E-BULK FOR E-VEHICLE

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ABSTRACT

The proposed DC/DC boost converter to reduce conversion stages and switching loss. To propose a control design and power management for a hybrid charging station for PHEV (Plug-in hybrid electric vehicle) by use of renewable source. In this paper, control of a PV charging station is designed and tested. This DC/DC interfaces a PV system, a DC system with an E-plug in electrical vehicles. The control of the DC/DC converter is designed to realize maximum power point tracking (MPPT) for PV. The RFID technology, to provide better service for the electric vehicle charging bulk, for electric vehicle identification as well as to debit the charging amount from users.

I – INTRODUCTION

Plug-in Electric Vehicles (PEVs) are envisioned as safe and reliable successors for conventional vehicles, given their significant economic and environmental advantages and recent technological improvements. It is expected that the integration of Plug-in Hybrid Electric Vehicles (PHEV) and Battery Electric Vehicles (BEV) will increase significantly in the near future in many countries [1]. For instance, in Australia the share of PEVs is expected to exceed 15% of the total new vehicle sales after 2020 [2]. Such high prevalence of PEVs requires investigation of their impact on the electricity grids, given that the uncoordinated charging of PEVs can significantly increase the load demand, raise the losses in the power systems and can cause overloading of power systems' components at the distribution levels [3]. Beside such impacts, when a high number of PEVs are connected to distribution feeders through power electronic based charging equipment, the PEVs may cause Power Quality (PQ) disturbances e.g. harmonics, inter-harmonics, voltage dips, voltage swells, long duration voltage variations, voltage fluctuation, light flicker and current and voltage unbalances [4]-[6].

In this context, considering the characteristics of the PEV loads, such as the uncertainties of their connection/disconnection times, the analysis and the mitigation of the negative consequences of PEVs in distribution power systems is highly challenging. Further, the connection of PEVs in the distribution system will add to the PQ disturbances generated by the connection of different nonlinear residential and industrial loads or the integration of distributed generation systems. This can cause further deterioration of the PQ in the distribution systems. Therefore, it is essential to investigate the impacts of the PEV connection on the distribution power systems so that the PQ of the electric grids are maintained within the required limits.

The contribution of this paper is multi-fold. First, we propose a hybrid framework to overcome the constraints of wireless charging and environmental harvesting techniques. To the best of our knowledge, this is the first work dealing with WSNs using such hybrid energy sources. Second, we use RFID technology, to provide better service for the electric vehicle charging bulk, for electric vehicle identification as well as to debit the charging amount from users.

II- RELATED WORK

M. Edington, et. al., presents a topology survey evaluating topologies for use in front end ac-dc converters for PHEV battery chargers. The topology survey is focused on several boost power factor corrected converters, which offer high efficiency, high power factor, high density, and low cost. As a key component of a plug-in hybrid electric vehicle (PHEV) charger system, the front-end ac-dc converter must achieve high efficiency and power density.

Thomas, et. al., propose a novel hybrid converter topology called Sepic Derived Hybrid Converter (SDHC) which is capable of providing step up/step down DC output and three phase AC

output simultaneously is proposed. This topology is called 3-φ Sepic Derived Hybrid Converter (3-φ SDHC).The main advantage of this architecture is inherent shoot through protection compared to conventional Voltage Source Inverters (VSI) which avoid dead time compensation. The other advantages include high power processing density, well co-ordination of power flow to both outputs, independent regulation of AC and DC outputs etc.

Tawfiq Aljohani et. al., presents dynamic simulations of the hour-to-hour operation of the distribution feeder to measure the grid's reaction to the EV's charging and discharging process. Four case scenarios were modeled here considering a 24-h distribution system load data on the IEEE 34 bus feeder. The results show the level of charging and discharging that were allowed on this test system, during each hour of the day, before violating the limits of the system. It also estimates the costs of charging throughout the day, utilizing time-of-use rates as well as the number of EVs to be charged on an hourly basis on each bus and provide hints on the best locations on the system to establish the charging infrastructure.

III - SYSTEM IMPLEMENTATION

To propose a control design and power management for a PV charging station for PHEV (Plug-in hybrid vehicle) by use of renewable source. The charging station charges PHEVs using power from PV panel. The RFID technology, to provide better service for the electric vehicle charging bulk, for electric vehicle identification as well as to debit the charging amount from users. The following figure.1 represents the proposed block for solar PV based electric vehicle charging station system.

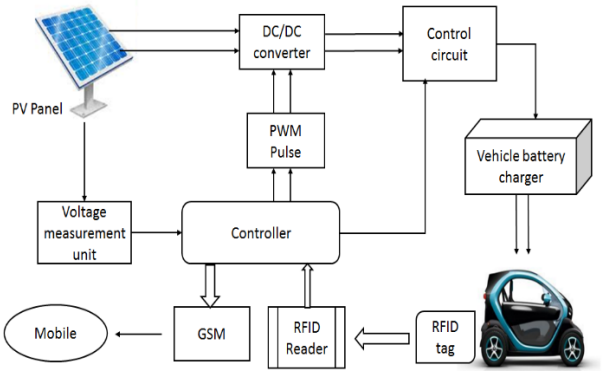


Fig 1. Proposed Block Diagram

In this figure.1, to charge the vehicle by using renewable energy. Solar panel used as renewable energy source. Solar panels use light energy (photons) from the sun to generate electricity through the photovoltaic effect. This output is given to DC-DC converter. Converter is used to boost the voltage from solar panel. In this project we use atmega328 controller. It is consists of 24 pins, the inputs can be controlled by transmitting and receiving the inputs to the external device. It also consists of pulse width modulation (PWM). Controller to measure the voltage from solar panel by using voltage measurement unit. Controller to give the PWM signal to converter by using gate driver unit. The vehicle is charged by using charger unit. The converter output is given to charger unit. RFID technology is used to identify the vehicle and to debit the charge amount. RFID reader is placed in the e-bulk. The tags are placed in the vehicle. RFID Reader reads the magnetic signal from RFID Tag and it converts the magnetic signal into serial data. GSM is used to send message to vehicle owner.

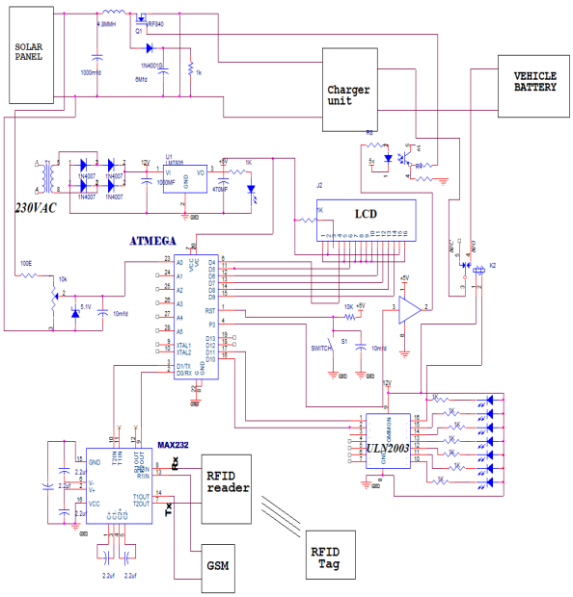


Fig 2. Circuit diagram

In this figure.2, the power supply gives supply to all components. It is used to convert AC voltage into DC voltage. Transformer used to convert 230V into 12V AC.12V AC is given to diode. Diode range is 1N4007, which is used to convert AC voltage into DC voltage. AC capacitor used to charge AC components and discharge on ground. LM 7805 regulator is used to maintain voltage as constant, and then the signal will be given to next capacitor, which is used to filter the unwanted AC component. Load will be LED and resister. LED voltage is 1.75V. The RFID tag sends

the encoded data signal in the form of Radio frequency wave form, the RFID reader will receives these signal data. The output of the RFID reader connected to MAX232 Pin No. 7&8. The output of the MAX232 is connected to the Micro controller ATMEGA 328. The ATMEGA 328 controller will produce the output according to the in-build program. The micro controller output signals are connected to the MOSFET gate and ULN2003 Driver. The Solar panel produce the current, the MOSFET gate will be opened according to the signals from the micro controller. The current from the solar panel will be applied to the charger unit. The charger unit will charge battery of the vehicle. The Battery charging can be controlled from micro controller though relay and ULN2003 driver. GSM is also interfaced to controller through MAX232. It is used to send message through mobile.

IV- HARDWARE DETAILS

1. SOLAR CELL

A **solar cell**, or **photovoltaic cell**, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Solar cells are the building blocks of photovoltaic modules, otherwise known as solar panels.

Fig 3. Solar panel

Solar cells are described as being photovoltaic irrespective of whether the source is sunlight or an artificial light. They are used as a photodetector (for example infrared detectors), detecting light or other electromagnetic radiation near the visible range, or measuring light intensity.

2. ATMEGA 328

ATMEGA 328 microcontroller, which acts as a processor for the arduino board. Nearly it consists of 28 pins. From these 28 pins, the inputs can be controlled by transmitting and receiving the inputs to the external device. It also consists of pulse width modulation (PWM). These PWM are used to transmit the entire signal in a pulse modulation. Input power supply such as Vcc and Gnd are used. These IC mainly consists of analog and digital inputs. These analog and digital inputs are used for the process of certain applications.

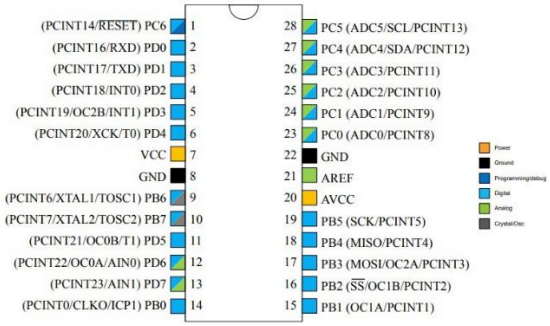


Fig 4. Pin diagram – Atmega 328

This ATMEGA-328 integrated chip consists of 28 pins. It consists of 6 analog inputs that are shown in the pin diagram. Analog inputs can be represented as PC0 to PC5. These analog input pins possess the continuous time signal which acts as an analog input for the system. Further it also consists of 12 digital inputs. It can be represented as PD1 to PD11 which act as a digital input ports based on pulse width modulation (PWM). These PWM, which transmits the signal in the form of discredited form. Both analog and digital input ports can be used for various applications for the input power supply, VCC and GND pins are used. Pins PB6 and PB7, which acts as a crystal to generate a clock signal. By using these crystal, we can generate the clock signals and by these clock signals, we can use this clock signals for input sources. PC6 pin are the one where it can be used for the reset option. Resetting the program can be done by using this PC6 pin.

3. RFID

Radio-frequency-identification (RFID) is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by electromagnetic

induction from magnetic fields produced near the reader. Some types collect energy from the interrogating radio waves and act as a passive transponder. Other types have a local power source such as a battery and may operate at hundreds of meters from the reader. Unlike a barcode, the tag does not necessarily need to be within line of sight of the reader and may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC).

Fig 5. RFID Reader module

RFID tags are used in many industries, for example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line;

4. GSM MODEM

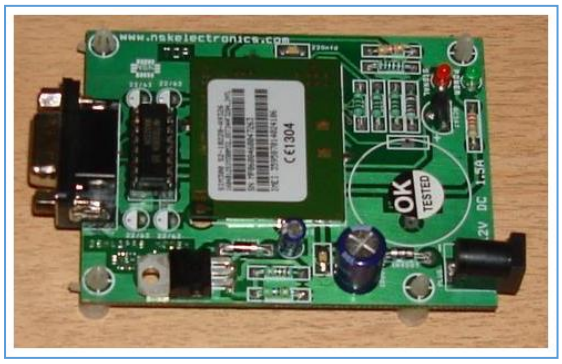


Fig 6. GSM module

A **GSM modem** is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. The GSM modem is a specific type of device, which accepts a SIM card operate on a subscriber's mobile number over a network, as a cellular phone. Modem sim300 is tri band GSM/GPRS locomotives that perform on EGSM900MHz, DCS1800MHz and PCS1900MHz frequencies. GSM Modem is used as a RS232-logic level compatible, i.e., it various from -3v to -15v as logic high and +3v to +15 as logic low.MAX232 is used to convert TTL into RS232 logic level converter is used between the microcontroller and the GSM board. The microcontroller signal is sent to the GSM modem through pin 11 of max232. The pin2 of the GSM modem received the signal from microcontroller. The GSM modem transmits the signals from pin3 to the microcontroller through MAX232.

5. MAX 232

- It used for interfacing with PC
- It is serial port
- It is used to convert TTL signal to RS232 level
- Typical voltage 1.5V,hysteresis voltage 0.5V

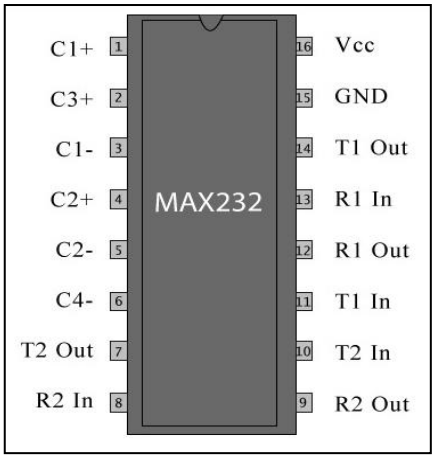


Fig 7. Pin Diagram – MAX 232

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other.

6. OPTO COUPLER

In electronics, an **opto-isolator**, also called an **optocoupler**, **photocoupler**, or **optical isolator**, is "an electronic device designed to transfer electrical signals by utilizing light waves to provide coupling with electrical isolation between its input

and output". The main purpose of an opto-isolator is "to prevent high voltages or rapidly changing voltages on one side of the circuit from damaging components or distorting transmissions on the other side."

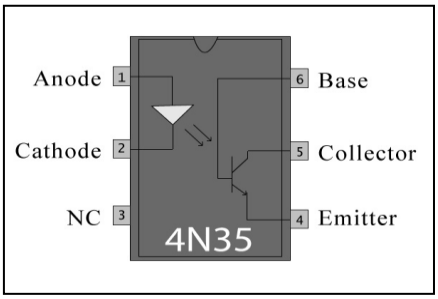


Fig 8. Pin Diagram – 4N35

The LED is a light emitting device and photo transistor is a light sensitive device. The conduction current of phototransistor can be controlled via the conduction current of the LED, even though the two devices are physically separated. Such a package is known as an opto coupler, sine the input (LED) and the output (phototransistor) devices are optically coupled. The most important point to note about the opto coupler device is that a circuit connected to its input can be electrically fully isolated from the output circuit and that a potential difference of hundreds (or) thousands of volts can safely exist between these two circuits without adversely influencing the opto coupler action. This isolating characteristic is the main attraction of this type of opto coupler device, which is generally known as an isolating opto coupler.

7. RELAY DRIVER

Driver is used for drive the relay. ULN2003A IC is used as driver. This IC has some special features

- Seven Darlington's per package
- output current 500ma per driver (600ma peak)
- output voltage 50v
- integrated suppression diodes for inductive loads
- outputs can be paralleled for higher current
- ttl/cmos/pmos/dtl compatible inputs

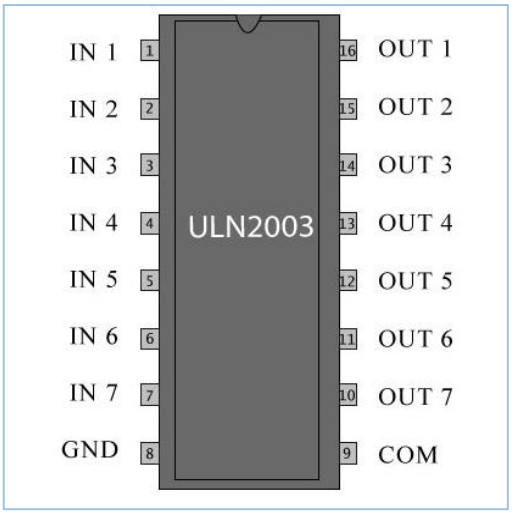
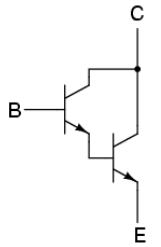


Fig 9. Pin diagram – ULN2003

Working of ULN2003 IC:

The ULN2003 IC consists of eight NPN Darlington pair which provides the proper current amplification required by the loads. We all know that the transistors are used to amplify the current but here Darlington transistor pairs are used inside the IC to make the required amplification.

An NPN "Darlington pair"



A Darlington pair is two transistors that act as a single transistor providing high current gain. In this pair the current amplified by the first transistor is further amplified by the next transistor providing high current to the output terminal.

When no base voltage is applied that when no signal is given to the input pins of the IC, there will be no base current and transistor remains in off state. When high logic is fed to the input both the transistors begin to conduct providing a path to ground for the external load that the output is connected. Thus when an input is applied corresponding output pin drops down to zero there by enabling the load connected to complete its path.

8. RELAY

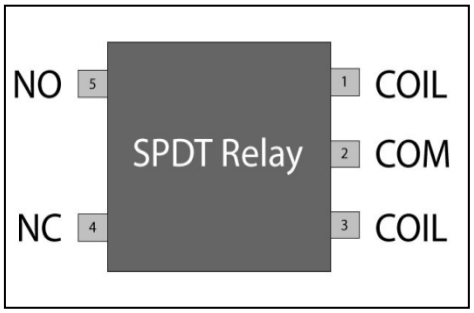


Fig 10. Pin diagram - Relay

Relays are switching devices. Switching devices are the heart of industrial electronic systems. When a relay is energized or activated, contacts are made or broken. They are used to control ac or dc power. They are used to control the sequence of events in the operation of a system such as an electronic heater, counter, welding circuits, and X-ray equipment, measuring systems, alarm systems and telephony. Electromagnetic relays are forms of electromagnets in which the coil current produces a magnetic effect. It pulls or pushes flat soft iron armatures or strips carrying relay contacts. Several relay contact can be operated to get several possible ON/OFF combinations.

9. LCD – Liquid Crystal Display

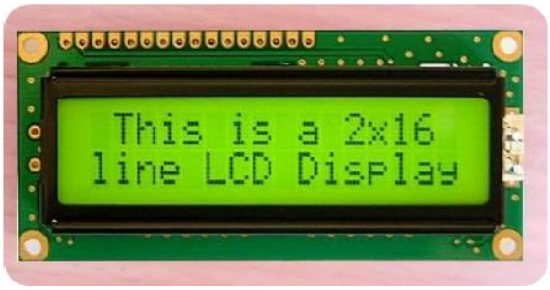


Fig 11. LCD (16*2)

Liquid Crystal Displays (LCDs) have materials, which combine the properties of both liquid and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. LCD display use of our project title message and information message. Our project connect to a microcontroller unit data line connected to a 'PORT 2' and control lines connected to a P3.5,P3.6,P3.7.

10. POWER SUPPLY

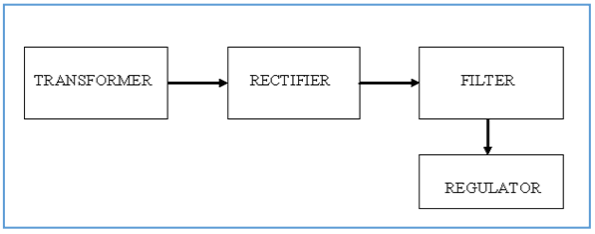


Fig 12. Power supply block diagram

Block diagram of AC to DC power Supply consists,

1. Transformer: Steps the household line voltage up or down as required.

2. Rectifier: Converts ac voltage into dc voltage.

3. Filter: Smooth the pulsating DC voltage to a varying DC voltage.

4. Regulator: Fix the output voltage to constant value.

V - RESULTS

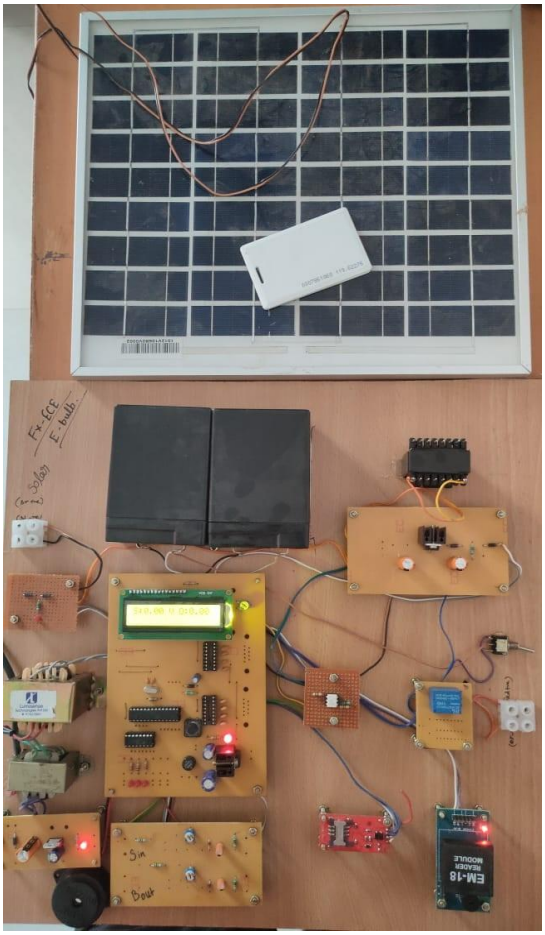


Fig 13. Hardware presentation

Fig 14. Verify the vehicle ID

Fig 15. Vehicle charging seconds: 3

Fig 16. Vehicle charging seconds: 15

CONCLUSION

This project presents the multiple PEVs charging point connected PV powered hybrid microgrid structure is proposed with their energy management algorithm to give the continuous supply to the utility loads including EVs changing points. The different modes of energy management strategies are developed and tested for the proposed microgrid to offer the continuous power supply to the EV charging point. The control strategy of the charging station is based on the measured DC bus voltage and vehicle voltage. The comprehensive hardware results determine the overall charging station control and the performance of the EV interfacing during all operating conditions of the microgrid.

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