

# Development of Automatic Rechargeable Handwashing Machine using Locally Source Materials

Umahi Ndidiamaka Maria-Theresa<sup>1</sup>, Babalola Segun Abioye<sup>2</sup>,  
Engr Afam Samuel Eneh<sup>3\*</sup>

<sup>1</sup>Departement of Biomedical Engineering, Enugu state university of Science and Technology, Enugu state

<sup>2</sup>Biomedical engineering unit, Federal teaching hospital, lokoja, kogi state

<sup>3</sup>Departement of Biomedical Engineering, David Umahi Federal University of Health Science, Uburu, Ebonyi state

Date of Submission: 25-10-2025

Date of Acceptance: 05-11-2025

## ABSTRACT

The necessity for this initiative was brought on by the harmful hand washing and drying practices found in many eateries and food sales locations. We have transformed the conventional mechanical hand washing into the technical marvel that is touch-less hand washing. The machine is made up of a housing with top and bottom sections. Water is injected into users' hands via a fluid injection mechanism in the upper part of the spherically shaped device. There is a box-shaped structure at the bottom. The machine also includes a wash basin that is connected inside the box-shaped structure with a circular opening underneath where used water passes through, an electronic eye that detects when hands are inserted into the wash basin, and a control unit that timed when the water injection was activated. This study has effectively demonstrated a low-cost, highly effective sensor-controlled hand washing system that may be used at many locations across our physical surroundings. The primary goal of this project is to create a machine that uses an infrared sensor to automatically identify a human body close to the washing machine and then permits water to flow.

**Keyword:** Automatic Rechargeable; Handwashing Machine

## I. INTRODUCTION

Importance of hand washing cannot be over-emphasized, especially in developing nations where eating with hands is a common practice [1]. In some developing cultures, there is always the reluctance of hand washing before meals; and in some, hand washing has become a culturally accepted norm. Eating with the hands was going on

for generations before anyone thought of washing their hands first. So, along the way, through technology and hygiene practices, people become educated in the improvement of hand washing [2]. An automatic rechargeable hand washing machine is an automated and mobile hand washing machine powered by rechargeable battery. This device was invited to fight against the novel coronavirus pandemic by not touching the tap before and after washing hands [3]. Hand washing is the single most important way of preventing the spread of infections, according to the US Centre for Disease Control and Prevention. Unwashed or poorly washed hands are very common way of spreading many diseases such as: cold, flu, ear infections, strep throat, diarrhea and other intestinal problems. Germs and viruses causing these diseases are passed on by such routine things as handling food, touching door knobs, shaking hands and putting mouths on a telephone receiver. And in our daily activities we practice one of these either in the offices, at home, in the market places, in the classroom and so on. Good hand washing practices have also been known to reduce the incidence of other diseases, notably pneumonia, trachoma, scabies, skin and eye infections and diarrhea-related diseases like cholera and dysentery, according to World Health Organization (WHO). The promotion of hand washing with soap is also a key strategy for controlling the spread of Avian Influenza (bird flu). After the incidence of SARS-severe acute respiratory syndrome in 2003, more and more people on their daily lives gave more attention to health habits; the daily number of hand-washing increased than before. This prompted us to contribute with this project as a way to increasing the practice of hand washing in our

society so as to remain healthy. This machine is specially designed for use in the offices, public restroom and as well for the general domestic washing and drying of the hands at home. It supplies clean water in a sequential order during the washing. It is handy and easy to use. More importantly, it can avoid the contagious diseases; for example, when it was a manual type hand washing machine, to turn on/off the tap, you must need the help of your hands. In this case, your hands or fingers would be infected with any virus left by any possible previous user if he or she is infected with a disease. With the automatic type, you will not only use the water at ease, but also avoid any possible contact with any contagious disease. Also, some cases were considered whereby people would inevitably, more or less, waste some water as we might have seen people washing their hands at any public places or at home. It is not necessarily because people tend to waste some water at their own will, for example, when it is a traditional mechanical type, people would wash their hands under the pressed water with the switch on, as the switch is positioned at this state, the water keeps being pressed down at the same amount no matter when the person really needs the water to wash or not. This causes low efficiency of water usage. Another possibility is that people who are in a hurry may often unconsciously forget about turning the tap off, if they really forget about it, the water would keep flowing or dripping until it gets turned off by the next user. As for the automatic type, it turns on and off automatically as it senses any object with energy or heat. In this case, the unnecessary waste of water can be avoided. Therefore, with all these benefits, the automatic hand washing machine are becoming increasingly popular among schools, families, dining halls, companies or any other public places. [4] proposed an Experimental-based automatic control of washing machine using a programmable logic controller. Their work is based upon experimentally, in which a Programmable Logic Controller (PLC) is used to control the washing machine. Nowadays, people's living arrangements are very tight, so they do not have time to clean clothes and spend a long time. In this case, a PLC-based washing machine (WM) can be used which

simply reliable, and time-saving. [5] proposed Operation System of Washing Machine with Fuzzy Logic Control System and Construction of Detergent box By using fuzzy logic controller, one can control uncertain system where uncertainty exists on the input parameters. Generally, the delay in the system may cause time shift which disturbs the stability of the system. Therefore, the time delay systems with uncertainty can be represented by type-2 fuzzy logic controller. [6] proposed Design and Demonstration of the Use of Automatic Hand Washing Sink Technology in Covid-19 Pandemic. The design of automatic hand washing technology tools to support blended learning in the COVID-19 pandemic is very much on order. In designing and demonstrating a hand washing device, an automatic faucet modification is needed which consists of an IR sensor component (Proximity Infrared Switch Sensor) as an automatic on and off switch, then to support the faucet to work with a good system, a transistor that has been modified with a modified dynamo integrated into the system. connected to a mini pump. [7] proposed a Design and fabrication of home automation. the objective of this project is to control all electronic device in the house, remotely and to automate some parts of the house like pipes, garage using Arduino or raspberry pi. The raspberry pi is a microprocessor which can be used for multiple purposes like getting input signal, based on the signal the output is calculated and sent to the actuators. In term of designing automatic system for handwashing standard procedure, [8] has developed a machine that accommodate wetting, lathering, scrubbing, rinsing and drying in automatic mode. The machine consisted of a sink and 3 outlets of water, soap, air blower that was controlled electronically. The hand-wash process used timer to exit soap, then water and then air blow. The design also included mechanical component of water piping, pump and housing.

## II. BLOCK DIAGRAM OF THE SYSTEM

The diagram below is categorized into the basic blocks of the system to give a clearer explanation of the working principle of the system.

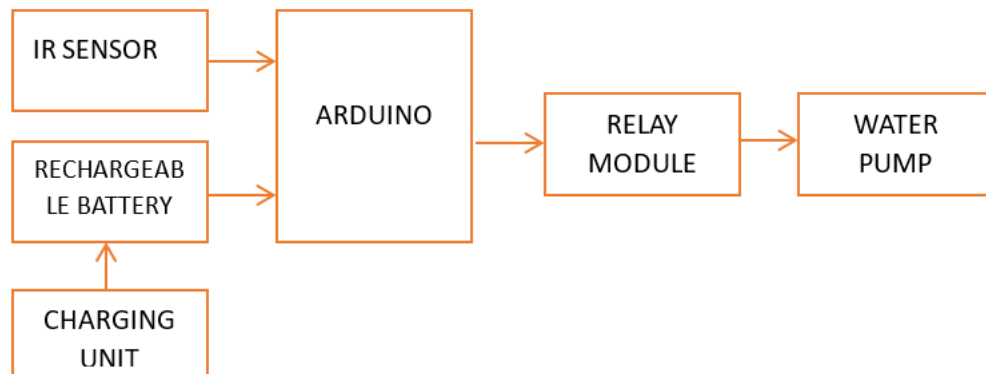


Fig 1 Block diagram of the system

**Infrared sensor:** The sensors have two data pins each; TX and RX which stands for transmitter and receiver. Detects an object or motion and sends signal to Arduino uno. The sensors have two data pins each; TX and RX which stands for transmitter and receiver.

**Microcontroller (Arduino uno):** The microcontroller is the brain box of the system. The MCU accepts information from the transducers and sends commands to the modules.

**Relay module:** Switch on/ off power to the water pump.

**Water pump:** Receive power and pump water accordingly.

**Rechargeable battery:** Provides power to the entire system.

**Circuit Diagram**

The complete circuit diagram for rechargeable Arduino based hand washing machine is shown below:

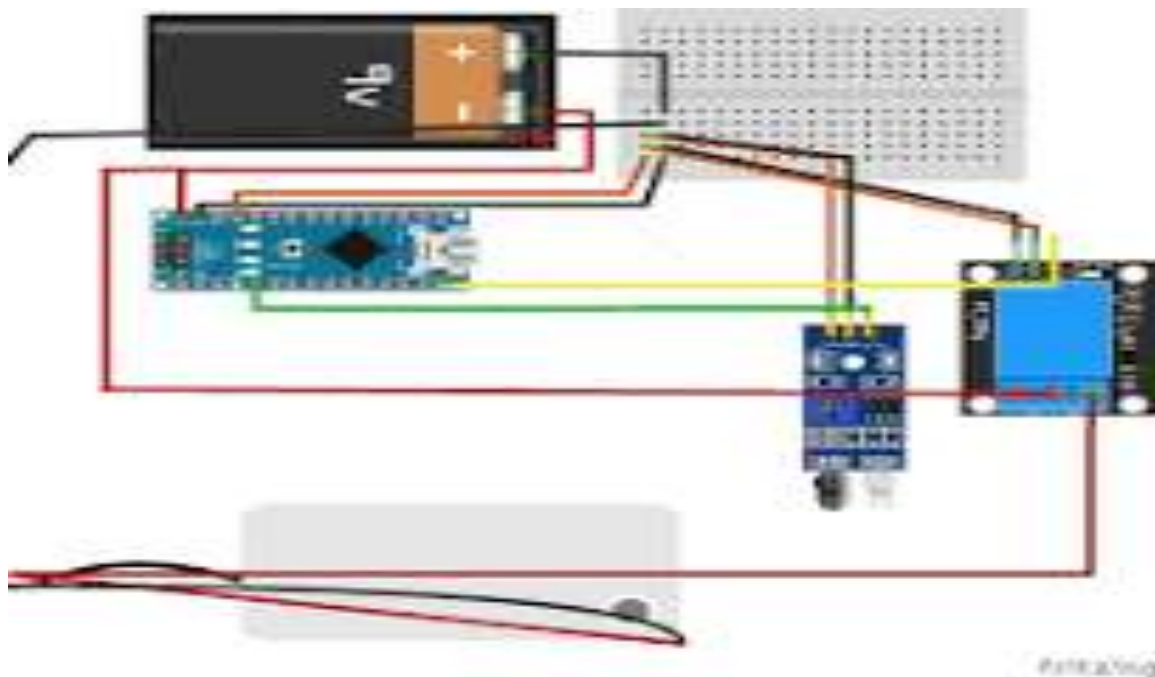
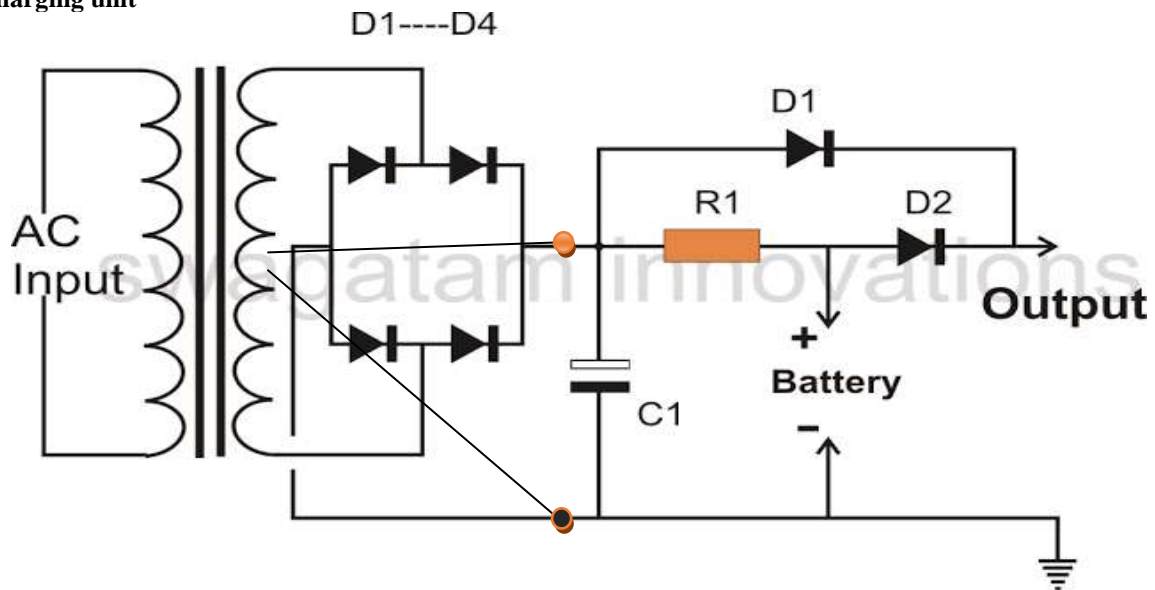


Fig 2. Circuit diagram

**Charging unit**



Charging unit

All diodes = 1n5402 for battery up to 20 ah, 1n4007, two in parallel for 10-20 ah battery, and 1n4007 for below 10 ah.  $R1 = \text{volt}/\text{charging current}$  (ohms),  $\text{Transformer current}/\text{charging current} = 1/10 * \text{batt ah}$ ,  $C1 = 100\text{uf}/25$

**III. DISCUSSION**

In building this project, the following procedures were properly considered, Purposing of the entire materials / accessories needed, drafting

out a schematic diagram or how to arrange the materials / components. Testing the completed system to see if the design works and finally, implementation of design of the project. Having provided all the accessories and having finished the construction of the sections of this system, the assembling then followed. The sections were properly laid out and assembled where the general coupling and linkages into the peripheral devices took place.



**Fig 3 Developed device**

Although this project has not been given due recognition by the authority concerned, whenever this equipment finds its use, the case is relatively cheap with a good efficiency and improves on its reliability. Due attention will be given to the viability of this project reliability maintainability and also the evaluation. In the manufacturing of any technological advancement or master piece the designer is expected to evaluate to what extent the equipment will stand the test of time. It is on this note that I have dedicated the section to explain the viability of this project (rechargeable hand washing machine). In the design of rechargeable hand washing machine reliability is taken into consideration to improve on the system performance. Here the concept of reliability has been associated, in a qualitative way with good design endurance consistence quality and dependability in recent years however, the much greater complexity of the line selector and the seriousness of a failure in the system have made it necessary to attempt not only to improve the reliability of the equipment but also to assesses it in qualitative terms. In order to appreciate some of the difficulties which are involved in the designer of this project, imagine a discussion concerning the relative merits of mobile grain drier in the first place the specifications of the picture quality and staying. The discussion may then turn to the likelihood of faults developing in the sets. Therefore, from this little explanation, "Reliability can be defined as the characteristics of a component or of a system which may be expressed by the probability that it will perform a required function under started conditions for a specified period of time".

#### IV. CONCLUSION

This research work has successfully presented a functional and highly efficient low-cost IR controlled rechargeable hand washing machine which is usable in different places within our geographical environment and settings such as hotels, homes, hospitals, executive offices, restaurants, schools etc. as way of adopting a good hand washing process or procedure hence improving hygienic condition of individuals; and this eliminates the transfer of fecal pathogens from one person to another.

#### REFERENCE

- [1]. Kohli and C.J.Lin. Acomparison of methods for multiclass support vector machines. International journal of Appliled science, 13(2) :415-425, 2020.
- [2]. D.J.Masadeh and M. Jaran. A clinical evaluation of glove washing and re-use in detail practice j. hospital infection. Journal for clinical services, 3(2): 51-55, 2019.
- [3]. Bonney, Abigail (May 2020). "Ghanaian invents sensor hand-washing sink from scraps". Adomonline.com. Retreved 2020-04-16.
- [4]. Koondhar, Mohsin Ali, Channa, Irfan Ali, Bukhari, Syed Abid Ali Shah, Soomro, Abdul Hameed, Channa, Abdul Sami, &Koondhar, Noshad Ali. (2022). Experimental-based automatic control of washing machine using a programmable logic controller. Journal of Applied and Emerging Sciences, 12(1).
- [5]. K. T. Oo and T. Z. Soe, "Operation System of Washing Machine with Fuzzy Logic Control System and Construction of Detergent box." International Journal of Science, Engineering and Technology Research, vol. 5, no. 9, pp. 2883-2888, 2019.
- [6]. Satria, Habib, Nasution, Mahliza, Mungkin, Moranain, Anisa, Yuan, &Hardinata, Aristo. (2022). Design and Demonstration of the Use of Automatic Hand Washing Sink Technology in Covid-19 Pandemic Conditions. International Journal of Education, Information Technology, and Others, 5(2), 127-132.
- [7]. Vignesh, T, Selvakumar, D, Prasath, C, Manikandan, N, & Viswanath, R Sri. (2019). Design and fabrication of home automation. Paper presented at the IOP Conference Series: Materials Science and Engineering
- [8]. A. Bianchi, D. M, WHO Guidelines on Hand Hygiene in Health Care: A Summary. World Health Organization Patient Safety: University of Geneva Hospitals (2019).