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Article

Design and Implementation a Hand Sanitizer Dispenser using Arduino

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Abstract: This project includes an introduction to sterilization in general and making a sterilization device using the Arduino program, and a statement of the method of work and the devices used in its work, with clarification of the programming code in a sequential manner. The work is illustrated through a closed loop in the program code and with certain conditions. Finally, future work is discussed. Because sterilization plays an important role in our daily lives and keeping away from germs, diseases and viruses such as the Corona virus, which transmits the infection through contact from a person infected with the virus to a healthy person, and to protect against the virus, it is through not contact and good sterilization.

Keywords: Design.. Implementation ..Hand Sanitizer Dispenser ..Arduino

1. Introduction

During this pandemic and disease, it has become very important to make sure that we take all necessary steps to keep this virus away from us and prevent most diseases. There are several ways to avoid these epidemics and diseases, including adequate sterilization of everywhere and everything around us. The Sterilization is the process of eliminating all living organisms in a food item. In this type of heat treatment, the food product is exposed to a temperature of more than 120 degrees Celsius for a period of 10-30 minutes. The product treated in this way does not contain any microscopic cells, but it may contain some of these types of spores. Products sterilized in this way are commercially sterile [1]. It can also be said that sterilization is the process of getting rid of microbes and eliminating all types of microbial life, including bacterial spores present on tools, devices, surfaces and walls, through many methods, including physical and chemical. Sterilization using steam under a certain pressure, while the other that it includes is radioactive sterilization - chemical sterilization [2]. Sterilization using the Arduino is considered a breakthrough in the sterilizers used in the current reality, as its use depends on the Arduino program and all that Arduino piece. Certain software devices to manufacture a sterilizer using Arduino.

Aim of Project

The project is to build an integrated system for sterilization using the Arduino program primarily, and it includes many secondary devices. It deals with control methods,

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connections, and programming code to implement several matters and instructions to operate the system accurately and with a regular sensor to start operation.

2. Materials and Methods

The design and implementation of a hand sanitizer dispenser using Arduino involved a systematic approach that integrated hardware selection, circuit design, programming, and assembly to create a reliable and contactless solution. The hardware components included an Arduino microcontroller, an ultrasonic sensor for detecting hand proximity, a servo motor or pump for dispensing sanitizer, a relay module for controlling higher currents, and a stable power supply. The ultrasonic sensor was configured to detect hands within a specific range, ensuring a touchless and hygienic interaction, while the pump mechanism was designed to dispense sanitizer in a controlled manner.

The circuit design focused on connecting the ultrasonic sensor to the input pins of the Arduino and the dispensing mechanism to its output pins. A relay module was used to manage the pump's power requirements safely. The software was developed using the Arduino Integrated Development Environment (IDE), with a program designed to monitor sensor output and activate the pump when a hand was detected within the set threshold range. The code included a delay mechanism to prevent repeated dispensing during continuous presence, ensuring efficient sanitizer use.

Prototyping was conducted on a breadboard to validate the connections and functionality of the components before the final assembly. The components were then mounted onto a stable frame or enclosure that securely held the sanitizer bottle and provided ease of refilling and maintenance. Testing involved verifying the accuracy of the ultrasonic sensor and calibrating the pump to dispense an appropriate amount of sanitizer with minimal waste. Adjustments were made to the sensor's range to ensure optimal sensitivity while avoiding false triggers from nearby objects.

The system was powered using a DC adapter or battery pack to ensure portability and flexibility, with a voltage regulator added as needed to maintain a stable power supply. Further optimization was performed to enhance the system’s efficiency by reducing power consumption, improving sensor accuracy, and ensuring reliable operation under various environmental conditions. The final design was enclosed in a durable and visually appealing casing, suitable for both public and private spaces. This comprehensive approach resulted in a functional and cost-effective hand sanitizer dispenser, leveraging Arduino technology to promote hygiene in diverse settings.

3. The result and discussion

Aim of Project

The project is to build an integrated system for sterilization using the Arduino program primarily, and it includes many secondary devices. It deals with control methods, connections, and programming code to implement several matters and instructions to operate the system accurately and with a regular sensor to start operation.

System design

In order to achieve the desired functionality, we use the system below, which revolves around having Microcontroller (Arduino) as the core of the system.

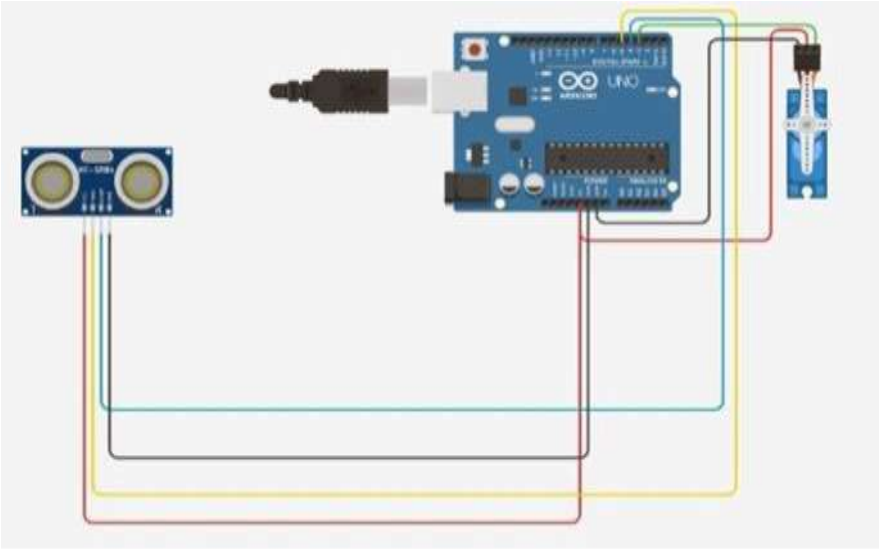

Figure (1): Circuit Diagram

4.1 System Component

4.1.1 Arduino Uno R3

The Arduino Uno is a microcontroller board based on the ATmega328P [3} as shown in Figure (2). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It includes all the necessary components to facilitate the operation of the microcontroller; you can either connect it to a computer using a USB cable or power it with an AC-to-DC adapter or a battery to begin. Table (2) gives the main specification [4].

Figure (2.): Arduino Uno R3[9]

4.1.2 HC-SR04 ultrasonic sensor

The HC-SR04 ultrasonic sensor employs SONAR technology to measure the distance to an object, similar to the method used by bats.

as shown in Figure (3). It offers superior non-contact distance measurement with high accuracy and consistent readings, covering a range from 2cm to 400cm or 1 inch to 13 feet,

all with a user-friendly design. Performance remains unchanged when exposed to sunlight or dark surfaces. However, soft materials such as cloth may cause detection problems. It comes complete with ultrasonic transmitter and receiver module, Table (3) gives the technical specification [5].

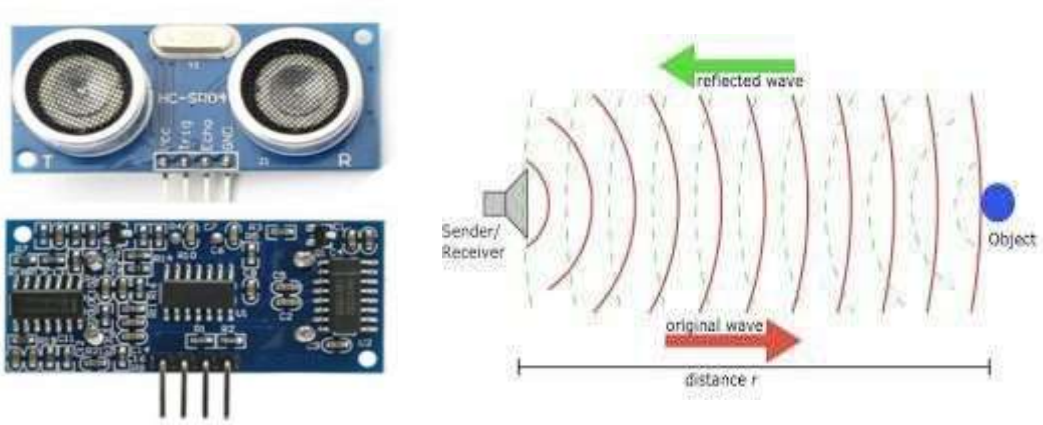

Figure (3): a-The HC-SR04 ultrasonic sensor
b- Waveform [10]

4.1.3 Servo Motor

** It offers exceptional non-contact distance measurement, characterized by high accuracy and reliable readings, covering a range from 2 cm to 400 cm or 1 inch to 13 feet, all in one intuitive design. Performance is not affected by exposure to sunlight or dark surfaces. However, detection issues may occur when measuring soft materials such as fabric.[6]. The motor requires a DC current and the voltage ratio is 4 to 6 volts [7]

Figure (4): Servo Motor

**Working of a Servo Motor with Arduino.

The principle of operation of this motor is when it is connected to the Arduino for the purpose of implementation, where it moves from 0 degrees to 180 degrees counterclockwise and returns from 180 to 0 degrees clockwise. The number of degrees of the motor and its rotation are controlled according to the type of code used in the Arduino, where they are connected to each other through connecting wires and a battery.The Servo Motor generally requires DC supply of 4.8V to 6 V [8].

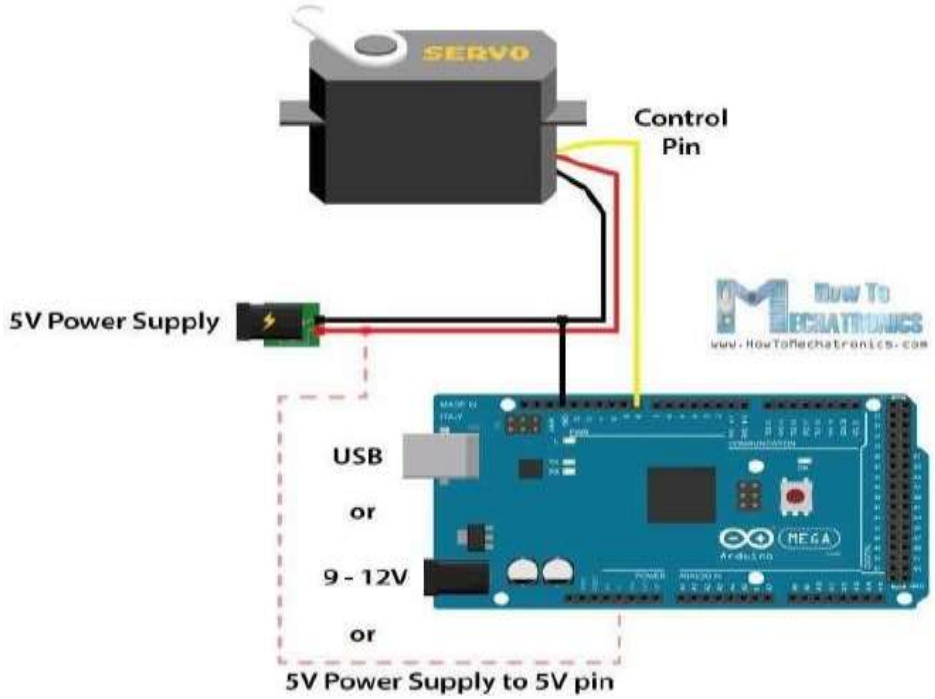

Figure (5): Servo Motor with Arduino

4.1.4 Ups Cable

An uninterruptible power supply (UPS), commonly known as a backup battery, serves as a backup power source in the event of a failure of the main power source or when the voltage level drops below acceptable thresholds. A UPS provides safe and systematic shutdown of computers and related devices. The length of time a UPS can provide power depends on its size and design.

-UPS Topologies

Measures to protect applications and sophisticated network equipment from harm resulting from power outages, voltage sags, voltage surges, overvoltage conditions, voltage spikes, frequency noise, frequency fluctuations, or harmonic distortion. [9]

The idea of working of this circuit is to sterilize without touching the device through which the sterilization is carried out. The Ultrasonic device is designed to detect ultrasound waves, enabling it to identify any object that moves within a specified distance, which can be set by the user in the programming code.That is, when the Ultrasonic device senses a foreign object passing in front of it, ultrasound waves will be issued to collide with the foreign body through one part of the device, and then these waves are bounced back to the other part of the device to be sensitized and identified. After receiving these waves, they are converted into the Arduino program code, and this program performs operations inside a closed loop, and when the desired result is obtained, it instructs the other device, which is the servo motor, to do its work, which is to rotate at an angle of 90 degrees determined by the user in the code, this is the main circuit job.

Connecting the circuit is through what was previously explained in the pictures.

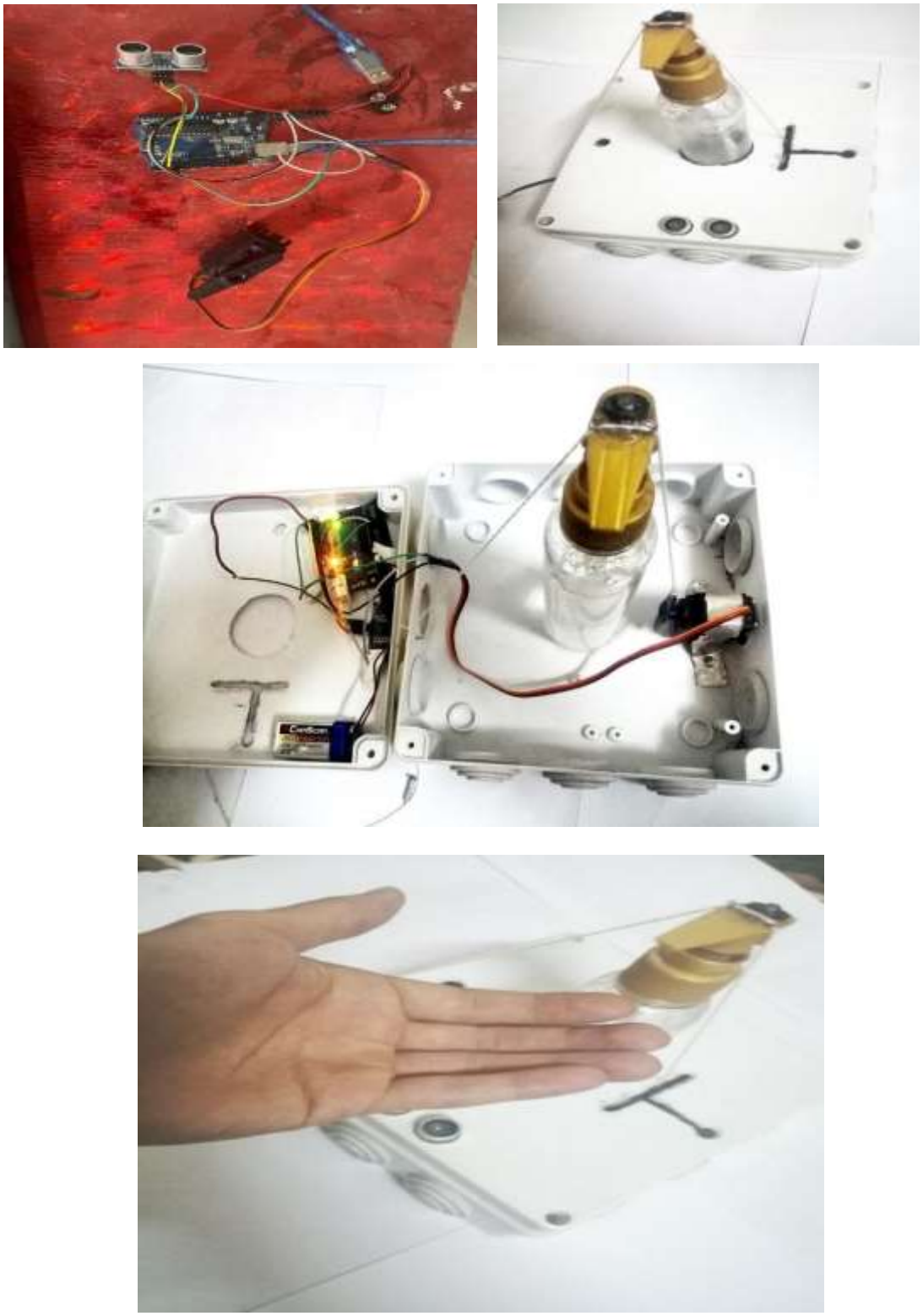

Figure (6): Circuit design of Arduino sterilizer in practically

4. Conclusion

The analysis of the circuit indicates that the primary component under control is the Ultrasonic device. This device detects any foreign object that comes within its range and subsequently directs the Arduino to execute the programmed sequence, ultimately providing the necessary output to the servo motor, thereby ensuring the optimal functioning of the device. The purpose of this topic is to stay away from diseases and

viruses that can be transmitted from one person to another through contact. We created this project to stay away from contact and maintain cleanliness. We hope to create a robot in the future similar to the sterilization project that sterilizes hospitals and places to create a healthy life.

REFERENCES

1. 1- a. M. Dr.. Asaad Rahman Saeed Al-Halfi - Food Laboratories Engineering - Lecture on Food - Department of Food Sciences, University of Basra.
2. Samih Al-Qarini-09-Vocational Training Corporation-Cleaning, preparing, disinfecting and sterilizing beauty centers.
3. 2022/5/18 https://www.arduino.cc/en/Guide/Introduction , Arduino home page
4. 2022/5/20 https://www.controlvoltage.net/search/arduino+mega/ , Control Voltage - Synthesizers & Music Electronics.
5. 2022/5/16, https://www.merriam-webster.com/dictionary/ultrasonic , merriam-webster SINCE 1828.
6. 2022/5/17, https://www.electrical4u.com/servo-motor-controller-or-servo-motor-driver , by Electrical 4 U./
7. Technical Explanation for Servomotors and Servo Drives, CSM_Servo_TG_E_1_1
8. 2022/5/20 https://www.academia.edu/41030652/Servo_Motor.pdf , by Fawaz Milli [8] 2022/5/20 https://www.cyberpowersystems.com/blog/how-does-a-ups-work/ , cyber power, power blog.
9. 2022/5/20 https://www.cyberpowersystems.com/blog/how-does-a-ups-work/ , cyber power, power blog.

Appendices

Table (1) Gives the main specification of Arduino UNO R3

Technical Specifications	Values and names
Microcontroller	ATmega328P
Operating Voltage	5V
Supply Voltage (recommended)	(7-12) V
Maximum supply voltage (not recommended)	20V
Digital I/O Pins - 14	(Of which 6 provide PWM output)
Analog Input Pins - 6	
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory - 32 KB	(ATmega328) of which 0.5 KB used by bootloader
SRAM - 2 KB	(ATmega328)
EEPROM - 1 KB	(ATmega328)
Clock Speed	16 MHz

Table (2) Gives the technical specification of HC-SR04 ultrasonic

HC-SR04 ultrasonic	sensor Specification
Power Supply	+5V DC
Quiescent Current	<2mA
Working Current	15mA
Effectual Angle	<15°
Ranging Distance	2cm – 400 cm/1″ – 13ft
Resolution	0.3 cm
Measuring Angle	30 degree