

## Smart Power Generation

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**Abstract** - In day today life the utilization of power turns to be necessary for each work. Now a day with the growing population and energy demand we should take a renewable option of energy source and also we should keep in mind that energy should not cause pollution and other natural hazards. In this case solar energy and foot step power generation is the best option for us. India is a highly populated country so we should take the advantage of such an energy which requires a very less space to produce energy efficiently. Now a day's lots of peoples are suffering from the Corona pandemic. In the hospitals the requirement of oxygen is also increased. In this project we are generating the power but side by side we also generating oxygen by electrolysis process. The electrolysis process is done only in a day while at night inverter is on for street light and other night applications. While the energy is generated from solar panels as well as from foot step piezoelectric system. The total energy is stored in the same battery for further use.

**Key Words:** Microcontroller, LCD, Solar Panel, DC Motor, Battery etc

### 1.INTRODUCTION

The main motive of this project is to generate the energy or power. Now a days the world is using the electrical power in every sector like transport, in industries, and everywhere. In this project the energy is generated by solar tree means the energy is generated by the solar panels which are arranged in the form of tree and also from foot step the power is generated by using the piezoelectric mechanism.

The energy generated from solar panel and foot step is stored in the same battery for the further use. In solar tree beside energy; oxygen is also generated by electrolysis process. In this pandemic the need of oxygen is increased, though this system will generate oxygen and can be stored in the oxygen tank.

### 1.1 Block diagram

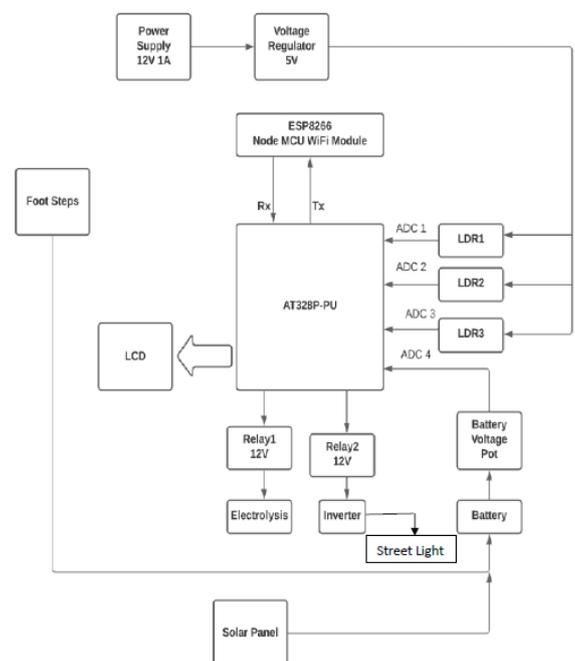


Fig -1: Block diagram

### 1.2 Block Description

The block diagram of this proposed project is as shown in above. The main motive of this project to generate energy. The energy is generated from the solar panels and from piezoelectric based foot step power generation. The microcontroller used in this project is AT328P-PU. It has power supply of 12V and this is given to the voltage regulator IC7805.

The output of the foot step arrangement is directly connected to the battery to store energy generated by it. The same battery is used to store power generated by solar panels. The solar panels here are having tracking system that can track the sunlight during day time. For that purpose, three LDRs are used here which are connected to the microcontroller. The 16:2 LCD is connecting to the microcontroller for showing the stages of battery levels and some indications.

The setup of electrolysis and inverter is connected to the microcontroller through Relay1 and Relay2 respectively. ESP8266 is a Wi-Fi module is directly connected to the microcontroller which is used for sending the data from system to the mobile phone. The

night lamps or street lights are connected to the inverter which will ON at night automatically.

## 2. CIRCUIT DIAGRAM

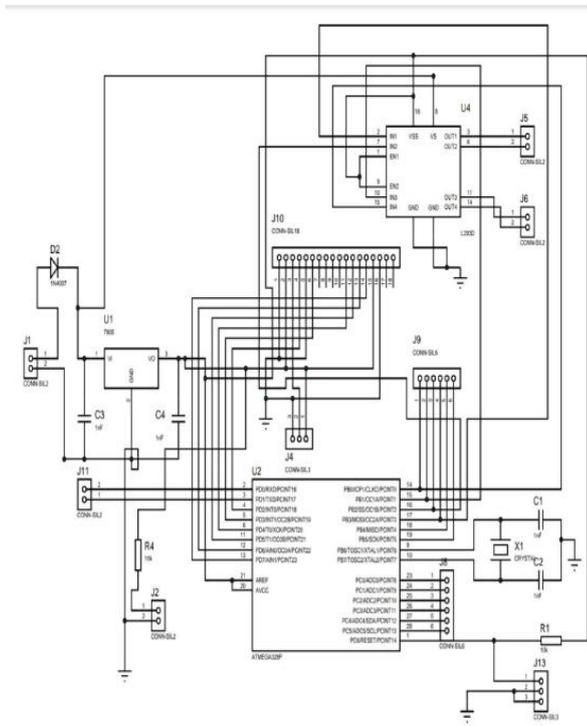


Fig -2: Circuit Diagram .

### 2.1 Working

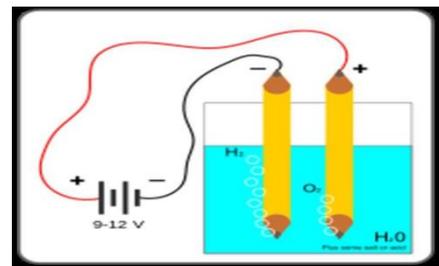
The working of this project is very simple. The above figure shows the circuit diagram of the project. When the main supply is give of 12V it passed through IC7805 as it is a voltage regulator IC which gives constant supply of 5. After getting supply the whole system is initializing at its starting point. The solar panels can charge the battery in only during the day time. At the starting of the day the position of the solar panel is at east when the sun is at middle panel will rotate towards it and at last the panels are positioned towards the west. As it is a solar tracking system and is done by LDR1, LDR2 and LDR3 respectively. During the day time the first preference is given to the charging through solar panel.

When pressure applied on the piezoelectric setup the non-conventional energy using foot step is converting mechanical energy into the electrical energy. This electrical energy is directly stored in the battery for future us. Foot step board consists 6 piezoelectric sensors which are connected in parallel. When the pressure is applied on the sensors, the sensors will convert mechanical energy into electrical energy. This electrical energy will be stored in the 12V rechargeable battery connected.

When the night is detected by LDR1, LDR2 and LDR3 the solar panel goes to its initial position and the inverter mode will be ON then the lights will be ON. The inverter will be ON only if the battery has fully charged or it is above the reference value.

The electrolysis process is done during the day time. It is also mandatory that the battery is fully charged during the electrolysis process. The condition of battery that is how much charging is there will be shown on the LCD which is a percent value.

### 2.2 Electrolysis process



Electrolysis of water is the decomposition of water (H<sub>2</sub>O) into Oxygen (O<sub>2</sub>) and Hydrogen gas (H<sub>2</sub>) due to an electric current being passed through the water. It uses an electrolysis tank filled with water, uses two copper electrodes one anode and another cathode. When supply is given to electrolysis tank, the process of electrolysis of water begins. Bubbles of Oxygen gas are evolved at anode whereas, Hydrogen gas bubbles are seen at cathode (negligible amount).

## 3. HARDWARE DISCRPTION

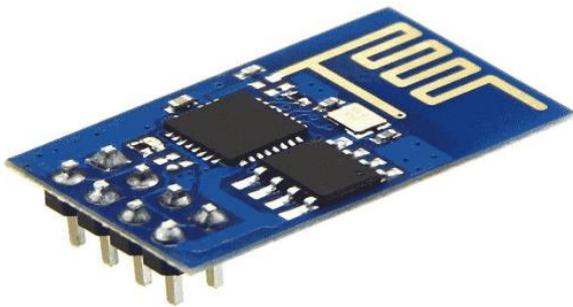
### Microcontroller:

(PCINT14/RESET) PC6	1	28	PC5 (ADC5/SCL/PCINT13)
(PCINT16/RXD) PD0	2	27	PC4 (ADC4/SDA/PCINT12)
(PCINT17/TXD) PD1	3	26	PC3 (ADC3/PCINT11)
(PCINT18/INT0) PD2	4	25	PC2 (ADC2/PCINT10)
(PCINT19/OC2B/INT1) PD3	5	24	PC1 (ADC1/PCINT9)
(PCINT20/XCK/T0) PD4	6	23	PC0 (ADC0/PCINT8)
VCC	7	22	GND
GND	8	21	AREF
(PCINT6/XTAL1/TOSC1) PB6	9	20	AVCC
(PCINT7/XTAL2/TOSC2) PB7	10	19	PB5 (SCK/PCINT5)
(PCINT21/OC0B/T1) PD5	11	18	PB4 (MISO/PCINT4)
(PCINT22/OC0A/AIN0) PD6	12	17	PB3 (MOSI/OC2A/PCINT3)
(PCINT23/AIN1) PD7	13	16	PB2 (SS/OC1B/PCINT2)
(PCINT0/CLKO/ICP1) PB0	14	15	PB1 (OC1A/PCINT1)

- 28-pin AVR Microcontroller
- Flash Program Memory: 32 Kbytes
- EEPROM Data Memory: 1 Kbytes
- SRAM Data Memory: 2 Kbytes
- I/O Pins: 23
- Timers: Two 8-bit / One 16-bit
- A/D Converter: 10-bit Six Channel

- PWM: Six Channels
- RTC: Yes with Separate Oscillator
- MSSP: SPI and I<sup>2</sup>C Master and Slave Support
- USART: Yes
- External Oscillator: up to 20MHz

**Wi-Fi Module ES8266:**



- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2).
- General-purpose input/output (16 GPIO).
- Inter-Integrated Circuit (I<sup>2</sup>C) serial communication protocol.
- Analog-to-digital conversion (10-bit ADC).
- Serial Peripheral Interface (SPI) serial communication protocol.
- I<sup>2</sup>S (Inter-IC Sound) interfaces with DMA(Direct Memory Access) (sharing pins with GPIO).
- UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2).
- Pulse-width modulation (PWM)

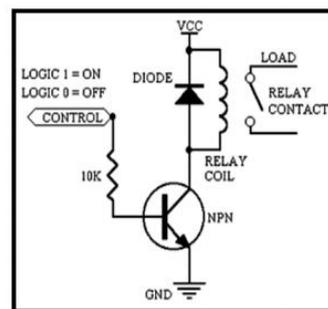
**Inverter:**

The inverter is connected directly to either the power source (solar PV array or wind turbine) or the charge controller, depending on whether backup storage batteries are used. Also, some manufacturers offer a single unit containing a charge controller and an inverter.



inverters designed for residential use, the output voltage is 120 V or 240 V at 60 Hz for North America. It is 230 V at 50 Hz for many other countries. The peak efficiency is the highest efficiency that the inverter can achieve. Most grid-tie inverters have peak efficiencies above 90%.

**Relay:**



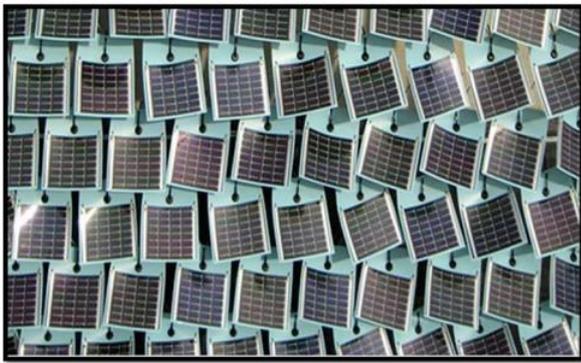
It is an electromagnetic switch. It is used to turn ON and OFF the main power supply and the exhaust fan.

**Relay drive circuit:**

It is used to drive the motor attached to the valve. The circuitry is driven by the actions of processor. It is used to turn ON and OFF the main power supply and the exhaust fan. It is an electronically controllable switch.

Widely used in industrial controls, automobiles, and appliances. It allows the isolation of two separate section of the system with two different voltage levels. One such relay is called electromechanical relay or electromagnetic relay. It have three components: coil, spring and contacts. When current flows through the coil, magnetic flux is created around the coil, which causes the armature to be attracted towards the coil. Armature contacts acts like switch and close or open the circuit.

**Solar Panel:**

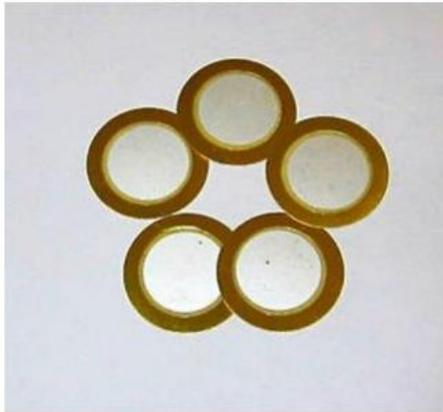


Solar panel refers to a photovoltaic module. PV module is packaged, connected assembly of solar cell. Solar modules use light energy from sun to generate electricity through photovoltaic effect. Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability.

**SPECIFICATIONS:**

Greenlight planet 700mW, 4.7 V (@1000 W/m<sup>2</sup>, 25oC)  
 Imp: 149 mA Isc: 238 mA Voc: 6.5V Max system voltage: 8V

**Piezoelectric Plate:**



**Piezoelectric Effect**

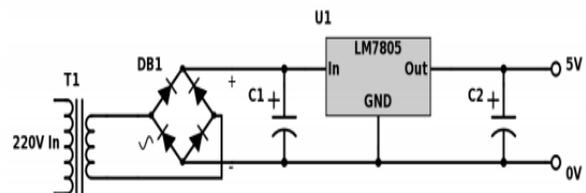
The ability of a piezoelectric material to convert a mechanical stress into electrical charge is called a Piezoelectric Effect. The word Piezoelectric derived from the Greek word 'piezein' which means to push, press and squeeze. Piezoelectric effect is reversible effect means when we applied mechanical stress to the piezoelectric material we get some electrical charge at output. Same as when we feed electrical charge to the sensor it gets stretch or compresses.

**Features and Specifications**

- Impedance: ≤500Ω;
- Voltage: ≤30Vp-p;
- Operating temperature: -20°C~+60°C

- Storage temperature: -30°C~+70°C
- Low Soldering temperature
- Strain sensitivity: 5V/μE
- Material: Quartz (mostly used)

**Power Supply:**



The microcontroller need +5V DC, these specifications dictate the use of a low-cost, ubiquitous linear regulator National Semiconductor LM7805. 7805 is voltage regulator which outputs +5V. It is a three pin IC.

Pin1: Input: Pin that accepts incoming DC voltage, which the IC will regulate down to 5V.

Pin 2: Ground: Establishes the ground for regulator.

Pin 3: Output: Regulated 5V DC.

**Battery:**



- The battery can be mounted in any position.
- Have shorter recharge time.
- Maintenance free

### LCD Display:



- It is used to display light intensity and battery condition. As LDR continuously senses the light intensity of sunlight, the status of light as well as the battery is displayed over the LCD.
- It is a 2x16 display.
- D0-D7 bits are used to receive an information from microcontroller.
- R/S bit is used for selection of two registers i.e. for data register or command register.
- If R/S =1, Data register.
- If R/S=0, Command register.
- Enable pin is used to latch the information presented to its data line.
- R/W =0, write the information into LCD.

### 4. SOFTWARE REQUIREMENT

#### ISIS proteus :

- System design circuitry and its hardware implementation is achieved with the help of ISIS proteus version 7.6 software.

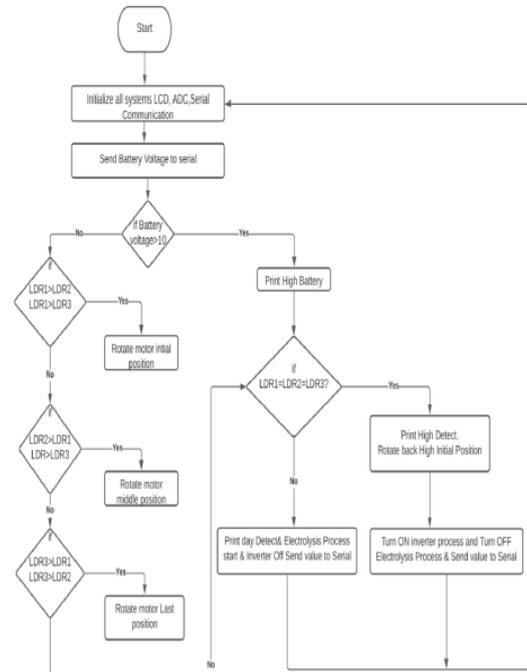
#### KEIL IDE:

- KEIL IDE i.e. Integrated Development Environment tool is used for programming of the microcontroller that has been used i.e. AT328P-PU Programming language used will be either assembly language or embedded C.

#### FLASH MAGIC:

- It is a PC tool for programming flash based microcontrollers from NXP using a serial or Ethernet protocol while in target hardware. It is used to download the program into the microcontroller AT328P-PU

### 5. FLOWCHART



### 6. ADVANTAGES

- Uses the waste water in electrolysis process.
- Increases aesthetic value of city area.
- Street lighting.
- Like a natural tree it can produce oxygen for fresh environment.
- It doesn't create any type of pollution.
- Foot step arrangement requires less area and having low cost to build.

### 7. APPLICATIONS

- Solar tree in oxygen park.
- Evolved oxygen through solar tree can be used to fill oxygen cylinders.
- Street lightning.
- Seating arrangement for campus or on road.

### 8. FUTURE SCOPE

- Solar Oxygen Tree along with oxygen evolves H2 gas which can be stored using gas absorber which in future can be used as clean fuel.
- We can use GSM module to make an advertising display which in future can be used as source of income.
- Also we can make multipurpose solar tree by using solar energy for various applications such as lighting, advertising, seating arrangement.

- We can use DC motor connected to solar panel which will trace sun according to its orientation which will increase efficiency of solar tree.
- This system will helpful in future for creating the Wi-Fi Zone. i.e. the routers or the Hub will be fitted on the solar tree and the battery power will have used for the same.
- The Advertising displays can be fitted on the Tree and the corporation can display the various adds on the tree display using Mobile SMS based and they can get income through the advertising source.
- The system for the Pollution Monitoring of the City can be placed and the data can be send to server via SMS, so the pollution condition will be recorded on the server.
- The various surveillance Cameras will be fitted for the monitoring of Vehicles.
- In future the power generated through solar tree will be able to use for Traffic signaling system

## 9. CONCLUSIONS

An environment friendly smart power generation system was proposed, designed and successfully implemented. • Along with evolution of oxygen the solar tree also illuminates the light. • The smart power generation fully utilizes natural resources. It is harmless and efficient system and can serve as an important factor of ecosystem which can provide no threat for deforestation

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