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Fabrication of a Novel wireless self powered Vehicle using Microcontroller and Photo Voltaic panel

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Abstract:

Due to rapid growth of the living standard and prosperity of a nation vary directly with the increase in the usage of power. The electricity requirement of the world is increasing at an alarming rate due to industrial growth, increased and extensive use of electrical gadgets so we can increase the usage of the best alternative source nothing but An efficiently natural source of energy from sunlight as "solar energy'. This paper presents wireless solar powered vehicle model which is an electric vehicle powered completely or significantly by usage of solar energy.

Usually, photovoltaic (PV) cells contained in solar panels convert the sun's energy directly into electric energy. The term "solar vehicle" usually implies that solar energy is used to power all or part of a vehicle's propulsion. Solar power may be also used to provide power for communications or controls or other auxiliary functions. Solar vehicles are not sold as practical day-to-day transportation devices at present, but are primarily demonstration vehicles and engineering exercises, often sponsored by government agencies. However, indirectly solar-charged vehicles are widespread and solar boats are available commercially.

Key words:

Solar panel, DC motors, RF transmitter, receiver, PIC Microcontroller.

I. INTRODUCTION:

Solar energy, radiant light and heat from the sun, has been harnessed by humans since ancient times using a range of ever-evolving technologies.

Solar radiation, along with secondary solar-powered resources such as wind and wave power, hydroelectricity and biomass, account for most of the available renewable energy on earth Only a minuscule fraction of the available solar energy is used. Solar powered electrical generation relies on heat engines and photovoltaic. Solar energy's uses are limited only by human ingenuity. A partial list of solar applications includes space heating and cooling through solar architecture, potable water via distillation and disinfection, day lighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes. To harvest the solar energy, the most common way is to use solar panels.

Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air. The Earth receives 174 petawatts (PW) of incoming solar radiation (insolation) at the upper atmosphere. Approximately 30% is reflected back to space while the rest is absorbed by clouds, oceans and land masses. The spectrum of solar light at the Earth's surface is mostly spread across the visible and near-infrared ranges with a small part in the near-ultraviolet.

Earth's land surface, oceans and atmosphere absorb solar radiation, and this raises their temperature. Warm air containing evaporated water from the oceans rises, causing atmospheric circulation or convection. When the air reaches a high altitude, where the temperature is low, water vapor condenses into clouds, which rain onto the Earth's surface, completing the water cycle.

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The latent heat of water condensation amplifies convection, producing atmospheric phenomena such as wind, cyclones and anti-cyclones. Sunlight absorbed by the oceans and land masses keeps the surface at an average temperature of 14 °C. By photosynthesis green plants convert solar energy into chemical energy, which produces food, wood and the biomass from which fossil fuels are derived.The total solar energy absorbed by Earth's atmosphere, oceans and land masses is approximately 3,850,000 exajoules (EJ) per year. Photosynthesis captures approximately 3,000 EJ per year in biomass.

The amount of solar energy reaching the surface of the planet is so vast that in one year it is about twice as much as will ever be obtained from all of the Earth's non-renewable resources of coal, oil, natural gas, and mined uranium combined. From the table of resources it would appear that solar, wind or biomass would be sufficient to supply all of our energy needs, however, the increased use of biomass has had a negative effect on global warming and dramatically increased food prices by diverting forests and crops into biofuel production. Depending on a geographical location the closer to the equator the more "potential" solar energy is available.

Solar plate is a light sensitized steel backed polymer material used by artists as an alternative to hazardous printing techniques. It is a simple, safer, and faster approach than traditional etching and relief printing. It does not use grounds, acids or solvents. it is exposed with u.v. light (the sun) and developed with ordinary tap water.Highly interaction in human machine in daily lives has made user interaction progressively very important. The hunger for automation brought many revolutions in the existing technologies. These had greater importance than any other technologies due its user-friendly nature.

Fig-1 Image of Solar powered robot model

II. RELATED WORK:

A solar vehicle is an electric vehicle powered completely or significantly by direct solar energy. Usually, photovoltaic (PV) cells contained in solar panels convert the sun's energy directly into electric energy. The term "solar vehicle" usually implies that solar energy is used to power all or part of a vehicle's propulsion. Solar power may be also used to provide power for communications or controls or other auxiliary functions. Solar vehicles are not sold as practical day-to-day transportation devices at present, but are primarily demonstration vehicles and engineering exercises, often sponsored by government agencies. However, indirectly solar-charged vehicles are widespread and solar boats are available commercially.

Limitations:

There are limits to using photovoltaic (PV) cells for vehicles:

• Power density: Power from a solar array is limited by the size of the vehicle and area that can be exposed to sunlight. This can also be overcome by adding a flatbed and connecting it to the car and this gives more area for panels for powering the car. While energy can be accumulated in batteries to lower peak demand on the array and provide operation in sunless conditions, the battery adds weight and cost to the vehicle. The power limit can be mitigated by use of conventional electric cars supplied by solar (or other) power, recharging from the electrical grid.

• Cost: While sunlight is free, the creation of PV cells to capture that sunlight is expensive. Costs for solar panels are steadily declining (22% cost reduction per doubling of production volume).

• Design considerations: Even though sunlight has no lifespan, PV cells do. The lifetime of a solar module is approximately 30 years. Standard photovoltaic often come with a warranty of 90% (from nominal power) after 10 years and 80% after 25 years. Mobile applications are unlikely to require lifetimes as long as building integrated PV and solar parks. Current PV panels are mostly designed for stationary installations. However, to be successful in mobile applications, PV panels need to be designed to withstand vibrations.

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Also, solar panels, especially those incorporating glass, have significant weight. To be useful, the energy harvested by a panel must exceed the added fuel consumption caused by the added weight.Different types of Solar powered vehicles and its applications has been given below-

(i) Solar cars depend on PV cells to convert sunlight into electricity to drive electric motors. Unlike solar thermal energy which converts solar energy to heat, PV cells directly convert sunlight into electricity. Solar cars combine technology typically used in the aerospace, bicycle, alternative energy and automotive industries. The design of a solar car is severely limited by the amount of energy input into the car. Solar cars are built for solar car races or daily usage on public roads. Even the best solar cells can only collect limited power and energy over the area of a car's surface. This limits solar cars to ultra light composite bodies to save weight. Solar cars lack the safety and convenience features of conventional vehicles.

Solar cars are often fitted with gauges and/or wireless telemetry, to carefully monitor the car's energy consumption, solar energy capture and other parameters. Wireless telemetry is typically preferred as it frees the driver to concentrate on driving, which can be dangerous in such a small, lightweight car. The Solar Electric Vehicle system was designed and engineered as an easy to install (2 to 3 hours) integrated accessory system with a custom molded low profile solar module, supplemental battery pack and a proven charge controlling system. As an alternative, a battery-powered electric vehicle may use a solar array to recharge; the array may be connected to the general electrical distribution grid.

(ii) Solar buses are proposed by solar energy, all or part of which is collected from stationary solar panel installations. The Tindo bus is a 100% solar bus that operates as free public transport service in Adelaide City as an initiative of the City Council.[2] Bus services which use electric buses that are partially powered by solar panels installed on the bus roof, intended to reduce energy consumption and to prolong the life cycle of the rechargeable battery of the electric bus, have been put in place in China. Solar buses are to be distinguished from conventional buses in which electric functions of the bus such as lighting, heating or air-conditioning, but not the propulsion itself, are fed by solar energy. Such systems are more widespread as they allow bus companies to meet specific regulations, for example the anti-idling laws that are in force in several of the US states, and can be retrofitted to existing vehicle batteries without changing the conventional engine.

(iii) Solar Bicycles A few true solar bicycles were built, either with a large solar roof, a small rear panel, or a trailer with a solar panel. Later more practical solar bicycles were built with foldable panels to be set up only during parking. Even later the panels were left at home, feeding into the electric mains and the bicycles charged from the mains. Today highly developed electric bicycles are available and these use so little power that it costs little to buy the equivalent amount of solar electricity. The "solar" has evolved from actual hardware to an indirect accounting system. The same system also works for electric motorcycles, which were also first developed for the Tour de Sol

(iv)Solar Railways Railway presents a low rolling resistance option that would be beneficial of planned journeys and stops. PV panels were tested as APUs on Italian rolling stock under EU project. PV Train concluded that the most interest for PV in rail transport was on freight cars where on board electrical power would allow new functionality: The Kismaros – Királyrét narrow-gauge line near Budapest has built a solar powered railcar called 'Vili'. With a maximum speed of 25 km/h, 'Vili' is driven by two 7 kW motors capable of regenerative braking and powered by 9.9m2 of PV panels. Electricity is stored in on-board batteries. In addition to on-board solar.

panels, there is the possibility to use stationary (off-board) panels to generate electricity specifically for use in transport. Direct feed to DC grids avoids losses through DC to AC conversion. DC grids are only to be found in electric powered transport: railways, trams and trolleybuses. Indian railways announced their intention to use on board PV to run air conditioning systems in railway coaches.

II. PROPOSED METHODOLOGY:

In this proposed model, the main aim is to control the robot (vehicle) using the wireless remote made using RF technology. The Robot is powered using the solar energy. As it is a wireless Robot it can be easily mobilized and can be controlled.

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The proposed model Self Powered solar vehicle is a combination of both hardware and software using PIC microcontroller as intermediate between input and output devices like RF remote wireless communication and DC motors of the vehicle. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors.

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. The reset logic is used to protect the internal program of the micro controller when the power spikes are present in the line current. And the oscillator is used to powered transport: railways, trams and trolleybuses. Indian railways announced their intention to use on board PV to run air conditioning systems in railway coaches.

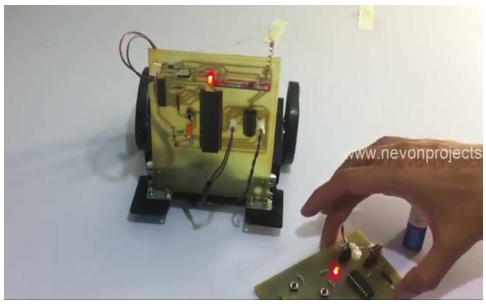

Fig-2 RF remote controlled Robot vehicle

generate the clock for the micro controller to run the internal programs and clock of the micro controller. PIC16F perfectly fits many uses, from automotive industries and controlling home appliances to industrial instruments, remote sensors, electrical door locks and safety devices. It is also ideal for smart cards as well as for battery supplied devices because of its low consumption. EEPROM memory makes it easier to apply microcontrollers to devices where permanent storage of various parameters is needed (codes for transmitters, motor speed, receiver frequencies, etc.). Low cost, low consumption, easy handling and flexibility make PIC16F applicable even in areas where microcontrollers had not previously been considered (example: timer functions, interface replacement in larger systems, coprocessor applications, etc.). In System Programmability of this chip (along with using only two pins in data transfer) makes possible the flexibility of a product, after assembling and testing have been completed. This capability can be used to create assembly-line production, to store calibration data available only after final testing, or it can be used to improve programs on finished products.

The PIC16F72 CMOS FLASH-based 8-bit microcontroller is upward compatible with PIC16C72/72A and PIC16F872devices. It features 200 ns instruction execution, self programming, an ICD, 2 Comparators, 5 channels of 8-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port, high-Performance RISC CPU. PIC16F72 has two separate memory blocks, one for data and the other for program. EEPROM memory with GPR and SFR registers in RAM memory make up the data block, while FLASH memory makes up the program block. The presented application is a low cost solution for fabricating a Solar powered vehicle using DC motors interfacing with e programmed chip PIC Microcontroller. The system depending on the charging circuit the DC motors.

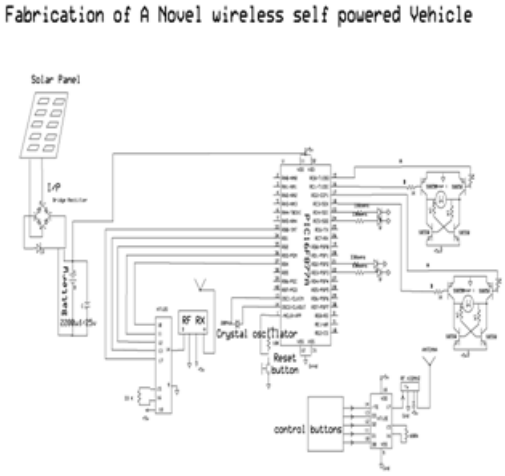

Figure- 3.Schematic diagram of interfacing section of all components to the PIC microcontroller

interfaced to the vehicle can be controlled using driver. The solar power stores the energy to a battery and then runs the motor through the switch.

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The battery gets charged up from the Solar energy. The battery is used to power up the robotic vehicle and peripherals connected to it. The controlling device of the Robotic vehicle is a Microcontroller. Each button in the RF remote transmits different data which will be received by RF receiver. The RF receiver feds the data to Microcontroller and Microcontroller acts on the dc motors to control the directions. The Microcontroller is loaded with an intelligent program written in embedded 'C' language.The present system uses an onboard mini computer named as PIC microcontroller which consists of number of input and output ports. The input and output port of the micro controller are interfaced with different input and output modules depending on the requirements.

III. HARDWARE DESIGN OF PORTABLE DEVICE :

In today's world, in almost all sectors, most of the work is done by remote controls systems like controlling of robots or robotic arms, devices switching's, Speed controlling etc as per the requirement. The entire proposed system has been divided into two sections: Remote section and vehicle section

A. Remote section:

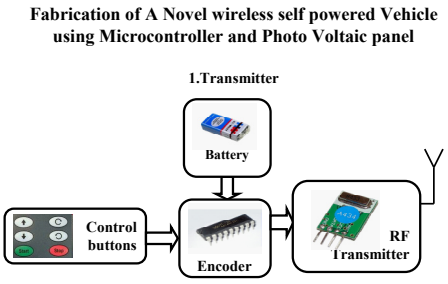

Figure- 4.Block diagram of Transmitter section.

RF remote section consists of control buttons interfaced with RF transmitter along with HT12E encoder IC. when the user presses the control button it feds as an input to the HT12E encoder IC and the output of the encoded data is given to the RF transmitter module to transmit the controlling signals to the vehicle wirelessly. RF transmitter ST-TX01-ASK is an ASK Hybrid transmitter module with an effective low cost, small size, and simple-to-use for designing. RF transmitter frequency Range: 315 / 433.92 MHZ, Supply Voltage: 3~12V, Output Power: 4~16dBm.

The STT-433 is ideal for remote control applications where low cost and longer range is required. The transmitter operates from a 1.5-12V supply, making it ideal for battery- powered applications. The transmitter employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance. Output power and harmonic emissions are easy to control, making FCC and ETSI compliance easy. The HT12 encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/ data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal.

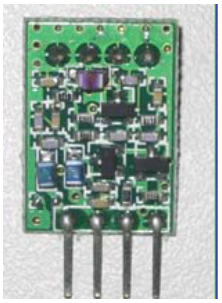

Figure- 5.315/434 MHz TRANSMITTER

A. Vehicle section:

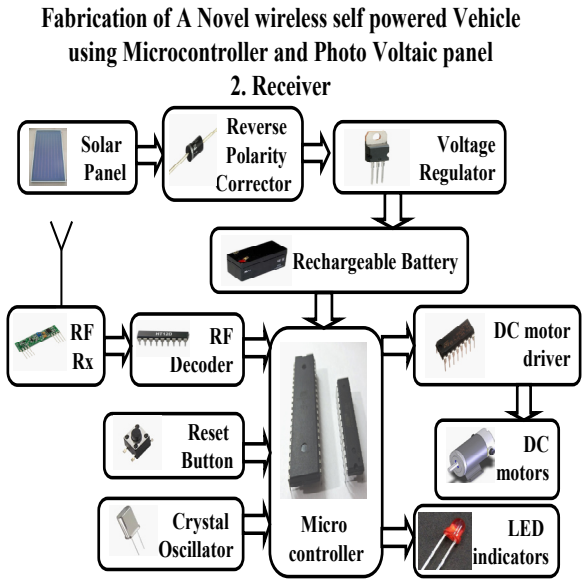

Figure- 6.Block diagram of Receiver or vehicle section

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The portable Electronic automation and Robot vehicle control model consists of PIC microcontroller, RF receiver and HT12D decoder, DC motors interfaced with Robot model along with driver, and Battery. The RF receiver receives the signals from transmitter which in turn decodes using HT12D decoder IC and sends as input to the microcontroller. This enables the controlling and the directions of robot movements. The controller acts accordingly on the DC motors interfaced along with drivers to switch according to the users input from remote buttons. In achieving the task the controller is loaded with a program written using Embedded 'C' language.

RF Receiver ST-RX02-ASK is an receiver module with an effective low cost solution for using at 315/433.92 MHZ, Receiver Frequency: 315 / 433.92 MHZ, Supply Current: 3.5mA The STR-433 is ideal for short-range remote control applications where cost is a primary concern. The receiver module requires no external RF components except for the antenna. The HT12D decoders are a series of CMOS LSIs for remote control system applications. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The VT pin also goes high to indicate a valid transmission. The 212 series of decoders are capable of decoding information's that consist of N bits of address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

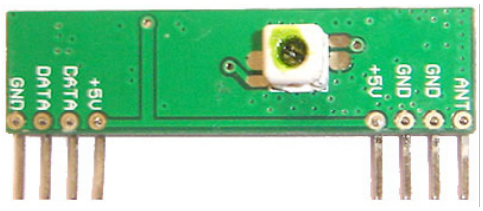

Figure- 7.315/434 MHz RECEIVER

This proposed self powered vehicle utilizes two DC Motors respectively. The DC motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary permanent magnets, and rotating electrical magnets.An advantage of a brushed DC motor includes low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. The driver used for DC Motors is L293D.

The Microcontroller acts as a Control Unit which controls the all devices interfaced to it. This project makes use of a micro controller, which is programmed, with the help of embedded C instructions. This microcontroller is capable of communicating with transmitter and receiver modules. The controller is interfaced with two DC motors to control the direction of the Robot vehicle. The advent of new high-speed technology and the growing computer Capacity provided realistic opportunity for new robot controls and realization of new methods of control theory. This technical improvement together with the need for high performance robots created faster, more accurate and more intelligent using new solar powered vehicles, new drives and advanced control algorithms. This project describes a new economical solution of Solar powered wireless remote control systems.

IV CONCLUSION:

The existed paper presents Fabrication of a "Novel wireless self powered Vehicle using Microcontroller and Photo Voltaic panel" has been successfully designed and implemented. Integrating features of all the hardware components been used and developed in it. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the best working unit for a remote controlling of vehicle using RF communication has been designed perfectly. Secondly, using highly advanced IC's like HT12E, HT12D, L293D etc with the help of growing technology, the project has been successfully implemented.

Thus the project has been successfully designed and tested. The microcontroller which acts as the mediator between the input module and output module has been successfully programmed using PIC C compiler software using Embedded C language. This proposed model finds its major applications while we are monitoring larger areas like political canvassing, cricket stadiums, international conferences, worship places, banking etc. This project assures us with more reliable and highly secured system.

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