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Generate Electricity using Solar Energy

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ABSTRACT: Solar Energy is a smooth and RE Strength aid and is on its manner to high stage penetration inside the global strength basket. However, there are several demanding situations related to Solar Energy, like intermittency, restricted dispatch capacity and non-storability. Non-storability in a standalone PV device can be mitigated by using incorporating strength garage gadgets like battery to store the electric strength produced with the aid of solar panel while the solar is shining and to supply energy when the sun isn't shining. Batteries are, therefore, one of the essential aspect in the standalone PV system. And regularly the weakest link in PV systems because it impacts the maintenance price and reliability of the system. This paper includes designing and development of a low fee, microcontroller based totally, su powered battery charging device. The developed system includes (i) MPPT (ii) Arduino Uno interface for battery control capabilities Arduino Uno interface, (iii) LCD show for statistics to the consumer approximately the system regarding the structures normal capacity to fee at any given time, (iv) information storage and carries Wi-Fi module for far off surveillance and uploading live records which can similarly be used for studying the fitness of the battery and help in maintenance of battery. The developed sun powered battery charging device for DC hundreds has been designed for use in Solar Home Systems (SHS). The character SHS can be linked to shape a low voltage DC micro grid for the remotely positioned rural populace for sustainable provision of electrical electricity offerings.

I. INTRODUCTION

To gain ratio among numerous electricity storage technology [3]. In this paper a low price Arduino Uno based totally solar powered battery charging device for SHS has been designed and advanced. The fundamental components in standalone Solar PV tool Solar PV panels, batteries and electricity conditioning gadgets .The solar PV panels produce DC power which turned into afterward transformed to AC the usage of converter gadgets. The use of strength Electronics converters boom the complexity and reduce performance of the strength gadget Nowadays, growing variety of gadgets which use DC, such as laptops, cellular telephones and exclusive power digital devices utilized in our each day existence are being incorporated. Such packages want to convert AC once more to DC. This conversion will boom the losses and complexity of the electricity device. This idea is especially useful for rural and moderately populated regions wherein in low voltage DC community can supply electricity generated through sun PV to cater to the load constituting of LED lamps, DC fan, TV and mobile charging stations. To decorate the overall performance of this kind of strength network, in preference to the use of a couple of conversions, the entire power device may be represented in figure 1. The DC based power device facilitates to remove the requirement of converters structures, lowering converter fee, energy system complexity, enhance efficiency and reliability. The batteries are used to save the electricity from sun panels as an power economic organization for emergency and night time hour utilization in home and enterprise programs. To price these batteries from the solar light rated quantity of contemporary for rated time duration is required. If extra current is provided, the battery may be damaged. If battery is overcharged or discharged for a long length of time, batteries life span will come down. The traditional battery chargers available in marketplace have restrained capabilities. And some time

they do now not screen the battery health properly, and can allow the battery to go through deep discharge or overcharge. If a battery goes into deep discharge, it is very tough to recharge it the usage of battery charger because the electrode plates of battery maybe sincerely sulphated, resisting the charging. Increasing power call for, depleting fossil fuels, new load types, rural elect ification, electricity protection are a number of the drivers for power place to embark directly to an adventure of sustainable energies. Renewable energies will play a key feature on this journey. Solar Energy is expected to contribute to the power blend in a big degree because it is considerable and easy. Solar PV systems include no fuel value, are silent in operation, require less renovation and have lengthy existence. In India the Solar Mission is supported via the usage of MNRE and MoP. A hundred GW of sun power is envisaged through 2022. Out of this 40 GW of Rooftop PV and 60 GW of Solar Thermal might be generated in line with report of JNNSM (Jawaharlal Nehru National Solar Mission) MNRE, India. Decentralized Distributed Generation (DDG) scheme envisage provision of power to villages from conventional or renewable resources on a standalone foundation . In order to provide get entry to to electricity to rural populace with low electricity intake in far off and off grid areas, a low,

Voltage DC distribution network, wherein in man orwoman Solar Home Systems (SHS) may be interconnected, is an appealing opportunity [2]. However such standalone renewable electricity solutions need strength storage devices for making the energy available without interruption over some of days. Lead acid batteries presently offer the great price

Objective of project
The main objectives of the project are:
i. To investigate the reliability factor of the Stand-Alone Electric Solar Systenl
(ESS) applies for a domestic house without utility supply.
. .
11. To estimate ESS equipments specification that able to power up a selected
household electrical appliances.

II. LITERATURE REVIEW

This chapter will describe the literature review which related with Electric Stand-
Alone Solar System for Domestic Sector. It consists of five literature reviews namely the Feed-in Tariff Engineering and Economic Benefits of Photovoltaic
System for Residential Sector in Malaysia, Applications of Solar Energy to Power
Stand-Alone Area and Street Lighting, and Research About How to Construct Alternative Energy Systems.

Previous Study
Bong Yann Kai (Universiti Teknologi Malaysia, 201 1). The study shows that the
feed-in tariff engineering and economic benefits of photovoltaic system for residential sector in Malaysia. It will be implemented in the year 201 1 in accordance with the Tenth Malaysian Plan under the New Renewable Energy Policy, **.** With the Feed in Tariff, firstly, need to apply for an account. Second, a renewable energy generator installed such as wind turbine or solar photovoltaic (PV) system. The renewable energy generator is installed together with a special two net metering system in our home. Joshua David Bollinger (University Missouri-rolla, 2007). This study about applications of solar energy to power stand-alone area and street lighting. One of the earliest studies was conducted by the Parks and Recreation Department of Albuquerque, New Mexico, [6]. The design of the system used two 50W photovoltaic panels with a 35W low pressure sodium lamp, [6]. The stand-alone systems were designed to last for six hours a night and used a boost converter due to the design of a working maximum power point tracker was still in the development stage. The results of the study showed the potential of using solar energy to power street lights, and built the groundwork for future designs, [6]. Isolated parts of the world are ideal places to study the abilities of stand-alone lighting systems due to the lack of electricity to those regions. Haifeng Ge, Liqin Ni, Sohrab Asgarpoor (University of Nebraska - Lincoln, 2008). Previous researches are available on how to construct alternative energy systems, combine them into the traditional power grid, [7] and how to size the storage volume or the energy source capacity to meet the loads' needs, [8]. The impact of the alternative energy on the traditional power grid is also examined in order to improve systems' stability, [9], [lo]. But most of the design rules are based on the "meeting the need" strategy, not based on the reliability. Therc are also some results available, for reliability evaluation of alternative energy systems, i l l] . 111 these papers, wind, photovoltaic, or their hybrid system were evaluated, to calculatethe reliability indices at the generation and transmission level, [12]. These indices are very useful for the planning and operation. However, these studies are based on high level performance studies, and do not give a clear guide on how to improve the system's reliability during design phase. Jasvir Singh (University Thapar Patiala,2010). This study abaout Study And Design of Grid Connected Solar Photovoltaic System, [13]. These systems are connected to a broader electricity network. The PV system is connected to the utility grid using a high quality inverter, which converts DC power from the solar array into AC power that conforms to the grids electrical requirements. During the day, the solar electricity generated by the system is either used immediately or sold off to electricity supply companies. In the evening, when the system is unable to supply immediate power, electricity can be bought back from the network. From the previous study that have been done by the several researches, it can be concluded that the solar system is the main alternativi source of concern from various parties. This can be seen from this that a lot of research before making the study of photovoltaic systems. In addition, demand for electricity from TNB is increasing. Lack of resources and higher prices require further research on the reliability of the ESS as a backup power supply or the mains supply, replace the existing systems for the domestic sector in india
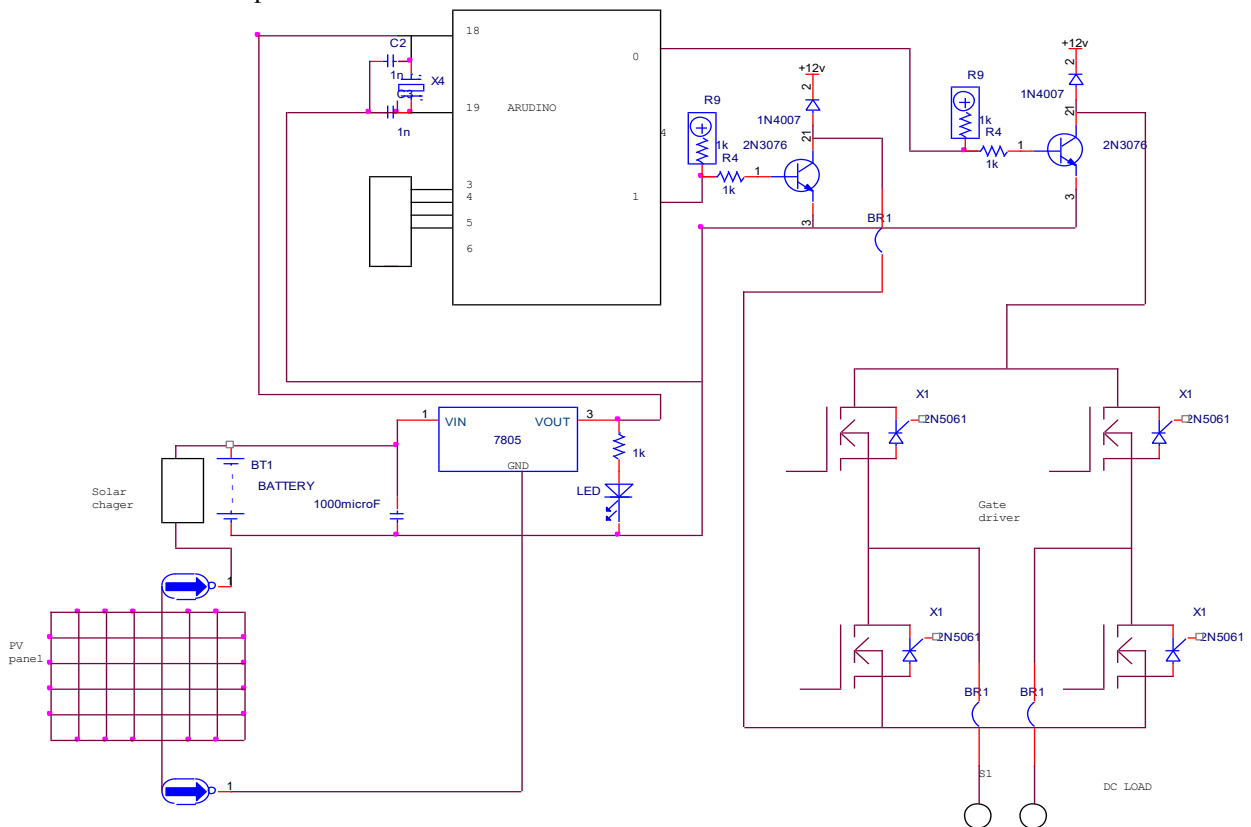
BLOCK DIAGRAM:
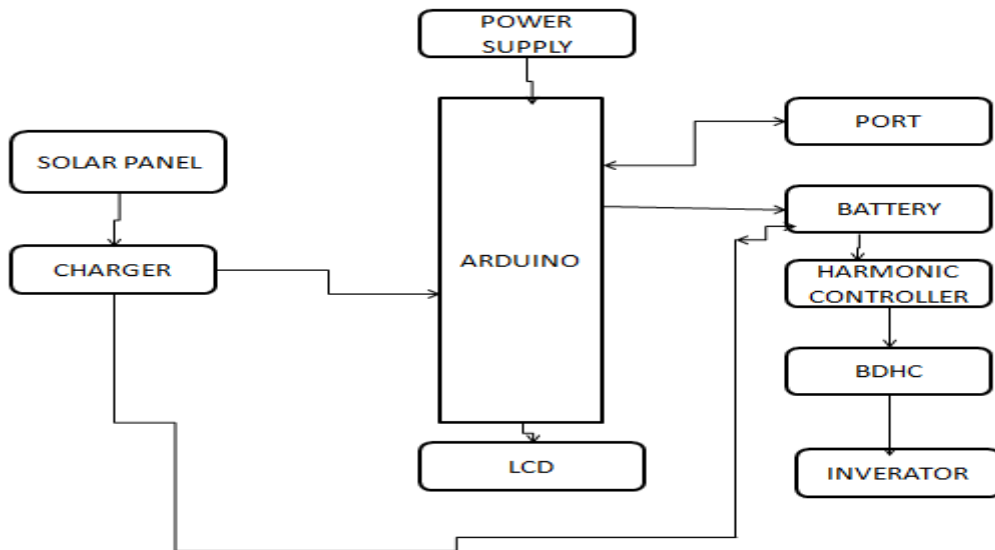
**CIRCUIT DIAGRAM:**

Circuit disc circuit description

CIRCUIT DESCRIPTION:

When the sunlight falls on the embedded solar panel, it rotates from east to west or vice versa depending upon the direction of sunlight. The converator is done using a BHDC.Thus maximum solar energy is harvested during different sections of daytime. This Photovoltaic voltage generated is a variable voltage. This output is then fed to a Charge controller circuit to give a constant BHDC output voltage of approximately 13 V. The 12V battery is only capable of charging if the input voltage is in the range of 12.7 V to 14 V. The battery percentage is calculated using a potential divider connected to an Arduino and shown in a LCD display.

A 500W 230V inverter converts the DC voltage to AC voltage of frequency 50 Hz. This output is connected to a 5V relay which in turn is connected to NodeMCU based on ESP8266 WiFi module. The user can select which loads to be working with a the help of a mobile app connected to the IOT server. When the User selects the load to be run, the relay works and the load is turned on.

POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.
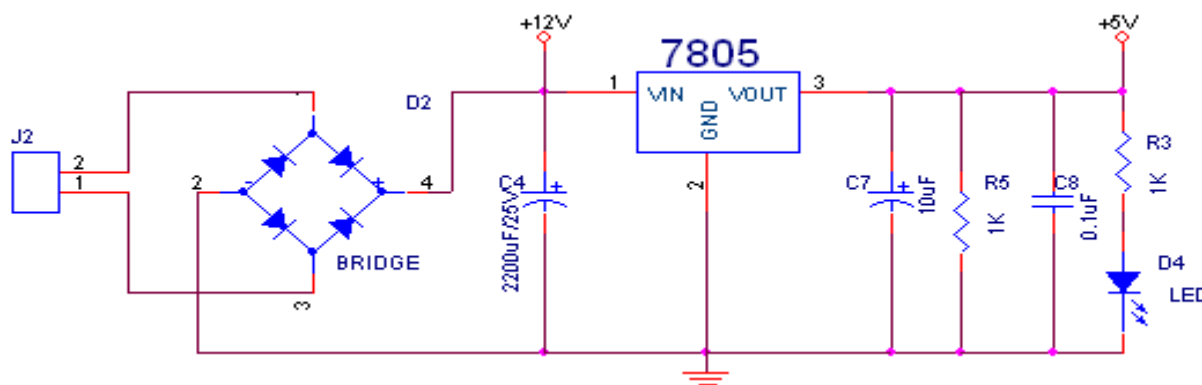
A 230v, 50Hz Single phase AC power supply is given to a step down transformer to get 12v supply. This voltage is converted to DC voltage using a Bridge Rectifier. The converted pulsating DC voltage is filtered by a 2200uf capacitor and then given to 7805 voltage regulator to obtain constant 5v supply. This 5v supply is given to all the components in the circuit. A RC time constant circuit is added to discharge all the capacitors quickly. To ensure the power supply a LED is connected for indication purpose.

RECTIFIER

A **rectifier** is an electrical device that converts alternating current to direct current or at least to current with only positive value, a process known as **rectification**. Rectifiers are used as components of power supplies and as detectors of radio signals.

Sinusoidal Signal

Half-wave Rectification

Full-wave Rectification
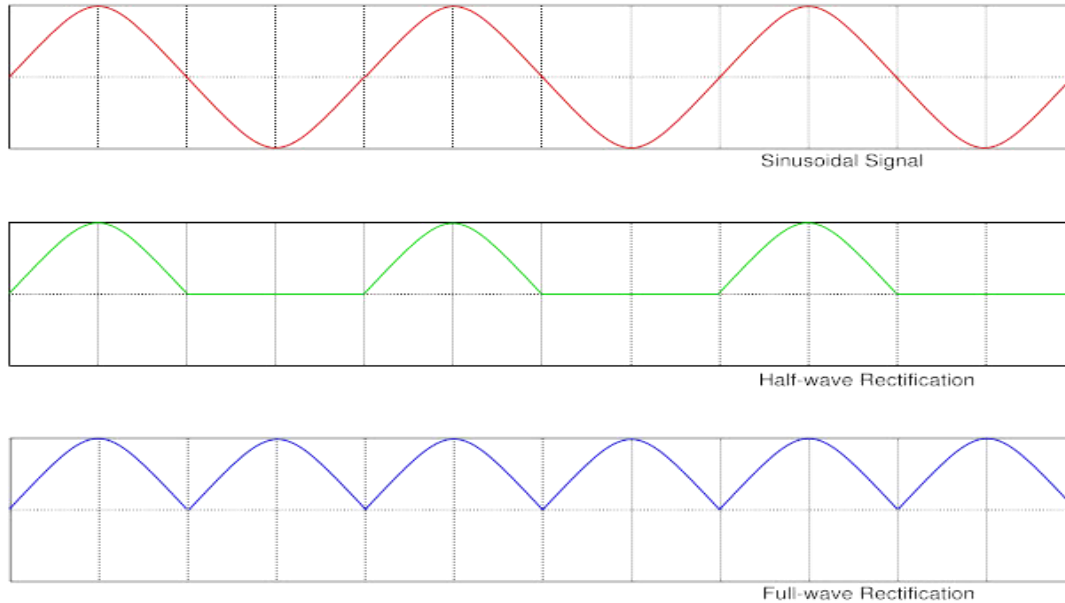
BRIDGE RECTIFIER

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.
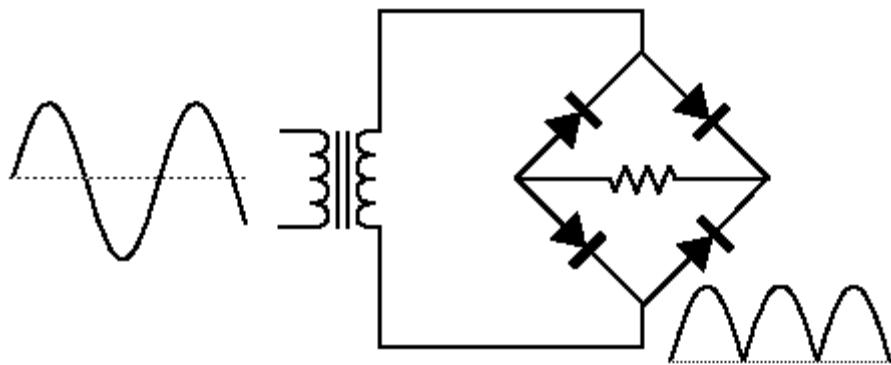
Capacitor is a basic storage device to store electrical charges and release it as it is required by the circuit. In a simple form it is made of two conductive plates (Electrodes) and an insulating media (Dielectrics) which separate the electrodes.

As the voltage applies between the opposite electrode plates of a capacitor, electric field takes place between the plates and charges start accumulating on the surface of the electrodes. The charges (Q) on the capacitor plates depend on the voltage (V)and the capacitance value (C) and is as follows:

$$Q=C.V$$

Capacitors charges exponentially versus time and the
$$I=dQ/dt=C.dV/dt$$

There are so many dielectrics in industry. Each dielectric is characterized by its ability to store energy (dielectric constant K), dielectric strength, Insulation resistance, Temperature Coefficient (TC), High Frequency performance, etc… Multilayer capacitor unlike single layer, is made of so many layers. This would allow the manufacturer to achieve higher capacitance values.

Voltage Regulator

Features:
• Output Current up to 1A
• Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
• Thermal Overload Protection
• Short Circuit Protection
• Output Transistor Safe Operating Area Protection

Description:
The KA78XX/KA78XXA series of three-terminal positive regulator are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents. The LM78XX series of three terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area -protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

8. ARDUINO UNO

The ARDUINO UNO 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

V. SIMULATION ANALYSIS

5.1. SIMULATION SOFTWARE – PDS
The software used for the production of a computer model of the proposed system is Proteus Design Suite. The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, light indication and message alert as output.

The Intelligent Schematic Input System allows the user to experiment with the computer model with animations and the flow of the signals.

5.2. ARDUINO IDE

The Arduino integrated development environment is a cross platform application (for windows, macOS, Linux) that is written in the programming language java. It is used to write and upload programs to Arduino board. The Arduino IDE supports the c and c++ using special rules of code structuring. The Arduino IDE supplies a software library from the writing project, which provides many common input and output producers. User-written cod only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program sub main () into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employees the program argued to convert the

executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. The libraries are necessarily written in c++.

ARDUINO IDE DEFAULT WINDOW: -

Download Arduino Integrated Design Environment (IDE) here (Most recent version: 1.8.10)http://www.arduino.cc/en/Main/Software

This is the Arduino IDE once it's been opened. It opens into a blank sketch where you can start programming immediately. First, we should configure the board and port settings to allow us to upload code. Connect your Arduino board to the PC via the USB cable.
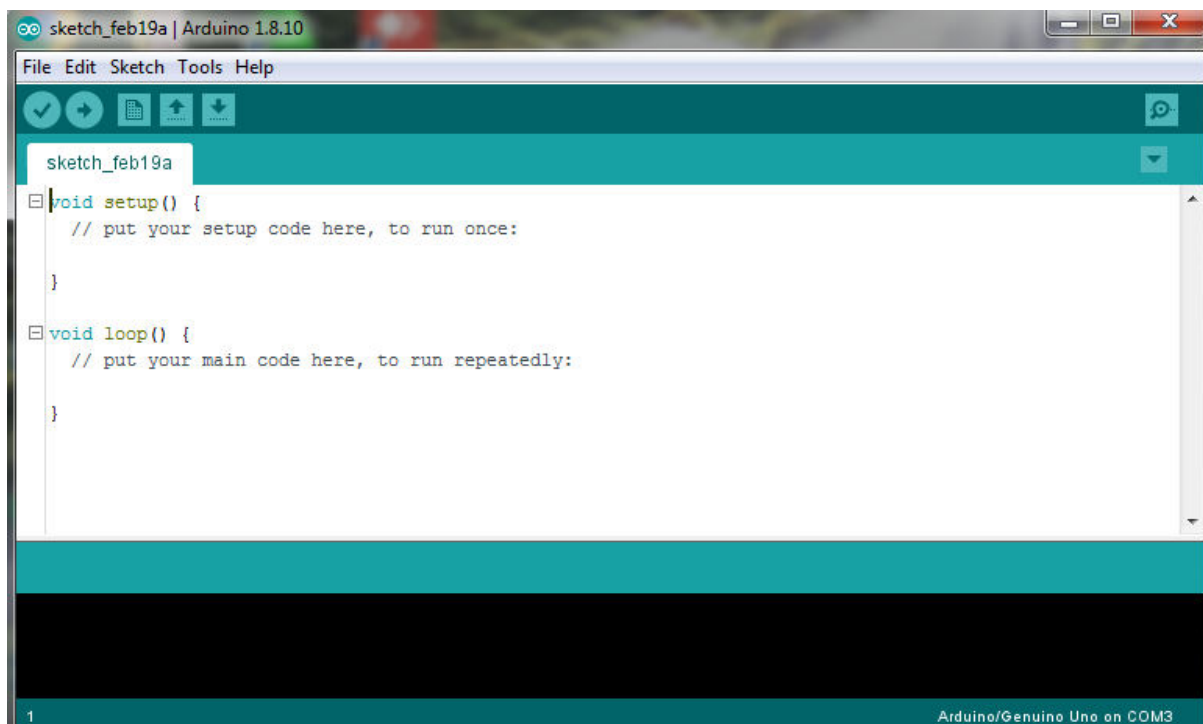

Fig 5.2.1 Arduino IDE Default Window

ARDUINO IDE: BOARD SETUP PROCEDURE: -

You have to tell the Arduino IDE what board you are uploading to. Select the Tools pull down menu and go to Board. This list is populated by default with the currently available Arduino Boards that are developed by Arduino. If you areusing an Uno or an Uno-Compatible Clone (ex. Funduino, SunSmart, IEIK, etc), select Arduino Uno. If you are using another board/clone, select that board.
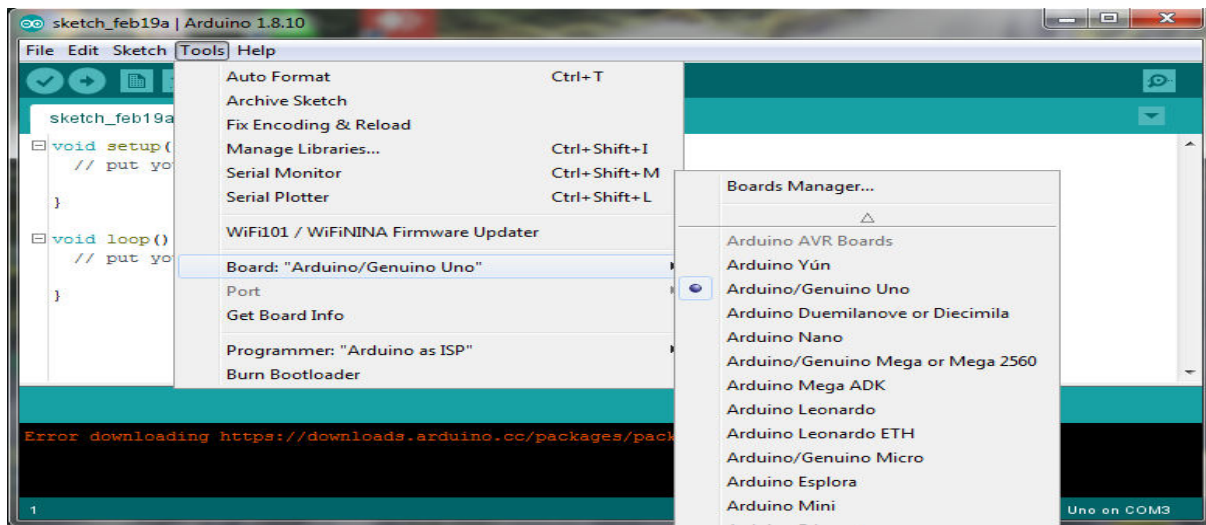
Fig 5.2.2 Arduino IDE: Board Setup Procedure

IDE: COM PORT SETUP: -

If you downloaded the Arduino IDE before plugging in your Arduino board. When you plugged in the board, the USB drivers should have installed automatically. The most recent Arduino IDE should recognize connected boards and label them with which COM port they are using. Select the Tools pull down menu and then Port. Here it should list all open COM ports, and if there is a recognized Arduino Board, it will also give its name. Select the Arduino board that you have connected to the PC. If the setup was successful, in the bottom right of the Arduino IDE, you should see the board type and COM number of the board you plan to program. Note: the Arduino Uno occupies the next available COM port; it will not always be COM3. At this point, your board should be set up for programming, and you can begin writing and uploading code.
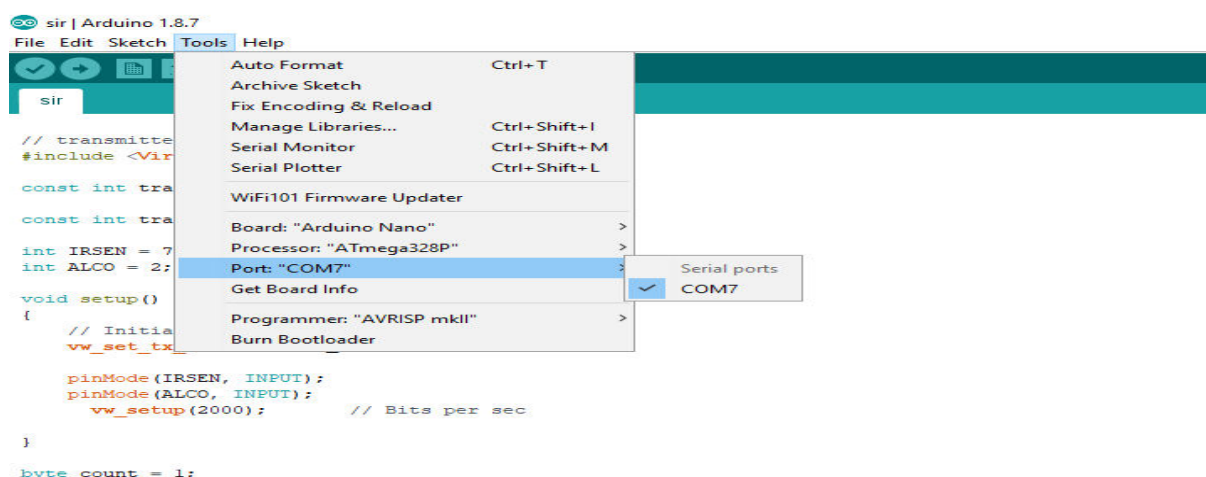

Fig 5.2.3 IDE: com port setup

Blynk application and Arduino IDE Preparation and Running

This project is running by Blynk application. Down load the application to a smart phone from Google play store and then create a project on it with four switches and one gauge to be as a temperature scale. Set buttons to be as switches on

D1, D2, D3 and D4. Then set gauge on A0 because the sensor output is on A0 in NodeMCU board. Figure 5 shows screenshots from Blynk application

ADVANTAGES

- Solar cells used for power generation causes no noise. whereas generators or turbines of other methods causes noise pollution.
- It does not cause much pollution compared to other power generating methods such as a thermal power plant, nuclear power plant, and so on.
- The solar cells do not consist of any moving parts and hence requires a little maintenance for their operation.
- It can be used in remote areas for generating and utilizing power in that locality, where the transmission of electricity is too expensive.
- The solar power offers energy security by avoiding the general power system in which there is a possibility of power theft.
- In general, calculators and some low-power-consuming electronic devices can be energized using solar energy effectively.
- The solar energy can produce 50% of the power required to house by installing the solar panels.
- In long term usage of solar energy, the solar power setup investment can be regained at maximum levels as solar energy is free of cost.

APPLICATIONS

- The Hybrid solar charger system used for multiple energy sources for providing full-time backup supply to other sources.
- Street lights use the solar cells to convert sunlight into DC electricity charge. This system uses a solar charge controller to store DC in the batteries and uses in many areas.
- Home systems use PV module for household applications.

VI. CONCLUSION

Photovoltaic power production is gaining more significance as a renewable energy source due to its many advantages. These advantages include everlasting pollution free energy production scheme, ease of maintenance, and direct sunbeam to electricity conversion. However the high cost of PV installations still forms an obstacle for this technology. Moreover the PV panel output power fluctuates as the weather conditions, such as the insolation level, and cell temperature. The described design of the system will produce the desired output of the project. The inverter will supply an AC source from a DC source. The project described is valuable for the promising potentials it holds within, ranging from the long run economic benefits to the important environmental advantages. This work will mark one of the few attempts and contributions in the Arab world, in the field of renewable energy; where such projects could be implemented extensively. With the increasing improvements in solar cell technologies and power electronics, such projects would have more value added and should receive more attention and support.

VII. FUTURE SCOPE

As whole world is facing a problem of global warming and energy crisis, our project will help to reduce these problems by using solar energy to generate electricity. Solar energy is an infinite source of energy. Main motto of our project is to promote use of renewable energy sources. This project is most useful in our life because in this project one time investment fixed on life time. In future one day nonrenewable energy will end then we will use to the renewable energy. The solar inverter made by us is just a prototype for making future projects which incorporate advanced technologies like micro controlled solar tracking, charge control, etc. this is to show that solar inverters are very cheap and easy to install so that the energy demands are shifted on using renewable sources of energy. There is more advancements pending in this field which will revolutionise the energy stream and solar energy will be playing the most important role of all.

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