OPEN ACCESS JOURNALS
Indiana Journal of Multidisciplinary Research
Abbreviated Tittle- Ind J Multi Res
ISSN *(Online)*- 2583-3820
Journal Homepage Link- https://indianapublications.com/Journals/IJMR
DOI: https://doi.org/10.5281/zenodo.21623722

INDIANA PUBLICATIONS
PRODUCTIVE AND QUALITY RESEARCH

Research Article

Volume-06|Issue-04|2026

Contactless Water Dispenser Using IR Sensor

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Article History
Received: 05.05.2026
Accepted: 22.06.2026
Published: 25.07.2026

Citation
Kumar, H., Manoj, A., Murthy, A. N., Kulkarni, G., Abhinav, A., Gowda, U., Nirmala, Y. N., Mekali, H. V. Savitha, G. & C.Rangaswamy (2026) Contactless Water Dispenser Using IR Sensor. *Indiana Journal of Multidisciplinary Research, 6*(4), 504-508.

Abstract: In this paper the design and implementation of a low-cost contactless water dispenser using infrared (IR) sensor is displayed. The model is built using Arduino UNO microcontroller, IR sensor for detection of and object, relay module, water pump motor and jumper wires. When the glass is detected by the IR sensor, the Arduino triggers the relay module to activate the motor and hence water is obtained in the glass without any physical contact. This project was tested and proved to be successful in real time scenarios. This can be used in schools, colleges, offices and other public events. The construction of this model is simple and cost effective, scaling more hygiene as no physical contact in any manner is required.

Keywords: Infrared rays, osmo-regulation, Adafruit, IoT, COVID-19

INTRODUCTION

Access to clean dispensable water is a need in the society we live in. Most of the water dispensers currently being used, even though effective, rely a lot on manual operation and lack automation and hygiene. With the advancement in IoT, it is now possible to develop an Automatic water dispenser which is cost effective as well as hygienic.

This project shows how a smart water dispenser can be made using jumper wires, relay module, IR sensor and DC motor. In the wake of increasing interest in automation and health safety, particularly after the COVID-19 pandemic, contactless dispensing solutions have become more relevant than ever [1].

The benefit of IR sensor is that it can be bought at a low cost, and it can sense objects without physical contact. Other works, for example Applied fuzzy heuristics for automation of hygienic drinking water supply system using wireless sensor networks, have shown how automation and sensors can enhance hygiene and control systems in water.

In conclusion, the smart water dispenser is a mix of electronics and automation [3]. This project is a small step towards advancement in utilization of devices, to automate and increase hygiene. This project can be a foundation for advancement in automated water management system that can be upcoming.

Cloud Database Reporting: Store the user data in the cloud for analysing and providing a long-term report, as well as provide optimization depending on the location of use.

Water Quality Sensors: Sense the pH of water and let the user know whether the safety standards of water are met or not.

MATERIALS AND METHODS

Arduino UNO / Microcontroller:

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Arduino Uno is based on the processor ATmega328p, and is an open-source microcontroller board that helps create interactive projects giving smart solutions by automation ARDUINO.CC [7],

Function:

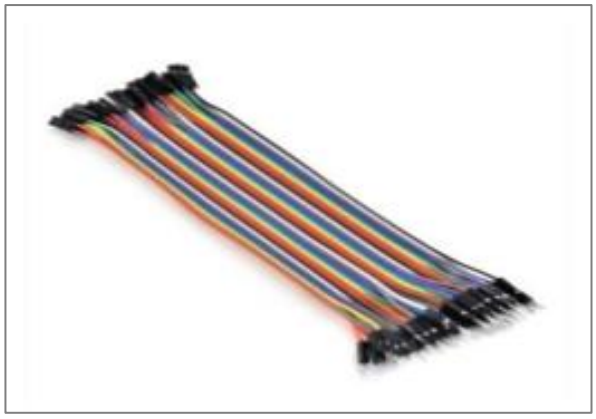
- It avails a variety of input and output pins that can be used to interact with various devices.
- It controls the duration of water flow based on the optimum distance based on the IR sensor readings [8].
- It executes the embedded program that enables the dispenser to function.

2.IR sensor:

IR sensor is an electronic device, that emits light to perceive and detect the objects of the surroundings. An IR sensor detects the motion of the object in the **infrared spectrum**. There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers (photodiode) and signal processing [9]. Infrared lasers and Infrared LED's of specific wavelength used as infrared sources.

The detected information is used to calculate the distance between the sensor and the nearest object. In our project, the Arduino will interpret the distance with the help of an IR sensor, i.e., hand movement in front of the sensor, for the initiation of water dispensation through the water pump [10].

3.Jumper Wires:



Jumper wires are short, flexible conductors that provide essential, electrical, temporary connections between the different components used in the prototyping, troubleshooting, and connecting various components.

Supplies power from the external source of energy or Arduino to the passive electronic devices.

Translocation of data and signals from the Arduino board to respective devices and vice versa based on the function of the individual devices.

4.Single Channel Relay Module:

A one-channel relay module features a single relay, allowing to control a single high-powered electrical device, such as a lamp or motor. The relay on the module can handle up to 10 amps of current at either 250 volts AC or 30 volts DC [11].

5.Water Container:

A temporary water container or tank is used in the project for the purpose of safe and hygienic storage of portable water. Based on real time project requirements and safety considerations the material and size will be selected.

6.Water Dispensing Tube:

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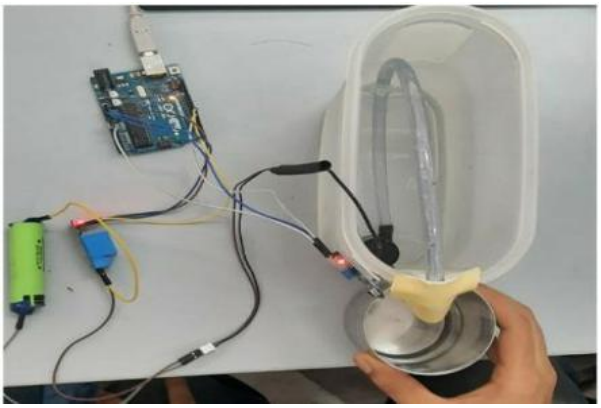
The water dispensing tube is characterized by food grade and non-toxicity. The tube is highly durable and flexible for easy dispassion of water from the water pump.

7.Water pump:

Water pump moves water from one place to another by creating a pressure difference. This works by converting mechanical energy, often from an electric motor, into hydraulic energy, which then forces the water to flow [12]. This is achieved through various methods, such as using rotating impellers to create centrifugal force or mechanically displacing a fixed volume of water.

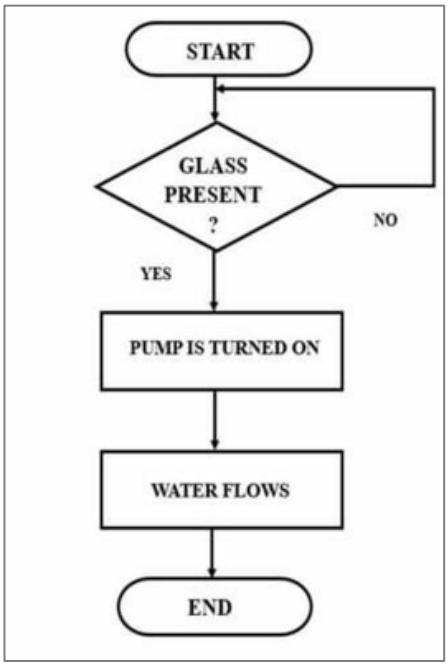
The IR sensor used in this project is an electronic sensor which contains an emitter (IR LED) and receiver(photodiode). Here is a detailed explanation on how it works:

The rays emitted by the IR LED travels continuously until it comes into contact with an object in its path. On hitting the object, a part of the rays gets reflected and is detected by the photodiode. The photodiode is a passive device whose resistance decreases when light is incident on it. The output voltage experiences fluctuations due to decrease in resistance.



These voltage fluctuations on detection, transmit a signal informing the Arduino that an obstacle is an placed in its path, leading the Arduino to send a HIGH(1) signal to the relay module which in turn closes the circuit of the water motor.

The submerged motor draws water from the container and dispenses water out through the tube as long as an object is detected by the IR sensor [13] . When the object is out of range of IR sensor, IR rays are no longer detected by the photodiode and hence Arduino sends a LOW(0) signal to the relay module which breaks the circuit of the water motor and dispensation of water stops.



RESULTS

The contactless water dispenser plays a significant role in healthcare IoT. These water dispensers are easy to handle by all age groups of people. This device is budget-friendly and helps to improvise the outlook of the location installed. Since the regional population is unaware of the fast-developing technology used in this

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contact less water dispenser, the vast usage of the device is low.

DISCUSSION

Smart Monitoring: IoT sensors can be added to track the usage, detect leaks, and alert the users that there is a problem.

Automated Water Refill: In institutions, apartments and houses the dispenser could monitor water tank levels and automatically notify the concerned authorities or automatically refill water up to the required level ensuring there is 24/7 water supply available.

Voice Controlled Dispensing: Utilization of voice assistant (like Alexa) can help to obtain water when required with lesser effort by the user and is very useful for senior citizens as well as people who are specially challenged.

Contactless water dispensers provide better water-management services as well as play a vital role in acting as a barrier during tough pandemic times. The significant objective of the above project is to maintain social distancing and prevent the spread of communicable diseases. Installation of these contactless water dispensers in public and socio-religious gathering places promote effective and hygienic water usage by the people and prevents wastage of enormous amount of water. In the present environmental conditions, there is a great strain on water resources in the rapidly growing population. Hence effective water management is the need of the hour.

Additionally, these contactless water dispensers installed with a specific water dispensing application connected to mobile phones through wireless media can set the quantity of water to be dispensed. This can facilitate the users to keep a track of water consumption per day to monitor conventional osmo-regulation of the body for both patients as well as fitness-freaks.

CONCLUSION

Since the water dispenser uses contactless technology, it ensures that hygiene is maintained, mainly in public places such as offices and hospitals.[14] Recently after the advent of covid-19 the usage of contactless devices has gained more importance due to the as virus's ability to spread through contact making this contactless water dispenser a valuable idea.

This project represents the diversity of IoT technology in terms of usage of sensors and other devices. In the future this project can be modified to dispense certain amounts of water by controlling it through a specifically designed application [15] . Other ideas which can be implemented in future are using voice recognition which can be achieved using Adafruit IO web interface which allows for remote and easier working of the motor [16].

There are a few demerits too like Environmental factors such as rain, fog, dust, direct sunlight, limited range of operation, Interference cause by due to Microwaves or radio waves, temperature sensitivity and many more. But An attempt can be made to overcome these demerits by modulation of IR signal, usage advanced filters and optics in the circuit, proper shielding, and regular maintenance of the contactless water dispenser for sensor calibration [17]. Thus, if we are successful in solving most of the disadvantages one day this contactless less water dispenser can be mass produced and be made available at an affordable cost all around the world.

FUTURE SCOPE

Smart Monitoring: IoT sensors can be added to track the usage, detect leaks, and alert the users that there is a problem.

Automated Water Refill: In institutions, apartments and houses the dispenser could monitor water tank levels and automatically notify the concerned authorities or automatically refill water up to the required level ensuring there is 24/7 water supply available. [18]

Voice Controlled Dispensing: Utilization of voice assistant (like Alexa) can help to obtain water when required with lesser effort by the user and is very useful for senior citizens as well as people who are specially challenged.

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