

## MICROCONTROLLER-BASED RAINWATER TO POTABLE WATER FILTRATION SYSTEM FOR HOUSEHOLDS

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### ABSTRACT

One of the major problems that the world faces today for both urban and rural areas is water scarcity. There are instances where clean drinking water is not good enough for the individuals who are present in the community. Philippines is one of the countries all over the world that is experiencing lack of water supply and clean drinking water, and this problem is also related to water pollution. This recommends that harvesting rainwater must be given prior attention and encouraged as a sustainable substitute for water supply as well as for integrated development. The Micro-controller Based Rainwater to Potable Water for Household system has its own potential to contribute to the conservation of clean drinking water usage. This is also an affordable water filtration system that can be used in households. Micro-controller Based Rainwater to Potable Water for Household system is consists of water reservoir, water filters, UV lamp, sensors, pump and pipes in order to create this complete system. The objective of this research is to collect rainwater through the use of reservoirs thus taking it nearby to the concept of nature conservation because rain is the main source of water and if rain is collected, water scarcity will gradually decrease.

*Index Terms—Microcontroller-based, pH level sensor, Rainwater, UV lamp treatment, Water Filtration System, Water sensor*

### INTRODUCTION

Harvesting rainwater can done directly through the utilization of containers or through the roofs. Harvesting rainwater is the best way to avoid the water shortage, the water supply is being limited due to the growth and development of the population of human along with the pollutions of the environment. The most accessible source of water is considered rainwater harvesting which can be used easily for potable purposes, both commercial and domestic. The rainwater can be utilized for both potable and non-potable it can use for cooking, drinking, and laundry. Throughout history, harvesting rainwater is the best technique which people used to survive in water crisis. In areas, having significant rainfall over a thousand years, the rainwater harvesting has been practiced. The basis of preserving potable water supplies remains to increase through the world and rainwater harvesting is the best tool that they used to achieve this necessity, but the lack of information concerning the value of harvested rainwater has prevented general use of this practice.

A good class drinking water could be made available by the water tank which is properly maintained. Whenever the rainwater could be free from impurities ill smell or taste and pathogens-free for most consumers, if the water catchment system is well maintained. In other countries the reservoir of drinking water is the rainwater tank and it is commonly used. Water that is used for household has to reach the water safety guidelines in order to keep the human health before it is to use in food preparation, bathing, and drinking. Water must be free from disease-causing microorganisms or unsafe levels of chemicals. The uncleanness of water with unsafe microbes like bacteria and parasites from animal droppings can cause extreme possible hazard to our health. Because of the roof or pipes materials the rainwater tank can be polluted.

The main objective of this study is to develop a microcontroller-based device that can analyze the alkalinity and acidity of water using Arduino water sensor, water filter, and pH sensor. This study would help the places that is no access of drinking water and always suffering water shortage, in this study it can fulfill their needs in terms of drinking water. The study is further aimed at better and easy conversion of rainwater to potable water which can be used for household chores.

## REVIEW OF EXISTING WORKS

The study of Pooja[1] entitled GSM based Smart Water Purifier build up a framework that puts the light on the gadget which can take care of this water tainting issue by filtering the water just as by observing the nature of the decontaminated water. This water purifier has for the most part a TDS sensor which detects the TDS level persistently. This message will be sent to the retailer just as to the client to alarm them about the administration of purifier utilizing the GSM innovation. The procedure utilizes for the cleaning of water is turn around assimilation. Alongside this module, keen purifier has temperature sensor to screen the temperature of the water leaving the purifier and gas sensor which will detect the LPG spillage in the kitchen. The data with respect to temperature will be appeared on the LCD and the data about the gas spillage will be demonstrated through the ringer. The fundamental preferred position is that the detecting module can be associated with any sort of purifier.

V.S.Rajashekhar and Dr.R.Senthili[2] directed an investigation entitled Conceptual Design of a Microcontroller Based Solar Water Purification System Using a Sliding Parabolic Cum Circular Reflector. In this paper, the creators have planned a sun-based water filtration plant that works nonstop to supply new water to the general public. A nickel chromium alloyed wire fortified dark body has been utilized to warm the polluted water and it consolidates on a thermally protected condenser. During night and on occasion of low sun beams, this electric vitality can be utilized to warm the nickel-chromium alloyed wire fortified dark body. These capacities are constrained by a microcontroller.

Dr.S.Prakash, Deepak Toppo [3] proposed a paper intitled Solar Energy Based Water Purification System. The study is making a water purifier which takes a shot at sun-oriented vitality. The fundamental guideline behind this undertaking is turn around assimilation. The sun-based radiations are gathered by sun powered board. This vitality is then put away in a battery. The battery is associated with the filtration unit through an electromagnetic transfer. The microcontroller 8051 holds a watch to the degree of water in the water tank and keeps it from over stream. Through this procedure we get the sanitized water in the water tank.

RhowelDelloso, Jon Edward Hernandez, Richard Mangay, Rockie Robles [4] introduced a paper entitled Microcontroller Based Wastewater Management System. The analysts expected to structure a framework that is equipped for separating the contaminants in water. The framework gives improved feeling and improved tasting drinking water by relinquishing chlorine and microbial impurities. The framework likewise evacuates the undesirable shade of the water. As far as exactness for deciding the ideal volume of water in the compartment, the framework was set to a predetermined period for to what extent it is intended to stop and switch the wellspring of water. The water per holder can't flood. The machine is a completely programmed separated drinking water candy machine, offering a touch less fixture that you can utilize it without a switch. Moreover, by the utilization of the Microcontroller Based Wastewater framework, precision is acquired. It is a computerized gadget that can give a protected, moderate and promptly accessible drinking water.

Carolyn Payus<sup>1</sup> and Kui Jun Meng<sup>2</sup> [5] displayed a paper intitled Consumption of Rainwater Harvesting in Terms of Water Quality. Concentrate the physical, microbiological and synthetic water quality examples were dissected utilizing film filtration system (ELE Paqualab 50), ICP-OES and Hach strategies, to guarantee the appropriateness of water gathering for local utilization. The investigation uncovers that general nature of the water is very palatable according to WHO and Malaysian measures, where the pH, turbidity, all out broke up solids, saltiness, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, Zn and Pb were still under as far as possible. In any case, the microbiological parameters (all out coliform, fecal coliform and E. coli) and concoction (Cr) were found surpassed the norms, because of poor sterile practices of the gathering framework. It tends to be presumed that the water collecting is as yet safe to drink and can be a potential elective wellspring of water supply later on.

## PROPOSED SYSTEM

The system aims to develop a human-free project that will help every household to save power and energy in using the system. pH Sensor is present in the system in order for the fastest way of monitoring the pH level of the water filtered by the filtration system and also the water level sensor is used to control the water motor pump in supplying the water in the whole process of water filtration system. This sensor is located at the water storage tank so that the owner of the proposed system or kit will not waste time in operating this water filtration system for household.

**Figure 1:** Prototype of the Proposed Project



Figure 1 shows the prototype model of the proposed system.

## METHODOLOGY

### A. Block Diagram

Microcontroller is the core element and brain of the system. It serves as a controller of the entire process. The relay module that serves as switch of the motor and is connected to the Arduino to switch on the motor in order to gather rainwater to pass through the water pipes, filters and UV lamp.

**Figure 2:** Block Diagram of Proposed System

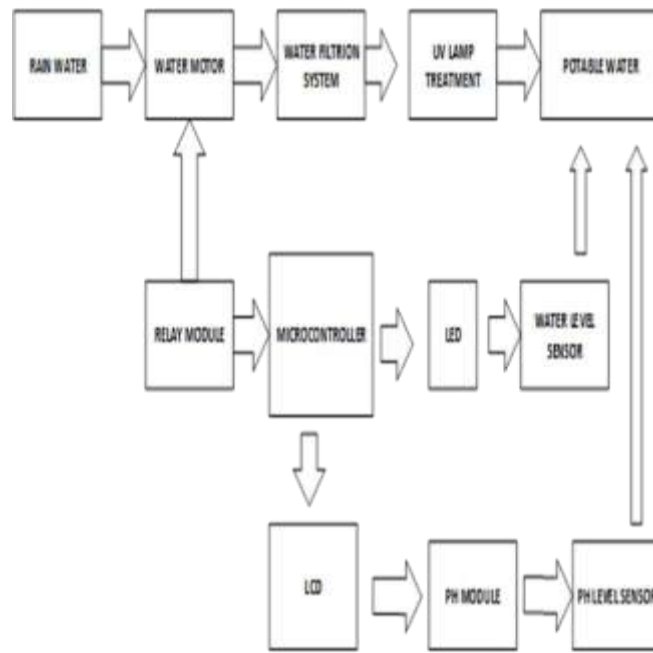


Figure 2 shows the block diagram of the proposed system.

### B. System Flow Chart

The system flow will begin in turning on the power supply and then the sensors will be activated in case of water level inside the tank then the next is the functions of water filters, when the water passes at that part the pH determination will measure the alkalinity and acidity of water. After killing all the microorganisms by the use of UV lamp Treatment, the LED will off to inform the user that the water is ready for use.

Figure 3: System Flow Chart

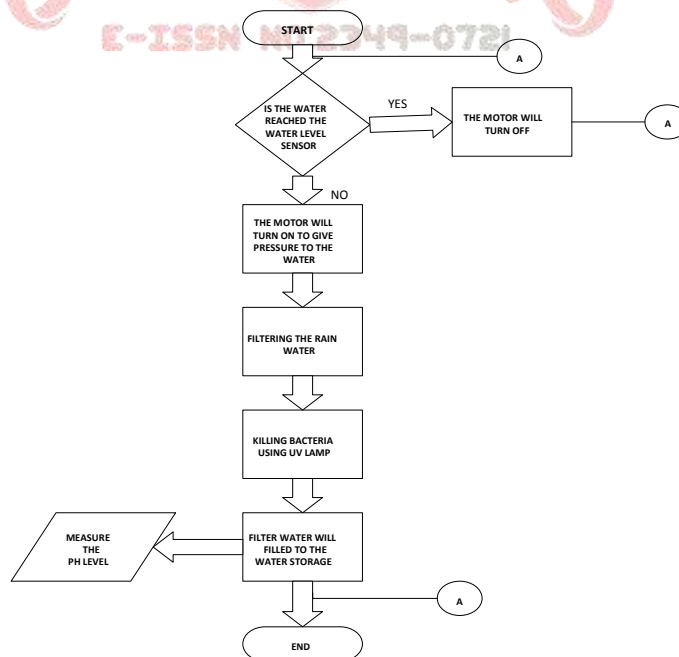


Figure 3 shows the system flow chart of the proposed system.

C. Schematic Diagram

Figure 4: Schematic Diagram of Water Level Sensor and Water Motor Pump

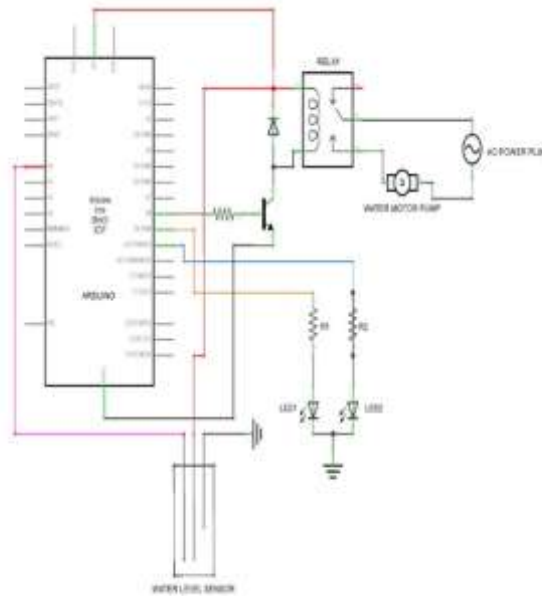


Figure 4 indicates the schematic diagram of water level sensor and water motor pump.

Figure 5: Schematic Diagram of pH Water Sensor and LCD

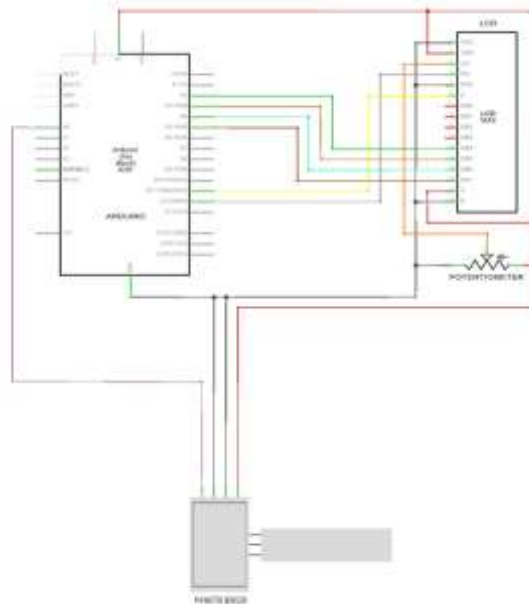


Figure 5 illustrates the schematic diagram of pH water Sensor

**MATERIALS AND SYSTEM REQUIREMENTS**

The system used 220V as the main power source of water motor pump which is connected to the relay which serves as the switch. The Water Sensor and pH Level Sensor is connected to the Arduino. The pH Sensor sends data to the Arduino that is displayed on the LCD.

The Arduino Uno is the head of the system, it commands the relay module to switch on when the water level sensor reaches the desire level of the water.

**Figure. 6: Water Pump Motor**



Figure 6 shows the water pump motor. Water pump Motor transports the water into Filter and it has a 0.5 Horse Power.

**Figure 7: Relay Module**

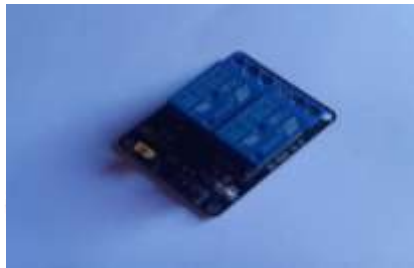


Figure 7 is the relay module which serves as a switch for the water pump motor, the relay is 250 VAC and 10 A.

**Figure 8: Breadboard**

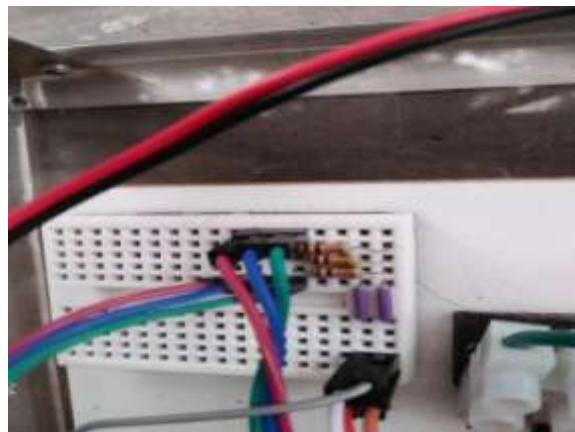


Figure 8 shows the breadboard connection.

## RESULTS AND DISCUSSION

A microcontroller-based device was constructed to determine the pH level of the water by the use of different devices such as pH water level sensor, LCD, and Arduino.

In identifying and developing the rainwater that was converted into potable water is ready to use or consumed if the result that should be seen in the LCD which is connected to the pH level sensor is below acidity level and above alkalinity level.

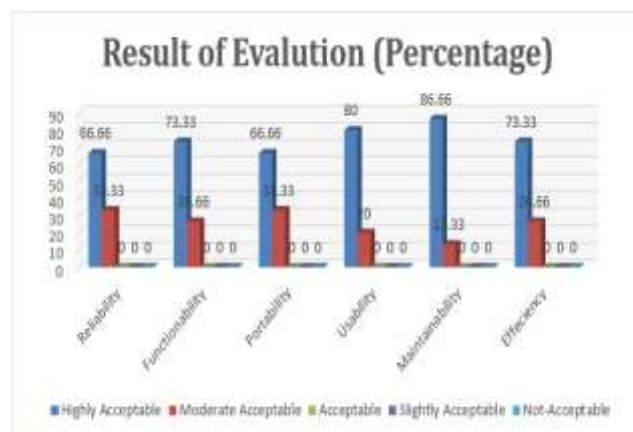
The water filtration system was integrated to separate water contaminants from the water by the use of water filtration system. A system was created that transform rainwater to potable water by the use of a microcontroller-based system.

The project was evaluated excellent in each criterion on: Reliability – the Micro-controller Based Rainwater to Portable Water Filtration System. Device work consistently and does produce desired output. (4.7, Highly acceptable), Ease of use – the device is easy to use and has simple mechanics (4.86, Highly acceptable), Portability – the device is compact and is easy to install and can be transported easily (4.66, Highly acceptable) and lastly the accuracy of the device it mostly does not detect nonliving thing that passes in the sensors field of view (4.88, Highly acceptable). which means the project is reliable, easy to use, portable, accurate and safe.

The figure below signifies the results of the evaluation that reveals that the system device fulfills with the software and hardware quality standards. The total score of the evaluation is 4.7 meaning the system is functional, usable, reliable, efficient, maintainable, portable. It suggests that the system can be very helpful in the society especially in household in converting rainwater to drinkable water.

This system is developed to offer hardware device capable of filtering water purposes in the areas that are lack of good drinking water. Evaluation results revealed that the mean functionality of the device was at 4.7, which is interpreted as highly acceptable, the device has the capability of sensing devices to the water and giving data to the Arduino Uno.

The system also provides and stores accurate data and information about pH level and height of the water I the storage tank. The device was described as reliable with the mean score of 4.6 and portable has the mean score of 4.6, usability has the mean score of 4.8, maintainability has the mean score of 4.8 and efficiency has a mean score of 4.7.



**Fig. 9: Evaluation Results**

Figure 9 presents the graphical presentation of the results of evaluation.

## CONCLUSIONS

Micro-controller Based Rainwater to Potable Water Filtration System was developed using an Arduino Uno. The system used pH Level sensor that was calibrated to detect the pH Level of the water. The device used water level sensor to detect the water level in the storage and send information to the motor pump through Arduino. The system also used UV lamp Treatment to kill the Micro-bacteria of the water. The system used indicators like LED and LCD to display the information from the sensors. Lastly, the system was evaluated as reliable, portable, maintainable, functionable, usable, and efficient.

## RECOMMENDATION

Other types of Arduino boards can be used in the system. Future researchers may also other types of power supplies like solar panels in order to store power for the operation of the system. To have a better and more efficient water, more filters should be added. And to have more supplies of water, bigger storage tanks is needed. To make the device more durable, it should be mounted on good quality metals.

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