RESEARCH ARTICLE

DEVELOPMENT OF AN AUTOMATIC HAND WASHING DISPENSER COVID 19

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ARTICLE INFO	ABSTRACT
	The outbreak of coronavirus (COVID 19) has led to the death of over 400,000 all over globe and over 7 million of confirmed cases within five months and exact drug for immunization and cure has not been obtained but preventive measure can be taken. One of such preventive measures involved washing of hand regularly, especially in the public like schools, shopping centers, religion centers, offices, bankse.t.c need to have automatic hand washing dispenser. In this work a low cost automatic hand washing dispenser was developed. It consists of three containers with soap, water and sanitizer, horse, 12 V dc pump, proximity detector, Arduino board, multicolor LED indicator, and battery plus solar power source. All are housed inside metal rectangular box including washing metal steel basing. Arduino microcontroller is used to coordinate the activities, it monitors the three ultrasound wave that travel from the transmitter to the receiver and compute for distance for each ultrasonic sensor. Distance used in detecting the present of hand is 15 cm, any object closed to the sensor less than that distance its triggers soap or water or sanitizer pump and fluid flow at predetermine time. The soap and sanitizer flow for 100 ms and water for 1 s. The operating time is 2000 ms, i.e time taken when hands are placed under the sensors and discharging of fluids is2000 ms.

INTRODUCTION

Since the outbreak of coronavirus called COVID 19,for some months ago it has created fear on the existence of human being. A COVID 19 cases as at June 14, 2020 on statistics and information officially released by World Health Organization (WHO) website have 7,690,708 confirmed cases and 427,630 deaths (https/covid19.who.int/?glcid=EAlai). It was further broken down by the World Health Organization according to continent in Americas, Europe, Eastern Mediterranean, South-East Asia, Western Pacific and Africa confirmed cases were 3711768, 2398779, 758551, 455439, 197864 and 167566 respectively. As at the time of compiling this information, United State of Americas has the highest confirmed cases while Africa has the least. During the period, offices, gymnastic centers, schools and shopping centers were closed down in countries around the globe. Economics activities shot down and people were under total lockdown, no movement and no transaction for many months. No specific drug has been found in treatment of coronavirus, but some measures are extremely necessary to prevention coronavirus which are: Often hands washing with soap and water and clean them with an alcohol-based sanitizer and this kills virus on your hands; practice social distancing to reduce the spread of the virus and

one should stay at home as much as possible, while going out, keep at least 6 feet away from others; wearing of face mask in the public to protect others reduces COVID-19, (this isn't a replacement for social distancing)there is need to keep a 6-foot distance between one and another; do not touch your face with because coronaviruses can live on surfaces touched for several hours. If they get on once hands and such a person touches his/her eyes, nose, or mouth, they can get into the body; and regularly clean and disinfect, one can clean first with soap and water, but disinfect surfaces one touch often, like tables, doorknobs, light switches, toilets, faucets, and sinks were very necessary approved material to treat SARS-CoV-2. (www.webmd.com/lung/coronavirus). The face covering is easy to obtain at cheap rate and social distance is easy to maintain. But regular hand washing in the public place is a thing of concern, especially in banks, schools, shopping complex, police stations, hospitals, government offices, market, worship centers like churches, mosque and view centers. There is need to developed very cheap automatic hand washing dispenser stress free, burden free and non-contagious.

Basic block diagram of covid 19 hand washing machine: The COVID 19 hand washing machine consists of three containers i.e containing soap, water and sanitizer, horse, 12 V dc pump, proximity detector, Arduino board, multicolor LED indicator, and battery plus solar power source. All are housed inside metal rectangular box including washing metal steel basing. The basic block diagram of the control circuit is shown in Figure 1.

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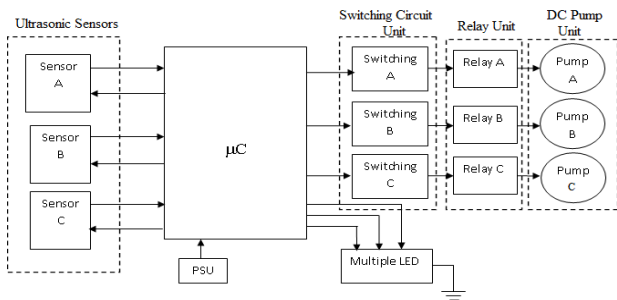Food Science and Technology, The Federal University of Technology, Akure.

Figure 1: The Block Diagram of an Automatic Hand Washing Dispenser for COVID 19

Metal Housing, Design and Construction: The metal housing is 14000 mm x 950 mm x 2800 mm. The metal housing is frame by using 1 inch angle iron and 1.5 mm iron sheet for covering. In the Figure 2 shows the constructed housing and position of the installed part.

Figure 2: The Constructed Housing

Sensing Unit: Ultrasonic sensors produce sound waves at frequencies (above 20KHz) which are beyond human hearing capability. A complete ultrasonic transceiver consists of a transmitter and a receiver. The ultrasonic sensor used in this work operates in the pitch catch mode. The transmitter and the receiver are installed at the same side thus functioning as a single transceiver. Ultrasonic transmitter emits an ultrasonic wave in one direction, and immediately starts a time counter. The wave spread in the air, and is reflected when encounters the obstacles along its path. The ultrasonic receiver stops the time count when it receives the reflected wave. Since wave velocity in the air is 340 m/s, and the wave's time of flight is recorded as t, we can calculate the distance h between the obstacle and the transmitter as $h = 340t / 2$. This is the echo method of probing depth otherwise known as time difference distance measurement principle. The Ultrasonic sensor used for this project is the Arduino ultrasonic range detector HC-SR04 shown in Figure 3. It is capable of detecting obstacle within a range of 2cm to 500cm with a voltage supply of 5 V (EF03085 HC-SR04 User Guide and Arduino Ultrasonic Range Detection Sensor HC-SR04 Manual). The sensor sends out an ultrasound of about 40 KHz when it is triggered through pin 2. As soon as the wave hits an obstacle, it is reflected and returned to the receiver so that a pulse (5 V) is produced by pin 3 (echo). (Theophilus*et al.,* 2019; Mohd, 2016).The Arduino microcontroller measures and records the time t taken by the ultrasound wave to travel between the transmitter and receiver. Distance used for the detecting of the present of hand is 15 cm, any object closed to the sensor less than that distance its triggers soap or water or sanitizer pump and fluid flow at predetermine. Soap and sanitizer flow for 100 ms while water for 1 s.
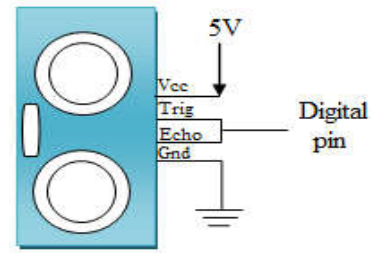

Fig. 3: The HC-SR04 Ultrasonic Sensor Connection

Switching Unit: The transistor switching device was employed to trigger a relay on in order to engage or disengage the pump. When 5V from digital pin of Arduino is at the base of the transistor, the base emitter junction conducts and allows current to from collector to the emitter through a load (relay) and then energized it (Buliaminu*et al.,* 2010). It activated until the digital pin of Arduino is at zero volt (LOW). The diode across the relay is to remove the back emf of the relay coil as shown Figure 4.
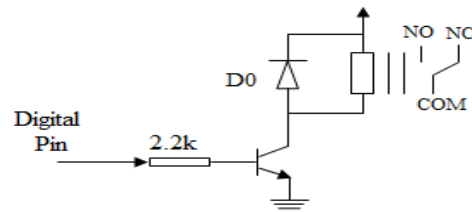

Figure 4: Switching Circuit

The flow liquid (soap, water and sanitizer) using pump

Pumps were used to raise the soap, water and sanitizer level and at intermediate points to boost the pressure for discharging the liquids.A centrifugal pump used consists of a rotating shaft that is connected to an impeller, which is usually comprised of curved blades. The impeller rotates within its casing and sucks the fluid through the eye of the casing (point 1 in Figure 5). The fluid's kinetic energy increases due to the energy added by the impeller and enters the discharge end of the casing that has an expanding area (point 2 in Figure 5). The pressure within the fluid increases accordingly.The rotating shaft was coupled to a dc motor that supply the propelling action. The small dc pump can deliver 2.5 liter per min, 12 V/0.3 A.
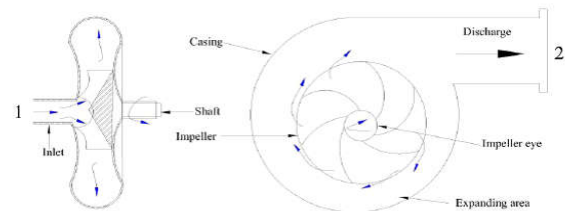

Figure 5. Schematic of a Typical Centrifugal Pump

ATmega328p Microcontroller

Microcontroller is small size computer containing processor core, memory and programmable input-output peripheral. Microcontrollers are designed for the use ofembedded applications, in contrast with microprocessor which are used for personal computers and other general purpose application Atmega328 is a low power, high performance; CMOS 8-bit

microcontroller based on the AV Renhanced RISC architecture. Atmega328 provides 32K bytes of in-system self-programmable memory with read while write capability and 1Kbyte EPROM (Ewetumo *et al.* 2019; Obagade and Ewetumo 2019)

Circuit Description: The three relay were used to drive the three pumps. The inputs triggers of the switching circuit were connected to digital pins 8, 9 and 10. Also, digital pins 5, 6 and 7 are in pinging mode to communication the ultrasonic finders. The distance of each finder is set to trigger at less than 15 cm. The complete Schematic diagram is shown on Figure 6. The LEDs indicator gives information on activities that is going on. Red, Green and blue indicate soap, water and sanitizer respectively.
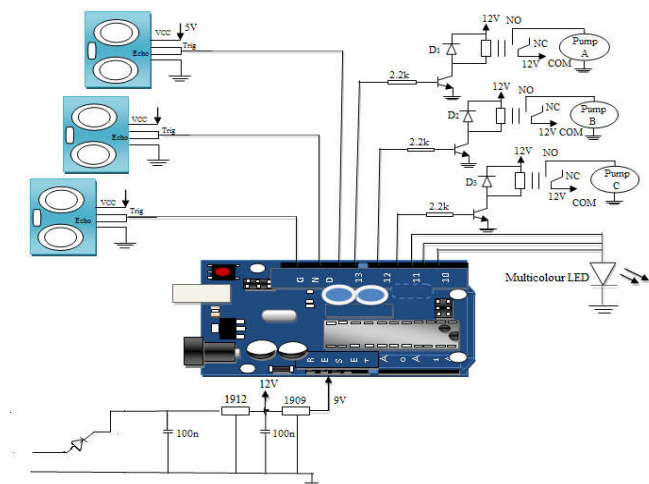

Figure 6. The Complete Circuit of an Automatic Hand Washing Dispenser for COVID 19

Testing and examination of automatic hand washing dispenser: The whole system was assembled as shown in Figure 7. Hand was inserted under each detectors and soap, water and sanitizer was coming out.It was discover that the time hand was inserted and time at which water comes out was about 2 seconds. It was tested repeatedly and function without malfunction. The energy source is from solar and battery.

Figure 7. Shows Completed Automatic Hand Washing Dispenser

Conclusion

In public places where people come IN and OUT every time like banks, schools, shopping complex, religion centers, government offices, hospitals and police stations require high precaution and prevention from coronavirus. Since other preventive measures like social distancing, covering of nose and mouth are easy to take care of. Washing of hand involves tap opening using manual or mechanical technique which is stressful and contagious. The developed automatic hand washing dispenser is stress and burden free. No energy requires in tap opening and the fear of tap damaging is completely eliminated. Even when closing the last tap one can still come in contact with virus if someone have mistakenly open before washing his or her hand with soap and water. Insertion of hand to dispenser prevent transmission of virus and delivers little quantity of soap, sanitizer and enough quantity of water is discharge to wash the hand.

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