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ELECTRIC VEHICLE SOLAR-POWERED WIRELESS CHARGING STATION

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Abstract: An article outlining the concept of a solar-powered charging station for electric vehicles is presented in this study. The design addresses the main drawbacks of fuel and pollution. More and more people are opting to drive electric cars, which are now on the road throughout the globe. Electric cars have helped lower transportation costs by substituting energy for petrol, which is much less expensive. This has further advantages for the environment. Here, we come up with a novel and inventive approach by creating an electric vehicle charging station. This electric car charging system uses solar electricity to keep the charging system running, so there's no need to stop the vehicle while it's charging. Additionally, it doesn't need an external power source. Integral to the system's development are components such as a battery, solar panel, regulator circuitry, copper coils, AC to DC converter, atmega controller, and LCD display. This technology shows how electric cars may be charged on the go, without stopping for charging stations. This technology so exemplifies a road-integrated, solar-powered wireless charging system for EVs.

Keywords: *Battery; Micro Controller; Embedded System; Transformer; Microprocessor; Electric Vehicle;*

I. INTRODUCTION

Electric Vehicles (EVs), represents a new concept in the transport sector around the world. It is expected that the market share of EVs will exponentially grow, comprising 24% of the U.S. light vehicle fleet in 2030, representing 64% light vehicle sales in this year. In this context, the EVs battery charging process must be regulated to preserve the power quality in the power grids. Nevertheless, with the proliferation of Evs a considerable amount of energy will be stored in the batteries, raising the opportunity of the energy flow in the opposite sense. In the future smart grids, the interactivity with the EVs will be one of the key technologies, contributing to the power grid autonomous operation. The concept of the on-board bidirectional charger with V2G and V2H technologies is introduced [1].

The electric vehicle has become more competitive when compared to the conventional internal combustion engine vehicle due to lower carbon dioxide emission and raising fossil fuels. However, the EV was not widely adopted into the market due to some limitations such as high vehicle cost[2]. limited charging infrastructure and limited all electric drive. EVs are vehicles that are either partially or fully powered on electric power. Electric vehicles have low running costs as they have fewer moving parts for maintenance and are also very environmentally friendly as they use little or no fossil [3].

II. Electric Vehicle

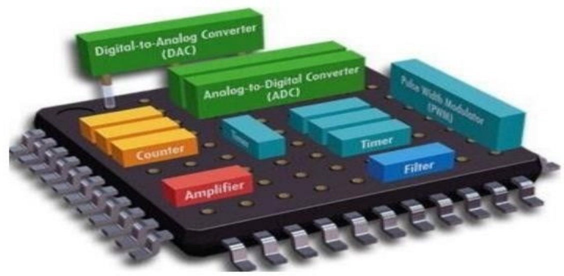
An electric vehicle (EV) is a vehicle that uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels, fuel cells or an electric generator to convert fuel to electricity[4]. EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. EVs first came into existence in the mid-19th century, when electricity was among the preferred methods for motor vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. Modern internal combustion engines have been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained commonplace in other vehicle types, such as trains and smaller vehicles of all types[5].

III. Introduction To Embedded System

3.1: What Is An Embedded System

An embedded system isa microprocessor- or microcontroller-based system of hardware and software designed to perform dedicated functions within a larger mechanical or electrical system.An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market[6].Its purpose isto control the device and to allow a user to interact with it[7].

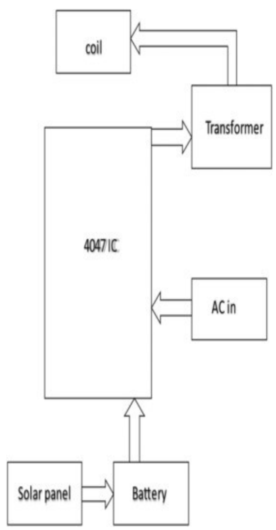
An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or specific application[8].

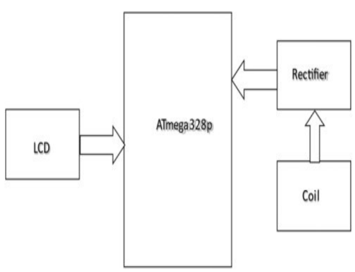


3.2 : Applications Of Embedded Systems

Embedded systems are used in different applications like automobiles, telecommunications, smart cards, missiles, satellites, computer networking and digital consumer electronics..

3.3 : Block Diagram





IV. Hardware Requirements

4.1 Hardware Components

1. Atmega 328p

2. 4047 IC

3. 1N4007

4. Coil

5. LED

6. 16*2 LCD display

4.1.1 : Atmega 328p

The Atmel ATmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at 20MHz[9]. The ATMEGA328-PU comes in an PDIP 28 pin package and is suitable for use on our28 pin AVR Development Board.The computer on one hand is designed to perform all the general purpose tasks on a single machine like you can use a computer to run a software to perform calculations or you can use a computer to store some multimedia file or to access internet through the browser, whereas the microcontrollers are meant to perform only the specific tasks, for e.g., switching the AC off automatically when room temperature drops to a certain defined limit and again turning it ON when temperature rises above the defined limit[10].

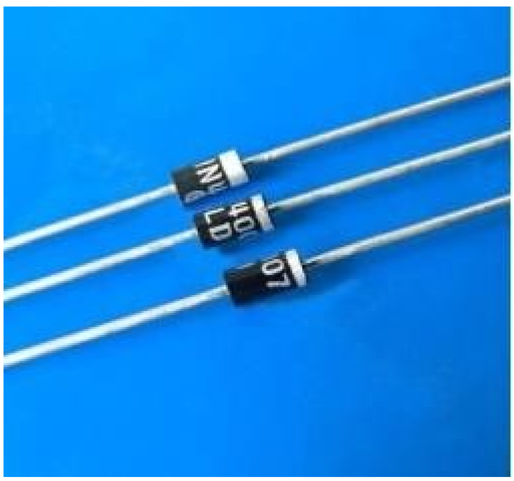
4.1.2 : 4047 IC

The CD 4047 IC is one kind ofmultivibratorincluding a high voltage. The operation of this IC can be done in two modes like Monostable & Astable. This IC requires an exterior resistor & capacitor to decide the output pulse width within the monostable mode & the o/p frequency within the astable mode[11]. This IC operates at 5 Volts, 10 Volts, 15Volts & 20Volts. The 4047 IC is aCMOSmultivibrator that works in two modes like monostable & astable[12]. The 4047 IC applications include a wide range like generation of the pulse wave, sine wave, and DC signal to AC signal conversion, etc.

4.1.3: IN4007

Diodes are used to convert AC into DC these are used as half wave rectifiers or full wave rectifier.Three points must be kept in mind while using any type of diode.

1. Maximum forward current capacity
2. Maximum reverse voltage capacity
3. Maximum forward voltage capacity



4.1.4: Coil

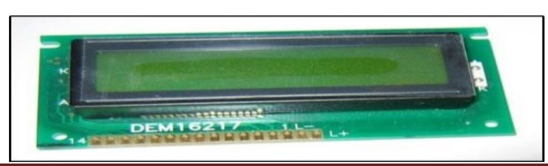
A circle, a series of circles, or a spiral made by coiling. 2 : a long thin piece of material that is wound into circles.

4.1.5 : LED

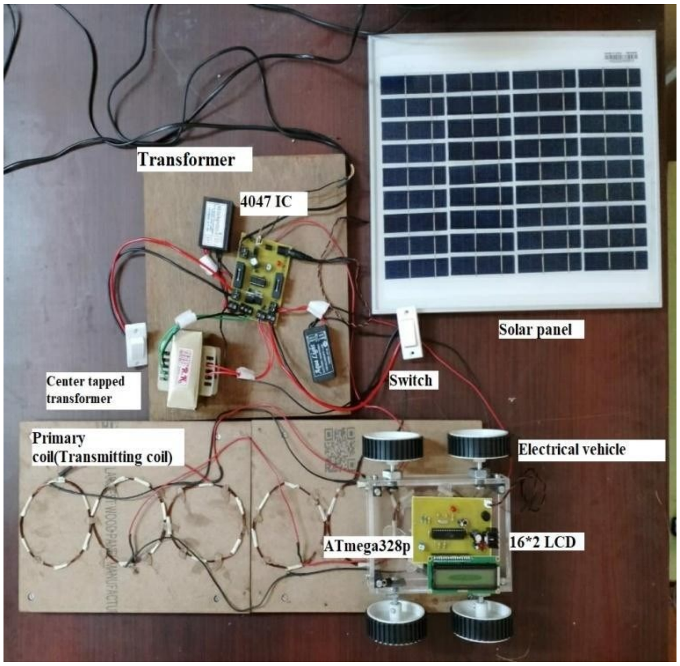
LEDs are semiconductor devices. Like transistors, and other diodes, LEDs are made out of silicon. What makes an LED give off light are the small amounts of chemical impurities that are added to the silicon, such as gallium, arsenide, indium, and nitride[13]. When current passes through the LED, it emits photons as a byproduct. Normal light bulbs produce light by heating a metal filament until its white hot. Because LEDs produce photons directly and not via heat, they are far more efficient than incandescent bulbs.

4.1.6: 16*2 LCD

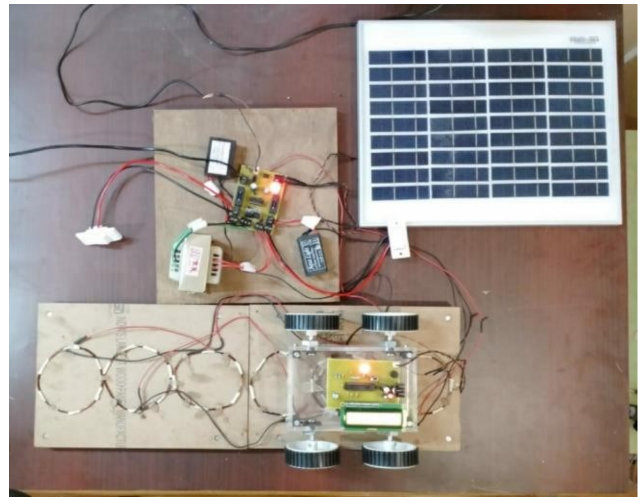
This is the example for the Parallel Port. This example doesn't use the Bi-directional feature found on newer ports, thus it should work with most, if not all Parallel Ports. It however doesn't show the use of the Status Port as an input for a 16 Character x 2 Line LCD Module to the Parallel Port[14]. These LCD Modules are very common these days, and are quite simple to work with, as all the logic required running them is on board.



V. HARDWARE OUTPUTS:



The system makes use of a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, atmega controller and LCD display to develop the system. The system demonstrates how electric vehicles can be charged while moving on the road, eliminating the need to stop for charging[15]. The solar panel is used to power the battery through a charge controller. The battery is charged and stores dc power. The DC power now needs to be converted to AC for transmission. For this purpose we here use a transformer.



The power is converted to AC using a transformer and regulated using regulator circuitry. This power is now used to power the copper coils that are used for wireless energy transmission. A copper coil is also mounted underneath the electric vehicle.

When the vehicle is driven over the coils energy is transmitted from the transmitter coil to ev coil. Please note the energy is still DC current that is induced into this coil[16]. Now we convert this to DC again so that it can be used to charge the EV battery.

We use AC to DC conversion circuitry to convert it back to DC current. Now we also measure the input voltage using an atmega microcontroller and display this on an LCD display[17]. Thus the system demonstrates a solar powered wireless charging system for electric vehicles that can be integrated in the road.

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