvehiclesundertheprinciplecalled,“mutual inductance”.Thechargingofelectricalvehicles in this method is similar to the transformerelectrictransformation,sinceweusinghere,“mutualinductance“principle.andlet'smoveontoouradditionalfacility,“smartparking”,thatreallymakes more comfortable to this wireless chargingsetup.Itconsistofitsensorandsteppermotorwhichhelpselectricalvehiclestoparkautomaticallytocharging point if they are in range to our chargingpoint.Existingsystemofchargingofelectrical vehicles is, “wired charging method”. Even thoughit was succeed in charging of electrical vehicles, itcomes with more disadvantages like high in initialcost, not much reliable, mechanical strength of thissetup is not much stronger, harmful and high risk ofelectricalaccidents,moreon.So,thissystemofcharging electrical vehicles is not much effective.Research team of electrical vehicles made decisionto make next level of charging type of electricalvehicles.

II. PROBLEM FORMULATION OF SMARTPARKING

Aftermoreresearchmadebyresearchteamsof electrical vehicles, we achieved the next level ofcharging of electrical vehicles, “wireless charging ofelectrical vehicles”. It becomes so advantages

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whencompared to wired charging of electrical vehicles.ithassoreliableperformance,lesslossandmoreefficient, more safety setup than compared to wiredcharging of electrical vehicles.so due to those with smart parking facility, so it will be automatedparking within certain range of IR sensor of chargingpoint.Withthissmartparkingtypefacilityofelectrical vehicles and wireless charging of electricalvehicles, our project is on whole another level ofsuccessinelectrical vehicles field.

III. BLOCK DIAGRAM

Smart parking part:

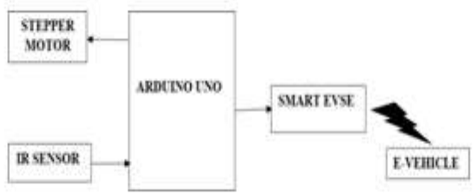

Fig. 1, Smart parking part WIRELESS CHARGING PART:

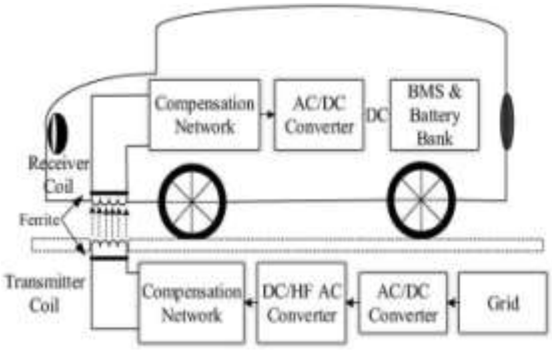

Fig.2,Wireless charging part

At first,220 volt,50Hz, is provided from SupplyGrid.This Ac voltage is converted into Dc Voltage byUsing Ac-Dc Converter. And That Converted DcVoltage is Converted into High Voltage AlternatingCurrent (HVAC) and fed into the Transmitter coil.Afterthisprocess,AlternatingmagneticFieldproduced, and When Coil cuts magnetic field, EmftransmittedtotheReceiverCoil.Duringthisprocess,theResonanceFrequencyshouldbeCompensatedtosmoothtransmissionofSupplyfromTransmissioncoiltoReceivingcoilbyprovidingCompensationNetworkonbothcoilTransmitterandReceiverrespectively.After Receiving this Ac Voltage from Transmitter coil, ItisconvertedintoDcvoltagebyusingAc-DcConverter. And this Dc Supply is saved or stored inBattery using Battery Management System (BMS).BythiswholeProcess,Thewirelesschargingof somuch advantages, vehicle manufacturers are moreencouragedtomakewirelesschargingsetupinelectricalvehicles.itworksintheprincipleof,“mutualinductance”.Andalsoourprojectislinked Electricalvehiclesusing,“MutualInductance”,Takes Places inComfortablemanner.

1. Implementation of Smart Parking with Wireless Charging

Inordertoachieveefficientchargingofelectrical vehicles, wireless charging of electricalvehicleswillbebestsolution.Herewediscuss aboutimplementationonsmartparkingwithwirelesscharging of electrical vehicles. "Mutual inductance"is theprincipleweusedinwireless chargingofelectrical vehicles. The charging point was made byarduino uno, infrared sensor, stepper motor, smartelectricalvehiclessupplyequipment(SEVSE).Infrared ray sensor will sense the electrical vehiclesthatparkednearthechargingpoint.Maximumrangeofinfraredsensorwill be10meters forreliableoperationofsensoryunit.Aftersensingtheelectricalvehicles, infrared sensor will give signal to steppermotor. This stepper motor will make adjustment inpositioningofelectricalvehiclestoachievecomfortable parking to the wireless charging point.Afterthissuccessfulparking,wirelesschargingtakesplaced.Smartelectricalvehiclessupplyequipment (SEVSE) is like connection of batterywithsupplysource.Thewirelesschargingofelectricalvehicleswasmadebysupplysource,transmitter andreceivercoils,rectifierandinverters,batterybanksandbatterymonitoringsystem(BMS).Initially 220v,50hz, Ac supply taken from supplysource and fed to rectifier. This converta.c supplyintod.csupply.Thisd.csupplyagainconvertedintohighvoltagealternatingcurrent(HVAC)byinverter and fed to the transmitter coil. Now, magnetic fieldwill be produced when transmitter coil energised.When coil cuts the magnetic field, EMF induced init. Voltage supply will be generated by EMF andtransmittedtoreceivercoil.Afterreceivercoilreceives a.c supply from transmitter coil, this a.cvoltage is converted into d.c voltage by rectifier.This converted d.c voltage will be stored or chargedby batteries of electrical vehicles as per their powerratingsthroughbatterymonitoringsystemandbatterybanks.Thisbatterymonitoringsystem(BMS) will be vital part of wireless charging ofelectricalvehiclessystembecauseitmonitor,protectthebatteriesofelectricalvehiclesfromhazards.These are all the implementations that we done insmart parking and wireless charging of electricalvehicles.

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IV. RESULTS AND DISCUSSION

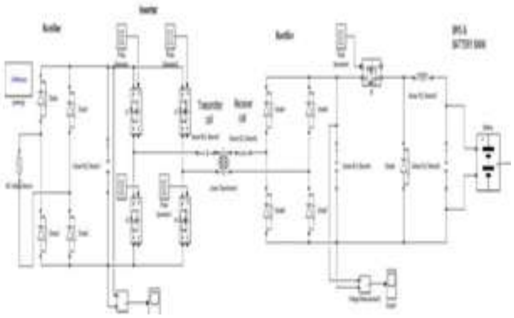

Fig.3,Simulationcircuit

Time periodin Ms	0	1.255	1.26
Transmittervo ltage(V)	130	230	45

Fig.3, represent the simulation circuit diagram of"Smart parking with wireless charging of electricalvehicles". It is clear that this simulation consist ofthreeParts:transmitterpart,receiverpartandbattery monitoring system. In transmitter part, it consist ofsupply source, rectifier, inverter, transmitter coil.When we clearly watch this figure, supply source230v,50hzAcSupplyisfedto'rectifier'anditrectified into dc voltage. Now, this dc voltage isagain converter into high voltage acsupplyby 'inverter'and fedintothetransmitter coil Now,thesecondpartisreceiverpartofthissimulation circuit. If we look carefully, the receivercoilandtransmittercoilisplacedsameastransformersinceweusingthesameprinciple"mutual inductance". So when the transmitter coilcuts the magnetic field with receiver coil, it createmagneticfieldandbycontrollingresonancefrequency with compensating networks, the supplyvoltage istransmittedtoreceivercoil. Nowthethirdandfinalpartofthissimulationcircuitis battery monitoring system (BMS). It consist ofRectifier,Batterybank&Batterymonitoringsystem(BMS).RectifierisusedtoconvertAcsupplyreceived by receiver coil to dc voltage. Now this dcvoltageisstoredinthebatteryandmonitoredcarefullytoprotectitfromhazardsbybatterymonitoring system.

Simulation output wave forms:
TransmitterWaveform:

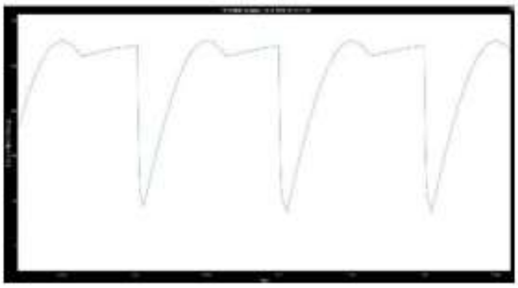

Fig.4,TransmittervoltageWaveform

Time periodin Ms	0	1.255	1.26
Transmittervo ltage(V)	130	230	45

Fig.5,Transmittervoltagetabularcolumn

Figure 5, shows clearlythat at initial timeperiod, the voltage rises to 130 volts.After1.255 (ms)time period reached, the voltage rises rapidly to 230volts.After few milli second time period, at 1.26milli second, the voltage dropped to 45 volts.Theseoscillations in voltages are repeated continuouslywith time periodinmilli second.

ReceiverWaveform:

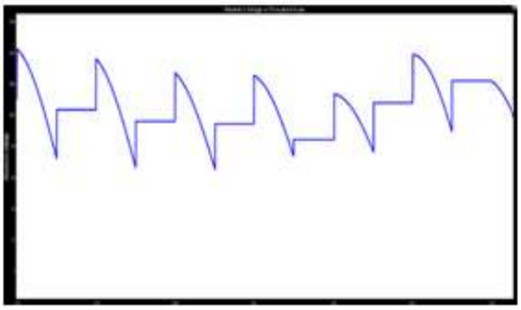

Fig.6,ReceiverWaveform:

Time periodinms	1.54	1.55	1.56
Receiver'sVoltage	142	70	138

Fig.7,ReceiverWaveformtabularcolumn

Figure 7 (Receiver's voltage tabular column)representsclearlytheoscillationsinreceiver's voltage with respect to it's time. From this tabularcolumn, we can see that voltage increased to 142volts,at 1.54 milli seconds time period. After fewtime period in milli second, voltage reduced to 70volts,at1.55millisecondstimeperiod.Again,voltage increased to 138 volts at 1.56 milli secondsintimeperiod.Soweclearlyseetheoscillations upsand downs in voltage with respect to its time

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periodin ms.

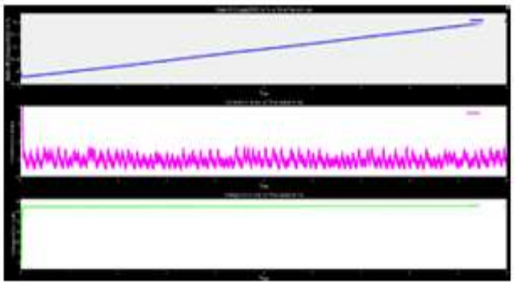

Fig8,Batterymonitoringsystemwaveform

TabularcolumnofSoc (%)vsTimeperiodinms

Time periodin ms	0.1	1	2
Soc(%)	79.98	80	8.03

Fig9, Tabular column of state of charge in % vsTime period in

Figure 9 (Tabular column of state of charge in %)clearlyrepresentsusthatstateofchargepercentageof battery is rising or increasing gradually withincrease in time period in ms. If we look on tabularcolumn, it denotes that at 0.1 milli second timeperiod, state of charge of battery reaches 79.98%.After gradual increase in time period, state ofcharge will also increase gradually as shown inabovetabularcolumn.

Tabularcolumnofcurrent(I)inampsvstimeperiodin ms:

Time periodin ms	0.1	1	2
current(I) inamps	10	-7	-2

Fig 10, Tabular column of current(I) in amps vs timeperiod inms

Figure 10 (Tabular column of current(I) in amps vstime period in ms) represents those current reaches10 amps at initial time period 0.1 milli seconds.When time period increased to 1 milli seconds,thencurrent reduced to negative amps. Then after 2 milliseconds, the current moved near to positive amps.Thisoscillationsincurrentwillbecontinuedthroughout signals at mentioned intervals in abovetabular column.

State Of Chargewaveform:

Tabular column of voltage(v) in volts vs timeperiodin ms:

time periodin ms	0.1	1	2
Voltage(v) involts	55	55	55

Figure11,Tabularcolumnofvoltageinvoltsvstimeperiod inms

Figure 11 (Tabular column of voltage in volts vstimeperiodinms)representsthatvoltagereachesto55 voltsatinitialtimeperiod0.1milliseconds.After 1millisecondstimeperiod,thevoltageismaintainedconstant55volts,eventhereisincrease in time period in milli second as we clearly see it inabovetabularcolumn.

V. CONCLUSION

ThemainoutcomeofourprojectistoCharge our Electrical vehicle's Battery 'Wirelessly'and to park our Electrical vehicles automatically orSmartlytotheGridofpowerSupply.IfourElectricalvehicleisparkedinsideIRSensor'sRange. By doing our Project Successfully, we canachieve this Comfortable charging facility and weneedtoresearchmoreonittoenhancemoreadvancedfeaturesandtechnologiesthatwillbehelpful in our future life. By More research on thisProject,toreducethepossibleerrorsandMalfunctionsin"Smartparkingandwirelesschargingofelectricalvehicles"Wecanachievemore flawless andComfortable Chargingmethodfor Electrical vehicles. By CreatingMore Awarenesson wireless charging method of electrical vehicles toall vehicles Manufacturers, surely it makes them tomanufacture the upcoming ElectricalVehicles withwirelesschargingfacility.Inadditiontothis,IfSmartparking too made in Charging point,then this wholecharging setup will be more Comfortable mannerand Easy method to proceed Wireless Charging ofelectricalvehicle.

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