

Solar Powered Automatic Wash Hand Basin System

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ABSTRACT: Wastage of water has been a common phenomenon in several public locations such as event centre, restaurants, malls, mosque, churches, and also at home due to negligence of tap user or due to sophisticated tap used that visitors may not know how to operate, to curb wastage and prevention of damage to the wash hand basin. A solar-powered automatic wash hand basin system was developed to cater for any challenges that may arise. The solar-powered automatic wash hand basin system is a sensor-based system with constant supply of electricity that starts automatically whenever anyone put his/her hand just below the water tap outlet, which significantly reduces water consumption to some extent and can as well eliminate cross-contamination by keeping hands and germs away from commonly-used surfaces especially during this COVID-19 pandemic. This system can help in automating the work of human beings with great ease and without any difficulty which will make the tap to last longer, reduce water usage, and also guide against any form of germs or diseases from cross-contamination.

Keywords-Automatic, solar-powered, wash hand basin, wastage.

I. INTRODUCTION

Covid-19 pandemic is a disease outbreak that spreads across the continents. It resulted in taking many lives which brought a lot of concerns or fears to society. The World Health Organization (WHO) declared COVID-19 as a pandemic when the illness became severe and spread quickly over a wide area [1]. The need to curb the spread of the covid-19 pandemic has been a major headache in society. Scientist has done so much research and came up with many preventive measures. The need to always wash our hands regularly is one of the best proffered preventive measures to curb the spread of the virus [2]. Similarly, water wastage happens in the event centre, restaurants, malls, mosques, churches, and also at home. due to the negligence of tap users or due to sophisticated tap used that visitors may not know how to operate [3], [4], [5]. Due to the low or unavailability of automatic water taps, the gatherings depend on low-cost mechanical water taps. One of the

problems of using mechanical water taps for handwashing is in its method of operation. Mechanical water taps need the user to the open handle and wash hands [6], then close the handle again causing contamination and increasing the means of spreading the virus.

The washbasin is the place where the hands are being washed by the people. Nowadays most of the work that is done through the manual method is being automated. Things are becoming smarter and smarter day by day. People are inventing new things to live a life in an automated way.

Presented here is a simple electronic circuit that can control the valve operation by sensing any obstacle obstructing the transmitted signals with the help of a Passive Infrared (PIR) motion sensing module. Practically, automatic taps are regarded as presence sensors not as motion sensors. The technology senses "presence" and not "movement" of objects [7]. The system is sensor-based and the tap starts whenever it senses hand in front of the sensor [8].

II. METHODOLOGY

The design procedure in this work involves three major stages namely: Solar powered, transmitter, and the receiver section. The system operates once the tap controller detects an obstacle or a hand just below the water droplet where the infrared sensor is placed, water gush out of the tap. The solar panel supplies an uninterrupted power supply for the effective performance of the system [9], [10]. The circuit is built around 555 timers and comprises transmitter and receiver sections, the transmitter and the receiver work off 5V DC. The IR rays uninterruptedly give out by the transmitter fall on the receiver [11]. As soon as an obstacle comes in between the receiver and the transmitter, interrupting the IR rays, The IR sensor incorporated with the receiver goes low momentarily as the receiver signals from the transmitter are low. The timer circuit in the receiver is triggered and the solenoid valve is actuated which makes water come out for eleven seconds through the tap.

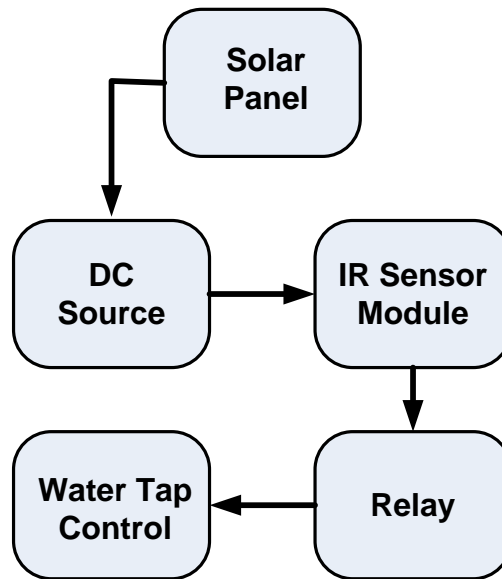


Fig. 1. Block diagram of the system

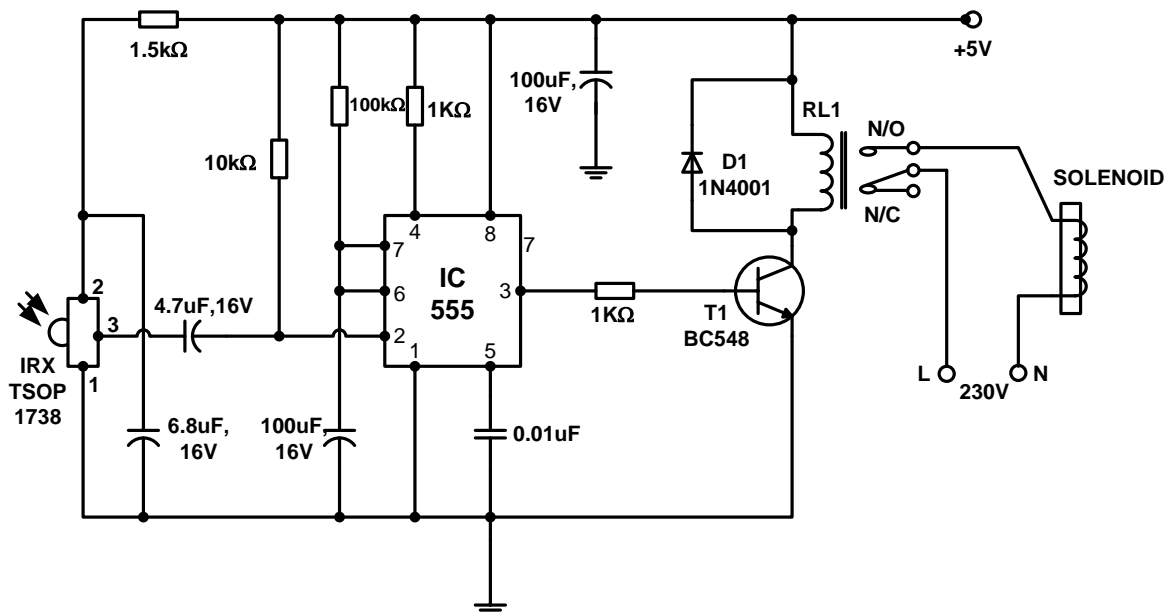


Fig. 2. Circuit diagram of the system

A. Circuit Operation

When IR rays falling on the receiver are interrupted, the sensor output goes low momentarily to trigger timer IC. The output of the timer reaches a peak point for eleven seconds and the relay drives the solenoid [11]. During this period, the energization of the solenoid lifts up the valve fitted in the pipe to let water flow out of the tap [12].

The relay driver circuit consists of a resistor, transistor BC548, and free-wheeling diode D1. Diode D1 protects the relay from damage by

high voltages generated by the back emf when the relay is de-energized.

Shielded wires are used for installing the IR LED and the IR sensor at opposite sides of the washbasin. The IR LED and IR sensor was installed around half a metre apart such that the IR rays transmitted by the IR LED directly fall on the IR sensor. The power supply was switched ON to the circuit. Whenever hands were put between the IR LED and IR sensor, the relay energizes to make the solenoid open up the valve and water flows out of the tap.

- B. Advantages**
- ❖ Shutting off automatically after hand washing.
 - ❖ Reduces water wastage
 - ❖ Fast sensor activation.
 - ❖ This tap is safe for the child.
 - ❖ This system is low-cost automation project
 - ❖ Easy to install and with high precision
 - ❖ Low Power Consumption
 - ❖ Save money on water bills and energy consumption.
 - ❖ Hygienic solution.

C. Disadvantages

- ❖ Extra Cost is required to introduce this framework.
- ❖ The sensor detecting separation is low.
- ❖ It requires an uninterrupted power supply.

D. Applications

- ❖ Home Application
- ❖ Hotel and eatery.
- ❖ Schools and Industrial Application
- ❖ Hospital
- ❖ Public borehole

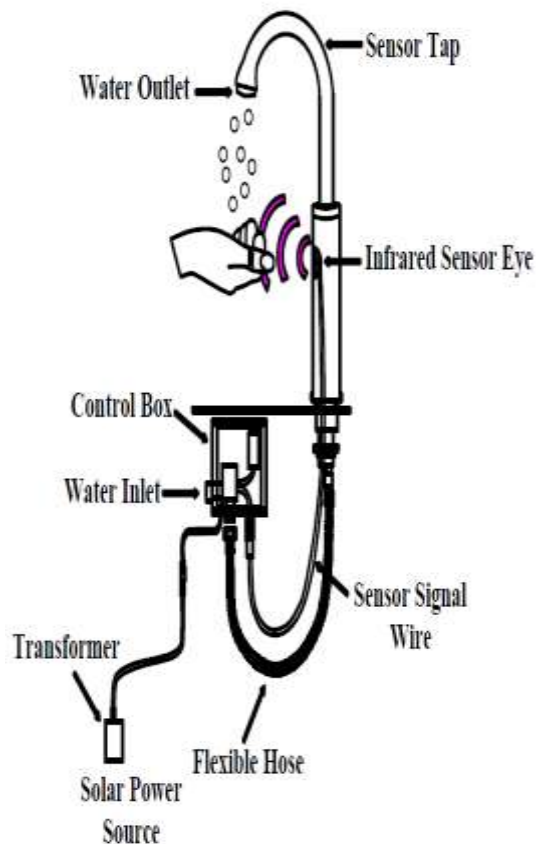


Fig. 3. The complete diagram of the automatic wash hand basin system

RESULTS AND DISCUSSION



Plate 1. Pictorial diagram of the electrical connection.

Plate 1 shows the pictorial diagram of the electrical circuit, with the control box beneath the wash hand basin and the 13Amps switch socket outlet to power the circuit, the purpose of the switch socket outlet is to switch ON/OFF whenever repair and maintenance need to be carried out.



Plate 2: Pictorial diagram of the water inlet and the sensor signal wire.

Plate 2 shows the pictorial diagram of the sensor signal wire, flexible cable, control box, and the water inlet respectively. Plate 3 displayed the pictorial diagram of the infrared sensor eye, sensor tap, and the water outlet point.



Plate 3. Pictorial diagram of the wash hand basin.

The result has shown that this design is the best option for economical and safety purposes. The system can be installed in different places and locations such as banks, supermarkets manufacturing companies, schools and other public places. This design is helpful, less stressful, reduces means of contacting covid-19 disease and it is also a big relief to society. The design is a welcome idea, unlike other alternatives in which individuals will control the tap for water to flow out and it eventually leads to wastage of water due to carelessness or when the tap controller is out of control. Meanwhile, it should be noted in mind that making contact with the manual wash hand basin tap controller is similar to making contact with the real body because a COVID-19 victim might transmit the virus in whatever he/she makes contact with.

CONCLUSION

With available facts, including the research of scientists, particularly WHO, Regular washing of hands has been one of the most preferred preventive measures proffered to curb the spread of Covid-19 by WHO. It is evident that the solar-powered automatic wash hand basin will boost energy efficiency and users will save money on water bills and energy consumption, it will be of

great importance when installed at different gatherings such as home, hotels, eatery, schools, mall, and many more. Hence, the system will help in automating the work of human beings with great ease and without any difficulty which will make the tap to last longer, reduce water usage, and also guide against any form of germs or diseases from cross-contamination.

REFERENCES

- [1]. WHO (2020), WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>, Accessed 15th April, 2020.
- [2]. Herbert W.; Thobius J. & Mauna B. C. (2020) War against Coronavirus (COVID – 19) in Tanzania: Designing a Low Cost Automatic Water Tap, International Journal of Computer Applications Technology and Research, 9(4), 150-154
- [3]. Sriram, V.; Tharun, V. & Vandana, A. (2020) Automatic Handwash & Automatic Control by PIR Module. Koneru Lakshmaiah Education Foundation, Vaddeswaram-522 502
- [4]. Al-Yemni, A.; Al-Balam, S.; Al-Kulib, S. & Abu Al-Haija, Q. (2018) An Arduino Based Smart Faucet Design, An international journal of advanced computer technology, 7 (5), 2752-2754
- [5]. Hassan J. (2016) Logical Automatic Water Control System for Domestic Applications, Proc. of Sixth International Conference On Advances in Computing, Electronics and Electrical Technology, 159-162
- [6]. Akash, C.; Prathap, S. G. & Dwarakanath, S. K. (2018) Automatic Water Dispenser, Journal of Control and Instrumentation Engineering, 4(3), 5-9
- [7]. Hareendran, T. K. (2015) <https://www.electroschematics.com/water-tap-faucet-controller>, Accessed 25th May, 2020.
- [8]. Jaspalsgr (2015) <https://www.instructables.com/id/Automatic-water-tap-using-555-timer>, Accessed 25th May, 2020.
- [9]. Adalakun, N. O. & Olanipekun, B. A. (2019) A Review of Solar Energy, Journal of Multidisciplinary Engineering Science and Technology, 6(12), 11344 – 11347

- [10]. Olanipekun, B. A. & Adelokun, N. O. (2020) Assessment of Renewable Energy in Nigeria: Challenges and Benefits, International Journal of Engineering Trends & Technology, Vol. 68, Issue 1. Pp 64–67 <http://doi.org/10.14445/22315381/IJETT-V68I1P209>
- [11]. Akshay M. & Abhay, M. (2017) Automatic Washbasin Tap Controller, www.electronicsforu.com/electronics-projects/automatic-washbasin-tap-controller, Accessed 25th May, 2020.
- [12]. Preeti M. (2015) Automatic “Anti Water-Flooding” Supervisory System, Using Wireless Water-Level Sensors, International Journal of Computer Science and Network, 4(4), 612-621