

Overview on solar based water purifier

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Abstract - This paper introduces water purifier by using solar energy. It is based on reverse osmosis process. This system contains mainly power supply circuit, purification circuit and control circuit. Power supply consists of solar panel, charge controller, battery and inverter. Purification unit consist of booster pump, Reverse Osmosis system and control circuit contains sensor, microcontroller and relays. High pressure is create by booster pump to carry out reverse osmosis process. The microcontroller keeps watch to level of the water tank and prevents it from the overflow. By using this process we obtain pure water in the water tank.

keywords - Reverse Osmosis, Solar Panel and Water Purifier

I. INTRODUCTION

Water is fundamental human need. Each person on earth requires at least 20 to 50 liters of clean and safe water a day for drinking, cooking and safely keeping themselves clean. Polluted water is not dirty it is deadly. In 2018 2439 people died because of water borne diseases such as cholera,diarrhea,typhoid and viral hepatitis.in all more than 1.3 crore people were diagnosed with this diseases. In the past five years 11768 people have died due to these diseases by seeing above problems it is necessary to be having system which gives us pure and clean water with minerals. The available water in many areas in the country is brackish, saline or impure. Salinity is a major problem in the coastal areas of thane and Mumbai district.RO is the system available for water purification, and sunlight is one of the source of energy that can be utilized in our system as energy source.RO system is most reliable method for purification of contaminated water the RO system has semi permeable membrane that filters excessive minerals and other soluble presents in the water. Particles as small as 0.0001 microns are effectively removed by the system. Solar based purifier use only the free pure power of the sun, thereby making system more efficient.

When purification of water is done on large scale, the purity decreases because of the long term use of filter in RO module hence monitoring of system is very substantive in order to maintain water quality as per the required standard by the World Health Organization(WHO). The monitoring can performed by microcontroller p89v51rd2bn.The monitoring system uses a pic microcontroller interfaced with sensor to measure the water level,PH of the purified water and temperature and amount of power produced by solar panel. The microcontroller is interface with display that displays the value. The system contains control circuit which contains sensors that senses water level ,temperature ,TDS in water,microcontroller,relay.the microcontroller gives three output signals to relay control circuit that are 1) when battery get overcharged 2) when tank overflows 3) when tank is low. If any one of the incidence happened microcontroller gives signal and ro get disabled manually.[1]

II. BLOCK DIAGRAM

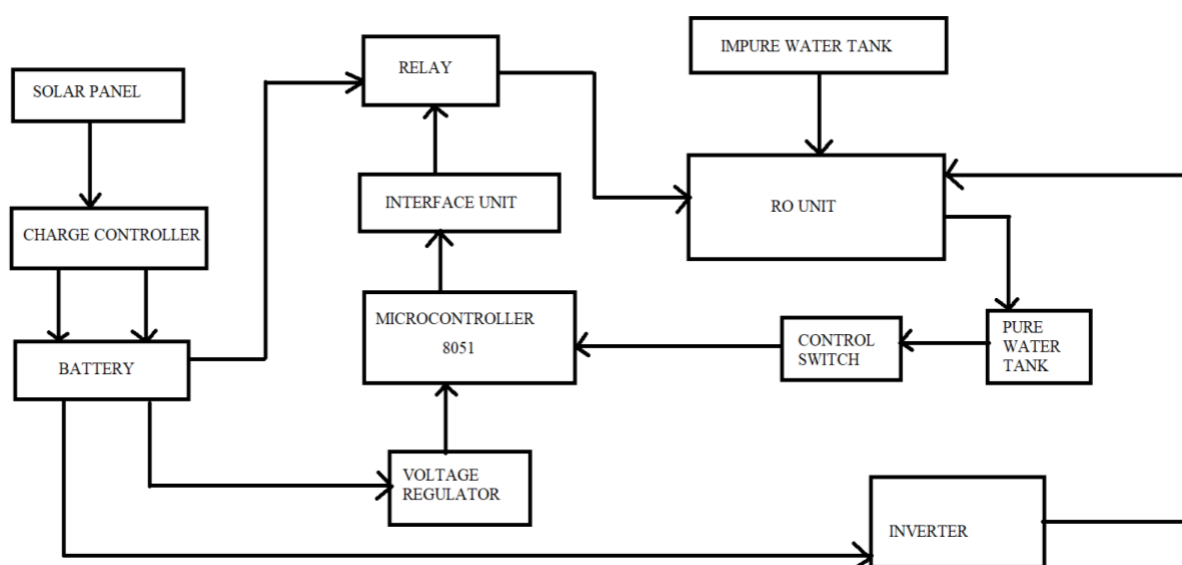


Figure 1 Block diagram

As shown in the block diagram. It mainly contains power supply circuit, control circuit and purification unit. Power supply circuit consist of solar panel, charge controller, inverter and battery. Control circuit consist microcontroller, relays and sensors such as TDS sensor, level sensor and purification unit consist RO membrane and booster pump. Solar radiation are collected by

solar panel , energy is store in battery , charge controller is used prevent battery from overcharged, inverter is fed by single phase supply through battery it give supply to RO unit then pure water from RO is store in pure water tank . Battery is connected to the RO unit through relay sensor, battery is also connected to the voltage regulator and

To Direct Current (DC) electricity. Charge Controller work as control the power from solar panel which inverter, RO unit consist of reverse osmosis processes .Control switch is get energized when tank get overflow, water level decreases, relay sense the signal and control switch get operate to prevent it from overflow.

Solar energy

Amount of energy in the form of heat is called solar energy. It is radiant light and heat from sun that is natural source of renewable energy. The large magnitude of solar power available makes highly appealing source of electricity. 30% (approx.) Solar radiation is back to space while the rest is absorbed by ocean,cloud. PV cells Convert Sunlight Reverse back to solar panel get cause of panel damage. Battery System act as storage of electric power is used when sunlight not Available (i.e. Night).From this system connected to inverter for convert Direct Current (DC) into Alternating Current (AC) [2]

Solar panel

Solar radiations are collected, by the solar panel. We are using 40Watt, 24V solar panel. The energy obtained from solar panel is then stored in battery. Being stored solar the battery panel is connected to battery through charge controller. The collected solar energy is in. In case of rural and remote areas and the areas affected but natural disasters where electricity is a big problem this stored energy can be used for the purification of water. The charge controller used here controls the required amount of solar energy to be stored in the battery.



Figure 2 Solar Panel

Battery

The battery is being charged by the solar panel. The solar panel produced voltage in the form of direct current (dc).a12V dc battery is common and easy to find so it is selected for this system. Two batteries are used in this system. Battery is connected to purification unit through relay.



Figure 3 Solar Panel

Charge controller

It is protective device. Charge controller prevents battery from getting battery from overcharge. This improves the battery performance and life span. Voltage rating of charge controller should not be greater than solar panel voltage rating. The maximum charge holding capacity of the battery is27.6V.A charge controller has been connected across the battery to prevent it from getting overcharged i.e., above 27.6V.

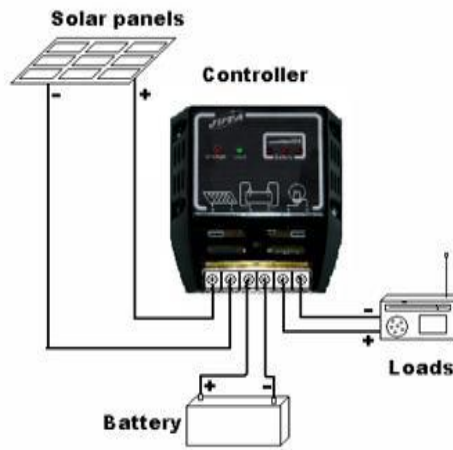


Figure 4 charge controller

Microcontroller P89V51RD2

It is implementation of 8051 microcontroller. P89V51RD2 is simply a chip which we have used in this paper. The microcontroller accepts three inputs at the following situations:-

- i) When the battery is overcharged
- ii) When the water tank overflows
- iii) When the water tank is empty

The microcontroller gives three output signals to the relay control circuit.



Figure 5 microcontroller IC

Sensors

TDS (total dissolved solvent), water level sensor and relays. TDS sensor indicates the total dissolved solids (TDS) of a solution, i.e. the concentration of dissolved solid particles. Water Level Sensors. Level sensors are used to detect the level of water.

Inverter

Inverter is device which converts dc into ac the energy collected by the solar panel is in the dc form. so system is depend on ac supply hence it is necessary to convert it into ac by using inverter in this paper we are using cd4047 inverter IC. To run AC loads this is mostly used as consumable purpose. The power output of the inverter is 100W, input voltage is 12V, Output is 220 V, and 50Hz square wave output. [3]

Booster pump

Booster pump is used to increase the pressure of water. In normal condition osmotic pressure is higher. For the purification purpose water should flow from high concentration to low concentration. Hence highly concentrated side pressure should higher than osmotic pressure to carry out reverse osmosis process.



Figure 6 Booster pump

Ro membrane

RO is heart of purification unit , the main function performed by the RO purification.it contains semipermeable membrane which removes the unwanted molecules from the water and gives us pure water a reverse osmosis is one of the most effective technology to purifier water which has high TDS level. RO membrane has a fine wholes to absorb salinity of water.reverse osmosis separation technology where dissolved impurities in water are separated by way of semipermeable membrane can process in which dissolved solids are removed from impure water is called as reverse osmosis. By using the semi permeable membrane we can removes remove many type of dissolved and suspended species from water. It is ions, molecules and larger particles from water.[2-4]

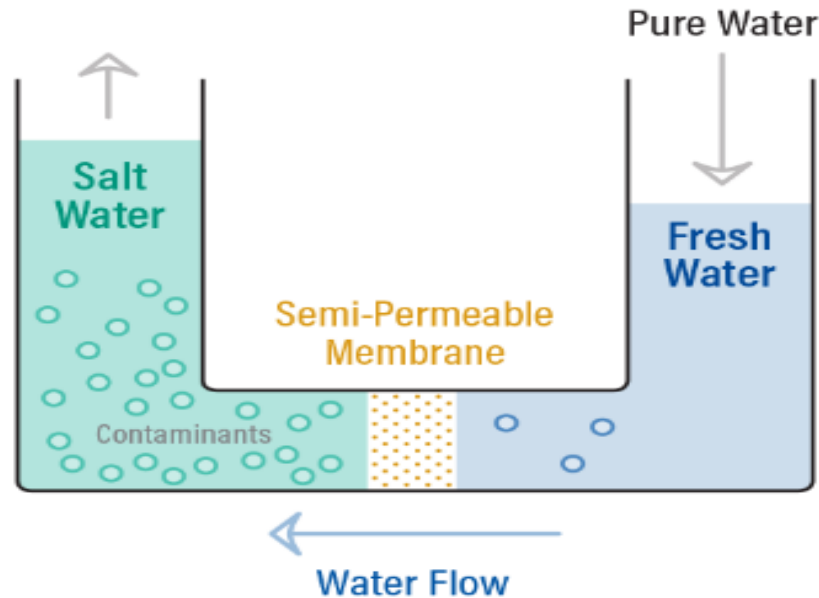


Figure 2 RO process

III. CONTROL CIRCUIT

The control circuit mainly consists of the microcontroller and an LCD display. The microcontroller accepts three inputs at the following situations:-

- i) When the battery is overcharged
- ii) When the water tank overflows
- iii) When the water tank is empty

The microcontroller gives three output signals to the relay control circuit. A 16*2 LCD display has been used here. The ON/OFF switch is manually operated. Whenever the tank is empty, the ON switch is operated and whenever it is filled, the OFF switch is operated. The RESET switch is automatically operated.[4]

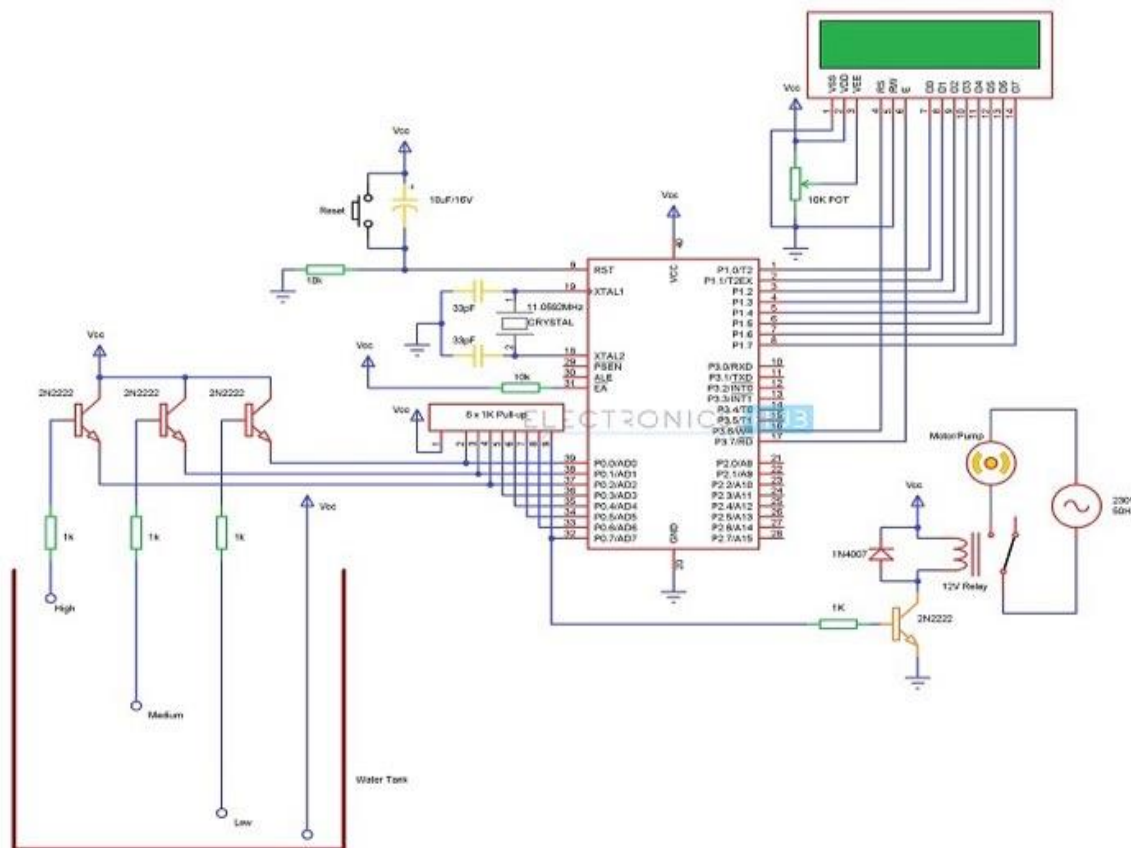


Figure 3 control circuit

IV. CONCLUSION

The solar radiations are collected by solar panel. This energy is then stored in a battery. The battery is connected to the purification unit through a electromagnetic relay. The purification unit consists of high pressure motor , reverse osmosis system and the water tank. The high pressure creates the necessary pressure required to carry out reverse osmosis. The microcontroller 8051 keeps a watch to the level of water in the water tank and prevents it from over flow. Through this process we obtain the purified watering the water tank. As solar energy is being used for the purification of water, which is cheap and abundant, it can be used everywhere where electricity is not available. Here, the microcontroller which is used also prevents the water from overflowing. Moreover, reverse osmosis is a good disinfectant process .This project has only capital cost and almost no running cost. Hence, It will prove to be useful in the near future.

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