

DESIGN AND ANALYSIS OF UV STERILIZATION WITH TEMPERATURE MONITORING SYSTEM

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ABSTRACT:

Globally more than one billion people lack access to safe drinking water. Approximately 80% of diseases in India are caused by water borne microorganisms. However, awareness of health risks linked to unsafe water is still very low among the rural population. Here we present a special idea of ultraviolet sterilization of water with temperature monitoring or automatic water purification system. This project provides a model for proper filtering, cooling and heating of water. This single system provides multitasking feature with the help of a single board. In this project we use Peltier module for cooling section and a heating coil would cater to the heating needs. For purification we use IR sensor (UV Sensor module) that acts as purifier and is placed at water inlet. In this project we use power supply module with the help of transformer and regulator 7805 IC. We use the ADC IC for temperature measurement and this temperature is displayed on LCD, we will provide the set value and according to this set value of temperature microcontroller will decide that whether the cooling or heating is to be done, we will provide cooling with the help of Peltier and heating is performed by a heating coil and the whole process is controlled by an advance circuitry.

KEYWORDS:

UV Lamp – Microcontroller - Driver Circuit – Relay – Peltier Module - Heating Element-LCD-Transformer

INTRODUCTION:

With more & more number people are becoming conscious about contaminated drinking water; the demand for water purifiers has seen an exponential growth of 22% CAGR. The UV segment of Water Purifiers constitutes more than 55% of the industry and water purifier manufacturers focus on this segment because of higher margins it offer. UV refers to ultraviolet light with wavelengths between 100 – 400 nanometers (nm). Here we are using UVC 100-280 nm. Light in the UV wavelength can be used for disinfecting water, sterilizing surfaces, destroying harmful micro-organisms in food products and in air. Ultraviolet water purification is the most effective method for disinfecting bacteria from the water. Ultraviolet (UV) rays penetrate harmful pathogens in your home's water and destroy illness-causing microorganisms by attacking their genetic core (DNA). A temperature of 175 degrees F (80 degrees C) for 5-10 min. For example, will destroy all active bacteria, yeast, and fungi Cells in their dormant phase (spores) are more resistant to heat, and temperatures above 240 degrees F (116 degrees C) must be used to inactivate them. After Sterilization, water is further operated upon to provide the required temperature. As we know that no one would like to drink warm water in summers and chilled water in winters, hence we provided the additional mechanism to make sure that the user gets the water at the optimum temperature. Temperature (as desired) is set by the user manually and then the system decides on whether the cooling or heating is to take place. Cooling is provided by the use of a peltier module and heating is supported by a heating element. A cut-off value is set beyond

which system stops heating or cooling. This system provides heating, cooling as well as filtration of water just as automatic water purifiers

EXISTING SYSTEMS:

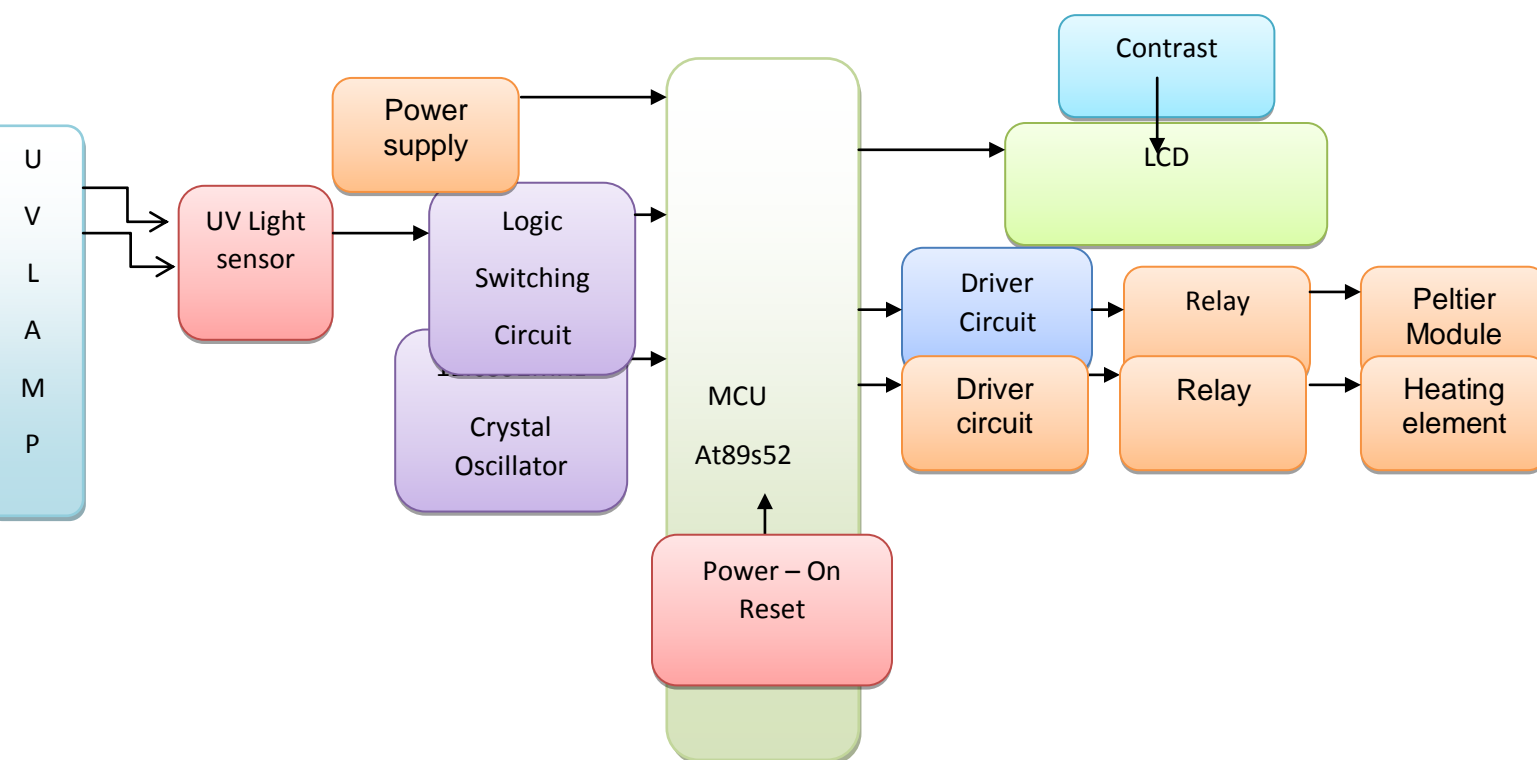
Though there are many water purification systems available in market, but very few of them provides the advanced multitasking features as proposed in this model. Most of the existing purification systems are obsolete and are not up to date, even the level of purification provided by most of the age old purifiers is in the gambit of doubt. So, a purifier renders totally useless if it fails to perform with 100% effect, the very task of purification. In present scenario we have a number of filters which work on various kind of technologies ranging from boiling, sediment filtration, ion exchange, activated carbon towers etc. But these methods have become obsolete and outdated, thus the technology used in this method is a way ahead in terms of quality of water and not to be forgotten the added advantage it comes with, that is the temperature controlling system. This is something which is not found easily in the existing system and is a major drawback of the existing filtration system. The normal filter present in market provide us with just the clean water but cannot set the temperature of the water according to our needs or demands. There are three types of Water Purifiers in the market:

- Ultra Violet Based
- Reverse Osmosis Based
- Chemical Based

The UV segment constitutes more than 55% of the industry and has its key focus area for water Purifier manufacturers because of higher margins it offer. The Indian water purifier market has tremendous potential with a market size of approximately INR 1400 Cr ore. It is more evident from the fact that global majors such as Philips and Hindustan Unilever have stepped in the area. In the years to come, we can expect to see others entering the battle.

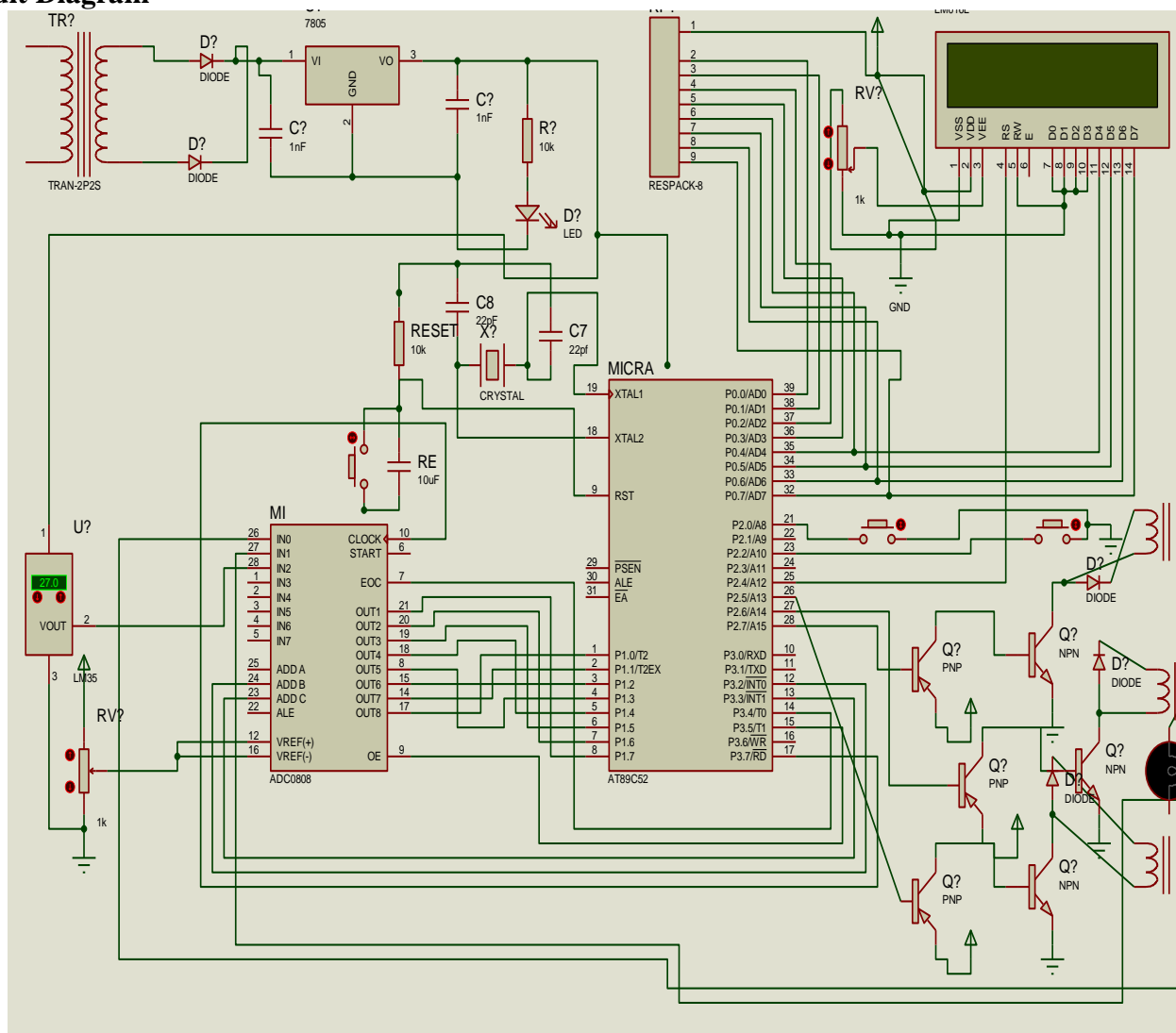
PROPOSED SYSTEM:

The model proposed by us here in this project not only provides the purification of water but it also has an advance circuitry with multitasking features such as heating and cooling up to a desired temperature. Moreover the advance technology is being used throughout which makes the system more energy efficient, safe and lesser complex. Providing water at the required temperature is one of the key and unique features. It provides complete protection from all water-borne diseases, unmatched convenience and affordability. It's unique Germ kill Battery technology kills all harmful viruses and bacteria and removes parasites and pesticide impurities, giving you water that is "as safe as boiled water". It assures your family 100% protection from all water -borne diseases like jaundice, diarrhoea, typhoid and cholera. Pure-it not only renders micro-biological safe water, but also makes the water clear, odorless and good-tasting. Pure-it does not leave any residual chlorine in the output water. The heart and soul of any purifier is its purification capacity and hence our proposed model made no compromises, employing one of the advanced methods of sterilization such as UV. This can be well seen from the block diagram as shown.

Block diagram**WORKING:**

The above figure shows the assembly of the various components of the system. It starts with the power supply of 220V which is a ac supply. Transformer is used to convert this 220V to 12V which is further reduced to 5V with the help of a voltage regulator. The UV lamp is used for producing UV rays which are useful in sterilization process, it is connected to a UV sensor which detect if somehow the lamp stops working in between the operation. We are using a AT89S52 microcontroller which is interfaced to each components. It has 40 pins, and 8kb ROM. Crystal oscillator is being used to stabilize the frequency of the microcontroller of 11.252MHz. Reset circuit is used to reset the system if the microcontroller hangs. Relay circuit is used to decide between the pelteir module and heating element. The pelteir module is connected to cool the temperature of the sterlazed water and heating element makes the temperature of the water hot. There are diode and capacitors used in the entire circuit for various purpose which is explained in the circuit diagram below. We are using a 2*16 liquid crystal dispaly LCD which has 2 rows and 16 coloums for displaying the temperature of the water at a given time. Detailed study of circuit diagram is explained below.

Circuit Diagram



We supply the ac voltage of 220V as the power supply, with the help of a step down transformer we convert this voltage to 12V. Since microcontroller works on the dc power so we use a Centre tape full wave rectifier circuit. During this rectification some noise harmonics are generated which are controlled using 1000uf capacitor. After that we use a regulator IC 7805 which converts the voltage of 12V to 5V, again due to this regulation there will be some fluctuations which are controlled by another 1000uf capacitor and we check the power supply using the LED and resistance present with the voltage regulator. Now the microcontroller AT89S52, which has 8kb ROM 256 byte RAM 8bit processor, 3 timer and counter, 40 pins, ceramic capacitor is used to stabilize the frequency of the crystal oscillator which is of 11.252 MHz. Reset circuit having 10kohm resistance and 10pf capacitor connected to pin 9 of mc is used to reset the system when some error occurs or the microcontroller hangs. LCD of 2*16 connected to pin p7 to p14 for data lines pin 4, is used to select command and data 5 read and write and 6 for new line, pin 1 is connected to ground VCC, and pin 3 is connected to a variable resistor to control the contrast of the LCD. ADC IC is used to measure temperature it converts the digital to analog using the thermistor which has been interfaced to it. It requires a reference voltage which it receives from the variable resistor. Comparator IC LM358 is used for UV radiation, it senses the radiation the gives a signal to comparator using the variable resistor, and the LED is used to indicate that sensor is on. Peltier module and heating element are connected using a Darlington pair (which

has p-n-p, n-p-n, diode and relay circuit). Relay circuit is used here to use 12V or 220V whichever is required thus either for cooling or heating.

RESULT AND CONCLUSION:

Thus we have successfully created a UV purifier with temperature monitoring system in the most efficient and cost effective way. This model will help the user on a daily basis and make their task easy and affordable. Even the circuitry is not so complex and easy to maintain. Apart from this there are many other advantages of this project such as, one of the best way of filtering the water as it is Chemical Free: UV purification does not use any chemicals like chlorine or leave any harmful by products. Taste& Odor Free: UV does not add any chemical taste or odor to the water.Requires very little energy, uses about the same energy as it would to run a 60 watt light bulb.Low Maintenance: Set and forget type of system, just change UV bulb annually.

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