COMPUTOLOGY: Journal of Applied Computer Science and Intelligent Technologies
Volume 1, Issue 2, Jul-Dec 2021, pp. 14-18
DOI: 10.17492/computology.v1i2.2102
https://www.journalpressindia.com/cjacsit

Low Cost Touch-Free Hand Sanitizer Dispenser to Fight against COVID-19

Ravi Tomar and Tanupriya Choudhury***

ABSTRACT

The world is facing a pandemic situation with COVID-19. The most prominent solution to this pandemic is to ensure self-hygiene, social distancing and building stronger immunity. The way of living has been affected in this pandemic and it is suggested to sanitize hands very frequently. The conventional way of sanitizing the hands through a spray based or press based bottles leaves with a risk of getting virus infection while trying to protect it. The technology has evolved so much that we can think of the impossible being done. This revolution is because of sensors and information technology. Earlier the use of sensors was limited to only big industries controlling critical production activities, whereas today sensors are available at very low cost and are in proximity of all individuals. Sensors and actuators together help to form practical solutions. To meet the needs of the society in this pandemic, efforts are being made to ensure cost-effective solutions. This work provides such a solution to develop a touch-free hand sanitizer dispenser and is focused on providing a cost-effective solution to win over the coronavirus.

Keywords: COVID-19; Sanitization; Pandemic; Dispenser; IoT.

1.0 Introduction

The world is struggling with the biological enemy i.e. novel coronavirus(COVID-19) disease, WHO has declared it as pandemic on 11th March 2020[1]. Almost all country around the world are infected by the virus and even after 3 months of excessive efforts the virus is still expanding. Globally, as of 2:42 pm CEST, 2 June 2020, there have been 6,194,533 confirmed cases of COVID-19, including 376,320 deaths, reported to WHO.[2]. According to WHO, no vaccine is available as on date and only precautionary steps need to be taken to avoid getting the infection.[3] The only cure to this virus is to stay safe and maintain social distancing. Various safety measure has been issued by WHO[3] to reduce the chances of being infected by the virus, the primary one is to wash hands frequently and/or sanitize them with alcohol-based sanitizers. The problem identified here is prominent to the nature of the virus, if a person presses the soap dispenser or alcohol dispenser then there are chances of leaving the virus on the dispensing utensil. This may lead to further spread of the virus. This work focus on avoiding physical contact with the dispensing utensil and still able to meet its purpose of sanitization. The work employs the usage of electronic sensors and actuators to sense the human hand and dispense the sanitizer. The work also emphasises on bringing this feature at a very low cost to help everyone use it. The paper is further divided into X sections

**Corresponding author; School of Computer Science, University of Petroleum and Energy Studies, Dehradun, Uttarakhand, India (E-mail: ravitomar7@gmail.com)*
***School of Computer Science, University of Petroleum and Energy Studies, Dehradun, Uttarakhand, India (E-mail: tanupriya1986@gmail.com)*

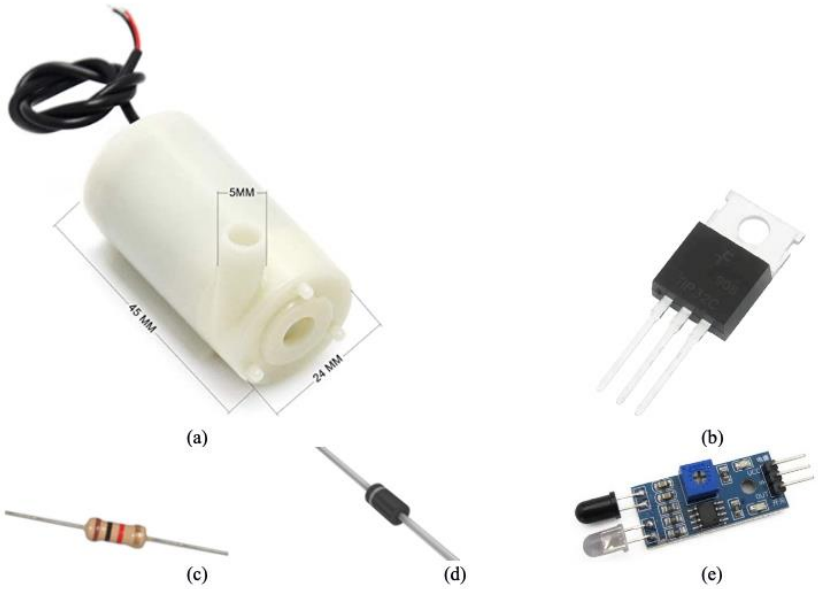
2.0 Components Used

This section presents the details of the required components involved in building the touch free hand sanitizer dispenser. While keeping in mind to build a low cost device, we have optimally chosen the electronic components to fulfil our requirements. The four components used are DC Water Pump, TIP32C PNP Transistor, 1 KΩ resistance, 1N4007 Diode and IR proximity sensor. The Fig.1 presents the images of the components used and following subsections briefly explains the components.

2.1 DC water pump

The DC Water pump motor are the low cost DIY submersible pumps, they operate on low voltage ranging from 3V to 5V and very low current consumption of 220mA.[4]The motor is available on mostly all online shopping sites and local electronic store. The cost of the pump is merely 40INR.

Figure 1: Components used (a) DC Motor (b) TIP32C Transistor (c) 1KΩ Resistance (d) 1N4007 Diode (e) IR Proximity Sensor



2.2 TIP32C PNP transistor

The transistors are the electronic component which are either PNP or NPN[5], the transistors are used in switching applications and amplifications. The transistor comprises of three pins namely Base(B), Collector(C) and Emitter(E). The gate pin controls the flow between the collector and emitter. The TIP32C PNP transistor[6] is used for this project due to its sufficient voltage and current requirement for this work. The cost of TIP32C is only 18INR.

2.3 Resistors

The resistors are the current controlling components, they are used to control the current flow and also as voltage dividers[7]. Resistors are measured in ohms. The resistor used for the present work is 1KΩ and is merely cost 1 INR.

2.4 Diode

The diode are the semiconductor device and are used to control the flow of current. The diode possess the property to allow flow of current in only one direction. The present work uses 1N4007 diode as a flyback diode. This diode is connected between the inductive motor load terminals. The cost of 1N4007 is 5 INR only.[8]

2.5 IR proximity sensor

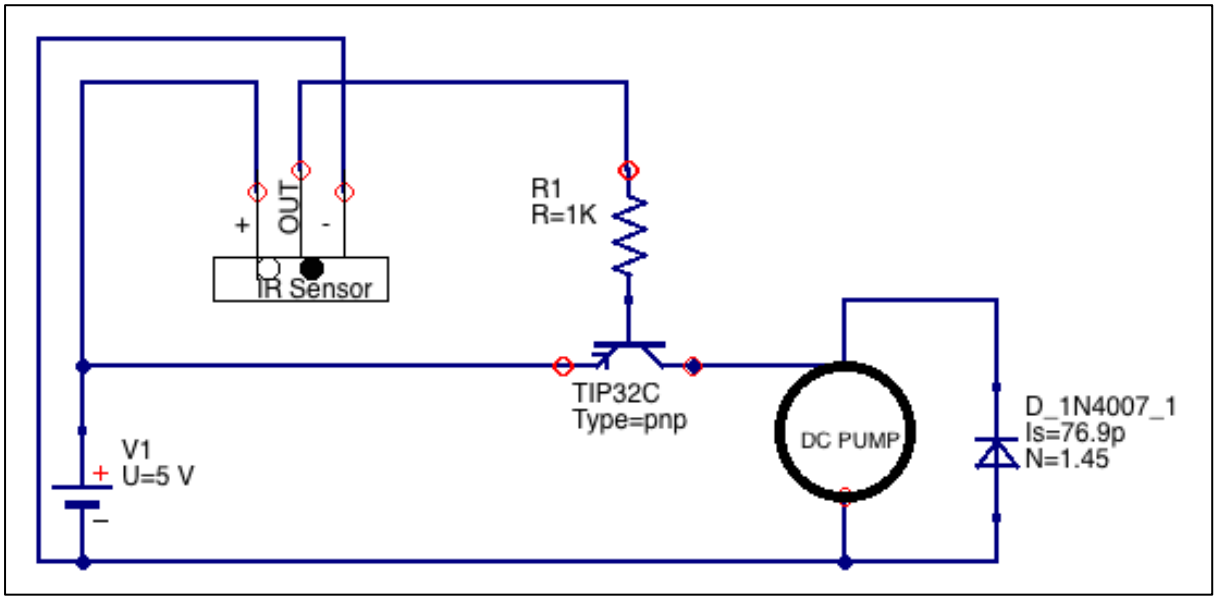
The IR proximity sensor is the combination circuit of 2 IR diodes, i.e. the emitter and the receiver. The emitter emits infrared rays, and if an object comes on the way of the infrared rays they are reflected. The receiver IR diode detects the receiving rays and triggers the output pin. The sensor operates on 3V to 5V, the sensor used in this work is available easily in 120 INR.[9]

3.0 Implementation

The components discussed in the previous section are the building blocks for the proposed device. The components are chosen such that the device can be operated on low voltage 5V DC supply such as a power bank or commonly available mobile phone chargers. The circuit wiring diagram is presented in the Fig X given below, the V1 is the power source of the circuit and the anode is connected to the Vcc pin of IR sensor and ground pin is connected to the cathode. This connection makes IR sensor to work, now if a hand or an object is detected in front of the sensor the output pin creates a signal. This signal represents the turn-on signal for the DC motor.

However, if we connect the DC motor directly to the output pin, this will create a heavy load requirement on the sensors output pin and may damage the sensors circuitry.

Figure 2: Circuit Diagram for the Proposed Device



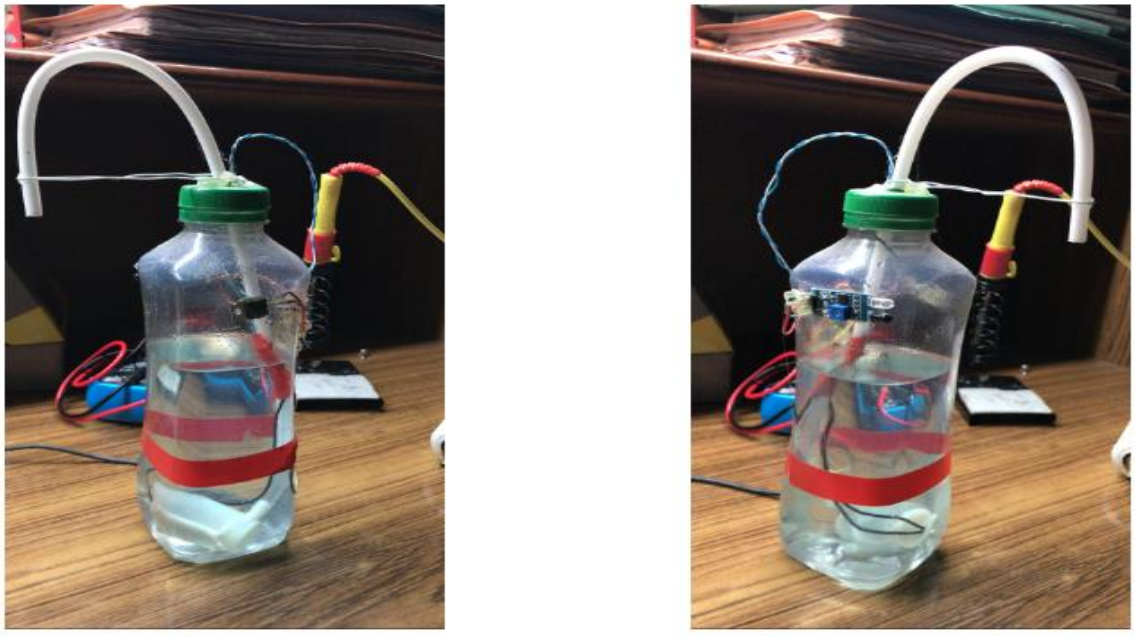
Moreover, by default the out pin is high and detecting an object creates resistance and makes it low, this configuration will require an additional inverter circuit to make the desired behaviour. This is the reason for using the TIP32C transistor to employ a cost-effective and minimal circuit to get

desired working behaviour. The base pin of TIP32C transistor is connected in series with a 1KΩ resistor to strong pull-up and prevent short in the circuit. This base trigger enables the flow of electrons between the collector and the emitter. Further, we connect the anode of the power source to the collector pin of transistor and the emitter is connected to the positive terminal of the dc motor. The negative terminal of the motor is grounded to the cathode of the power source. The system is in the working condition now, but still has a drawback of back EMF from an inductive load like DC motor in our case. The back EMF is also called as flyback, the flyback is a sudden voltage spike across the load when its supply is interrupted. The flyback diode 1N4007 is connected between the positive and negative terminal of DC motor to avoid flyback.

4.0 Results & Discussions

The circuit created in previous section is assembled to create a fully working model as shown in Fig. X below. The DC motor is dipped inside a sanitizer bottle, a small hole is performed on top of the bottle cap to bring out the 5mm output pipe of the motor and the wire of motor. The IR sensor is placed near the mouth of the pipe such that if a hand is detected then sanitizer is dropped on the hand through the pipe. The remaining circuit is kept hidden behind for better design. The device is performing as desired and the overall cost of components is about 200 INR or 3$. The image below demonstrates the front and back view of the devised product.

Figure 3: Final Working device front and back view



5.0 Conclusion and Future Work

The work concludes by providing a low cost touch free hand sanitizer dispenser, the concepts and the circuit diagram are well explained in this work. The limitation of the work is the operation of proximity sensor in open area, due to its interference with IR rays from the sunlight. The limitation

can be achieved using the ultrasonic sensor in place of IR based proximity sensor or by using a microcontroller in between the sensor and the actuator. The use of microcontroller will increase the cost and will defy the purpose of the work. However, for future version the work is been carried out to include a microcontroller to enable remote monitoring and other IoT features in the same device. The inclusion of different services with the help of microcontroller will make cost vs service balance and shall provide a good trade-off between the cost and features.

References

1. "WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020." [Online]. Available: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020. [Accessed: 03-Jun-2020].
2. "WHO Coronavirus Disease (COVID-19) Dashboard." [Online]. Available: https://covid19.who.int/. [Accessed: 03-Jun-2020].
3. "Advice for public." [Online]. Available: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public. [Accessed: 03-Jun-2020].
4. "Submersible Mini Water Pump buy online at Low Price in India - ElectronicsComp.com." [Online]. Available: https://www.electronicscomp.com/submersible-mini-water-pump-india. [Accessed: 03-Jun-2020].
5. H. W. Henkels, F. S. Stein, and F. S. Stein, "Comparison of N-P-N Transistors and N-P-N-P Devices as Twenty-Ampere Switches," IRE Transactions on Electron Devices, Vol. 7, No. 1, pp. 39–45, 1960.
6. "TIP32C STMicroelectronics | Mouser India." [Online]. Available: https://www.mouser.in/ProductDetail/STMicroelectronics/TIP32C/?qs=ljbEvF4DwONbJ5tF0yFRvw%3D%3D&gclid=Cj0KCQjwlN32BRCCARIsADZ-J4sKp079ghypRpJ0dj5fd6_btmBFP2_O49rVAvuOdNaflJCwC7HZvwcaAko3EALw_wcB. [Accessed: 03-Jun-2020].
7. F. Y. Wu, Theory of resistor networks: The two-point resistance, *J of Phy A: Math and Gen*, **37** (2004) 6653–6673.
8. "1N4007 Diode: Pinout, Equivalents, Description & Datasheet." [Online]. Available: https://components101.com/1n4007-diode. [Accessed: 03-Jun-2020].
9. "IR Obstacle Sensor module IR Obstacle Sensor module [RKI-3141] - ₹140.00 : Robokits India, Easy to use, Versatile Robotics & DIY kits." [Online]. Available: https://robokits.co.in/sensors/ir-and-pir-sensors/ir-obstacle-sensor-module?gclid=Cj0KCQjwlN32BRCCARIsADZ-J4vlusxMKKJ2hGoJLex2oPEI8Tjse_hKFotoFyZElFfdYZhgj6LyJkkaAma9EALw_wcB. [Accessed: 03-Jun-2020].