

## FABRICATION OF SOLAR POWERED ROBOTIC VEHICLE USING ARDUINO

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**Abstract**—There's nothing in the world now a days without electrical resources. It is possible to take electrical energy from different methods such as windmills, power plants. Yet the raw materials that will be used to generate electrical energy are not enough for years to come. Solar energy is required to resolve the issue. It's an energy that is sustainable, evergreen, and everlasting This project focuses on the design and development of LiPo battery charging systems with the help of tracked solar panels. In robotic vehicles, therefore, an energy management system is implemented. The system proposed on the VANTER robotic platform was undergoing testing. This robotic system is designed using microcontroller for smart host. Our plan makes a double-sided argument on the basis. In the one side, it demonstrates the use of constructing a solar tracking system to increase the strength of the robots, with less regard to their mobility. At the other hand, it has design output of the power system based at two batteries. Within these two batteries one charges independently and another provides robot energy .

### 1. INTRODUCTION

Solar power systems have been used commonly in autonomous robotic vehicles for several years. A specific example is the Sojourner rover, where a reduced size photovoltaic (PV) panel produces much of the energy supplied. Nevertheless, in the event of little to no solar energy, the rover will reduce consumption, as its batteries can not be recharged in line when depleted . The use of rechargeable batteries was first used in the Mars Exploration Rovers in a space mission. Nevertheless, Spirit and Opportunity addressed the need for greater operational flexibility by means of broader deployment solar panels. This approach serves as the basis for developing solar panels for the future mission to Exo Mars. This rover is capable of delivering higher power thanks to its high-efficiency ultrathin-film silicon cells built on carbon-fibre-reinforced

plastic. NASA projects inspired exploration vehicles of various generations.

More recently, Lever and his colleagues identified the principles of modeling, designing and producing a prototype robot-box for use in polar environments. The platform – known as Cool Robot uses a maximum power point (MPP) control algorithm to optimize system-supplied power for five cube-designed PV modules. Lastly, there are several notable projects whose key accomplishment is the optimum selection of solar energy and different power sources according to a robo's operating conditions. The VANTER robotic exploration vehicle aims, for scientific and academic goals, to develop various aspects of the aforementioned rovers.



Fig.1 Basic Robotic Vanter

The next segment describes the robotic mobile system. It defines its main features and introduces its architecture of hardware and software. Section III presents the concept of a smart host microcontroller (SHM) applied to an exploration vehicle for intelligent power management The following sections describe the battery-charging system control through tracked solar panels, which is the main purpose of this paper; the design of its mechanical structure, its electronic devices, and the graphical user interface (GUI) are presented Therefore, Section V brings the existing technique into practice by testing the

rover power systems. Finally, it presents the results and findings from the research produced.

## 2. TECHNICAL HISTORY and PROGRAM CRITERIA

The rover to be set up has a set of two rear end wheels coupled to a chassis plane that rotates self-reliantly. These two wheels are driven by a permanent stepper motor that delivers 1000rpm with a starting torque of 2Kg / cm .The programming needed for this robotic stage has three key stages. Begin stage software will be executed in Matlab language, which will be executed on remote PC, and GUI will be used to view and monitor robotic vehicles. Second stage software will be implemented in C language running over Arduino Microcontroller. Wifi protocol will allow connectivity between master Microcontroller and Remote pc.

### 2.1 ARDUINO

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (IntegratedDevelopment Environment), which is used to write and upload the computer code to the physical board.

Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions. You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software). Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

Arduino is used as a smart microcontroller that performs two major tasks. First it experiences sunlight and second it controls the traced solar panels to get maximum power. It recognizes the controlled data from the batteries and solar panels to adjust the charger mode accordingly. So we will be using Arduino microcontroller because of its high concert and low power feeding.

## 2.2 INTER INTEGRATED CIRCUIT BUS

This was a two-wire serial bus set up by Philips for easy and low-priced low-bandwidth applications. It is used to connect integrated circuits on the same printed circuit board. Two bus lines used by Inter Combined Circuit bus are serial data line (SDA) and serial clock line (SCL). Every computer that is joined to the bus is addressable program. Inter Integrated Circuit Bus supports single master and multi slave creation with collision intervention and arbitration.

## 3. IMPLEMENTATION DETAILS

The project's key focus is solar power grid which will run the robot. The power management will consist of smart battery for this purpose, which combines both communication devices and electronics that control the charge. Cleverness must be extended to device architecture for basic batteries to achieve this cost effective method Our main goal is to build a smart microcontroller for low-cost management system on a robotic vehicle stand. Power management system consists of a photovoltaic device, a charger, a selection device and a battery system.

### 3.1 SMART MICRO CONTROLLER

Arduino which is used as a smart microcontroller, conducts two key tasks that include sensing sunlight and regulating the sensed solar panels for full power. It understands controlled battery and solar panel data to control the charger's operating mode.

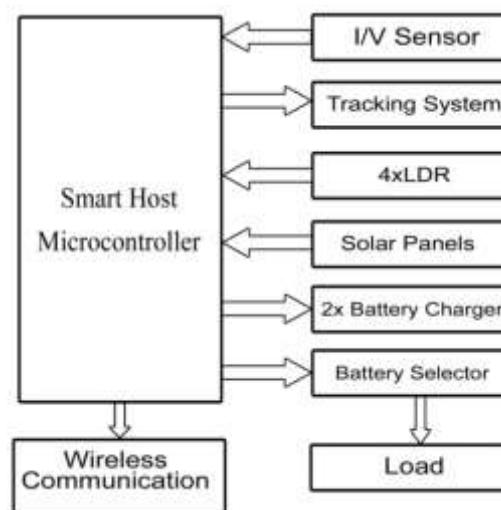


Fig.1.1 Block Diagram of Hardware Architecture of System

### 3.2 SOLAR PANEL



Fig.1.3 Solar Panel

Solar panel refers to a device designed to absorb the sun's rays as a source of energy for electricity generation. A photovoltaic (PV) module is a packaged, connect assembly of typically  $6 \times 10$  photovoltaic Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies electricity in commercial and residential applications. Photovoltaic panels use light energy (photons) from the sun to produce electricity via the photovoltaic effect. Most panels use crystalline wafer-based silicon cells or thin film cells. A module's structural (load carrying) component may be either the top layer or the rear layer. The cells do need to be secured against mechanical damage and moisture. Most modules are rigid but there are semi-flexible modules, based on thin-film cells. The cells must be electrically connected in sequence, one to another. Inside, most photovoltaic modules use form of MC4 connectors to allow simple weather-proof connections to the rest of the network. The electrical connections of the modules are made in series to achieve the desired output voltage and/or in parallel to provide the desired current. In the case of partial module shading, bypass diodes can be integrated or used externally to optimize the performance of still illuminated parts of the module. Many special Solar PV modules have concentrators where light is concentrated on smaller cells through lenses or mirrors. This allows for the cost-effective use of cells with a high cost per unit area (such as gallium arsenide). Solar chargers are converting light energy into current in DC.

### 3.3 DC BATTERY

An automotive battery is a rechargeable battery supplying an vehicle with electric power. This is historically called a SLI for start, light, ignition and its main function is to start the engine. Starting discharges usually less than three per cent of the battery capacity The SLI batteries are designed to emit high current bursts, measured in amperes, and then recharged quickly. They are not built for deep discharge, and a complete discharge

could reduce the lifetime of the battery. A 10-hour battery will take 15 hours to achieve a fully charged state from a fully discharged condition with a 1-amp charger because it will require approximately 1.5 times the capacity of the battery Lead – acid batteries would experience considerably longer longevity by using a maintenance charger to "float" the battery. This prevents the battery from ever being under the 100 percent limit, thereby preventing the formation of sulfate. Compensated float voltage of the correct temperature should be used to produce the best output.



Fig.1.4 DC Battery

### 3.4 MECHANISM FOR BATTERY SWAP

The charging circuit for batteries consists of relay, transistor, and capacitor and diode. The charging circuit for the batteries is connected to both batteries. Relay is used as a triggering circuit option. Relay is an electromagnetic device that is used to electrically detach two circuits and connect them magnetically.. Sometimes they are used to connect an electronic circuit to an electrical circuit that runs at extremely high voltage. For example a relay can make a 5V DC battery circuit to which a 23V AC mains circuit. The small sensor circuit can drive, say, a fan or an electric bulb.

Their key role is to link electrically charging and discharging path between batteries, converter unit and dual battery pack. The aim is to route current from PV panels to converter input and from there to the battery designated at each moment Dynamic electrical circuit contacts decided by the master micro controller according to logic grades cleared.

The Arduino is used as the monitoring device for solar panels. Once Arduino is starting it reads the values of the LDR stream. When measuring the LDR values as the LDR1 is first sensed it shifts in the direction of the clock wise.

And if it exceeds 180 degrees then it checks performance values for the LDR. It applies to usual place as the values are negative If LDR2 is observed, the rotation of the solar panels is anti-clockwise. If it crosses the 180 degrees and when the values are negative it scans the LDR output values, then the solar panels come to normal location.

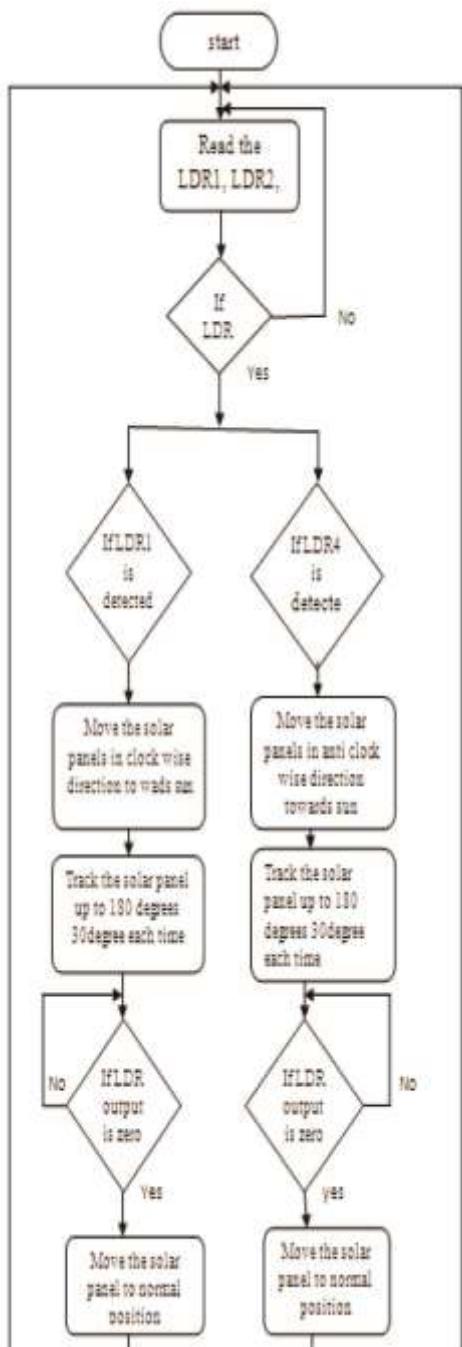


Fig.1.5 Flow Chart for Charging Discharging Algorithm

### 3.5 WIRELESS COMMUNICATION

Wi-Fi is a family of wireless networking technologies which are commonly used for local area networking of devices and Internet access. *Wi-Fi* is a trademark of the non-profit Wi-Fi Alliance, which restricts the use of the term *Wi-Fi Certified* to products that successfully Complete interoperability certification testing. As of 2010, the Wi-Fi Alliance consisted of more than 375 companies from around the world. As of 2009, Wi-Fi-integrated circuit chips shipped approximately 580 million units yearly. Devices that can use Wi-Fi technologies include desktops and laptops, Smart phones and tablets smart TVs, printers, digital audio players, digital cameras, cars and drones.

Wi-Fi uses multiple parts of the IEEE 802 protocol family, and is designed to interwork seamlessly with its wired sibling Ethernet. Compatible devices can network through wireless access points to each other as well as to wired devices and the Internet. The different versions of Wi-Fi are specified by various IEEE 802.11 protocol standards, with the different radio technologies determining radio bands, and the maximum ranges, and speeds that may be achieved. Wi-Fi most commonly uses the 2.4 gigahertz (120 mm) UHF and 5 gigahertz (60 mm) SHF ISM radio bands; these bands are subdivided into multiple channels. Channels can be shared between networks but only one transmitter can locally transmit on a channel at any moment in time.

### 4. CONCLUSION and RESULT

The project is successfully designed to gain maximum energy from the sun with the help of solar panels using LDR's. The efficiency increases and power output from the panel also increased. Although automatic solar tracking system (ASTS) is a proto type towards a real system, but still its software and hardware can be used to drive a solar panel tracking rover. Values of the light sensors and battery values are transmitted using the different wireless communication. Transmitted values are studied in the system PC. Then it will be worked as a satellite rover for the data transmission.

The project's main focus is on solar power system, which will run the robot. The power supply would also consist of a smart battery that

incorporates both communication devices and electronics capable of monitoring the charge Power management system consists of a photovoltaic device, a charger, selector device and battery system Arduino is used as a smart microcontroller which performs two main functions, i.e. detecting sunlight and controlling the tracked solar panels for extreme power. To detect sunlight, light sensors are used, and the solar panel rotates to the right side. And Battery switching uses another microcontroller. All batteries use two current sensors to feel the current. Depending on the current ratings switching operation, the system will be provided with ongoing supply. The battery charging circuit is provided the collected energy from the solar panel, and the charging circuit charges the one battery and the second battery provides the energy for the solar panel tracking device and drives the rover in the forward direction. When the second battery discharges the battery switching circuit switches to charge the second battery, then the first battery give the energy to the solar panel tracking system and to move the rover in forward direction.



Fig. 1.6 Solar Powered Robotic Vehicle

## 5. REFERENCES

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