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Design of Automatic Sanitizer Dispenser

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Abstract

Now-a-days sanitizing hands is a vital thing that every individual must do, for the sake of health and care. In this pandemic hand wash, hand sanitizer, disinfectant sprays became essential stuff. An Automatic Sanitizer Dispenser is built which ensures sanitization of hands with no contact with Sanitizer bottles using smart operations. An automatic Sanitizer dispenser is automated, non-contact which finds its use in hospitals, work places, offices, homes, schools and much more. It comprises an Arduino uno, used as a microcontroller that controls the Automatic Sanitizer Dispenser which is triggered by an Ultrasonic sensor detecting the hand under the Sanitizer pump, servomotor.

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1. Introduction

Apart from social distancing , sanitizing & washing hands effectively have become the most effective measure to fight against COVID-19 .While sanitizing hands we repeatedly touch the Sanitizer dispenser bottle to get drop of sanitizer again initiates contact with persons , that may be risky , this create the need of touchless automatic Sanitizer dispenser

The design of the device can be mounted on the most common Sanitizer pumps in the market making it easy to refill or change the Sanitizer bottle.The device's design is made with 3D printed structural elements for quick, precise and replicable parts. A simple lever mechanism has been chosen for pump operations, calculated the required lengths and travel distances and experimented to determine the correct torque to be used for pump operations. The device is made cost effective as possible, as the components used in the device are worthwhile, noteworthy.

2. Necessity.

As every individual is much concerned about his /her personal care and health these days and taking preventive measures like wearing a mask, sanitizing hands, washing hands with hand washes has become a crucial task. But while sanitizing hands we oftenly touch the Sanitizer bottles, which initiates contact with other repeated users, which may be risky. So, there is a need to create a touchless automatic Sanitizer dispenser. An automatic Sanitizer dispenser is a touchless device, which helps to ensure that there is no cross-contamination between repeated users. With hundreds and thousands of people using facilities in airports, restaurants; the possibility for infection is higher. However, it is not only limited to the public sphere but also in any given household. An Automatic Sanitizer dispenser will prevent this and make maintaining sanitization easier. This device will distribute a required set amount of sanitizer, as the amount of sanitizer would be predetermined thus waste will be minimal. The mechanisms of this device not only work for sanitizer but also other liquids like hand wash, dish washing liquid, detergent, etc. The wide range of possibilities extends the need of dispensers to other locations other than bathrooms.

3. Components Descriptions

There are mainly seven components as mentioned below:

1) Arduino UNO 2) SG-90 Servo Motor 3) Ultrasonic Sensor 4) Passive Infrared Sensor 5) Piezo Buzzer 6)Connecting(Jumper) Wires 7) Light Emitting Diode(LED).

1) Arduino UNO

It is an open source microcontroller based computing platform used for straightforward programming and synchronizing of various analog and digital sensors and it's also capable of sending and receiving data over the internet. It is built using an 8 bit Atmel AVR or 32 bit Atmel ARM microcontroller. It provides a comfortable design platform for hobbyists , students and professional designers

Figure 1 illustrates the Arduino UNO R3 pinout.

Figure 1: Arduino UNO.

2) SG-90 Servo Motor

Micro Servo Motor SG90 may be a tiny and light weight servo motor with high output power. Servo can rotate approximately 180 degrees and works a bit like the quality kinds but smaller. It comes with 3 horns and hardware.

Figure 2: SG-90 Servo Motor.

3) Ultrasonic Sensor

The HCSR04 Ultrasonic Sensor may be a sensor used for detecting the space to an object using sonar. It's ideal for Arduino projects. The HCSR04 uses non contact ultrasound to live the space to an object, and consists of two ultrasonic tra

nsmitters , a receiver, and an impact circuit.

Figure3:Ultrasonic Sensor

4) Passive Infrared Sensor

Passive Infrared sensor senses human motion . The sensor is made employing a pyroelectric sensor ,it detects infrared signals , as every living body emits some level of radiation. The sensor divides the sensed signal into 2 halves, which are wired up,to wipe out one another and together part senses the signal more or less, the output swings high or low.. The Fig 4 illustrates PIR Sensor.

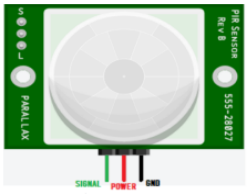


Figure 4: Passive Infrared Sensor

5) Piezo Buzzer

It produces a tone when it is synchronized with other sensors or it is made to produce tone for particular purposes.. The Fig 5 illustrates Piezo Buzzer

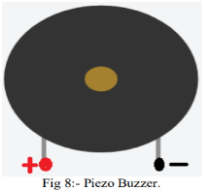


Figure 5: Piezo Buzzers

6) Connecting (Jumper)Wires

A Connecting (Jumper) Wires is an electrical wire, or group of them in a cable, with a connector or pin at each end. Fig 6 illustrates Jumper Wires.

Figure 6: Jumper Wires.

7) Light Emitting Diode(LED)

Light Emitting Diode is a semiconductor device that emits light when an electric current is passed through it. The Fig 7 illustrates LED.

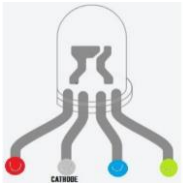


Figure 7: LED

4. Assembly Guide

The design may be mounted on the foremost common sanitizer pump within the market creating it straightforward to refill or amend the sanitizer bottle. The device was created with 3D written structural parts for fast, precise and replicable elements. SOLIDWORKS is employed to style the structural parts so 3D printing the device basic structural parts. Use of Polylactic Acid (PLA) filament material is suggested however Acrylonitrile-butadiene-styrene (ABS) material would conjointly do.

MATERIAL PROPERTIES :

1] Polylactic Acid (PLA):

Polylactic Acid (PLA) is a thermoplastic polymer derived from renewable resources and is biodegradable.
-Uses include plastic films, bottles, and biodegradable medical devices. (e.g. screws, pins, rods, and plates that are expected to biodegrade within 6-12 months).
-PLA material can be melted with very ease which is beneficial for 3D printing .
-This material is cost-efficient, non-petroleum plastic production. The huge benefit of PLA as a bioplastic is its versatility and the fact that it naturally degrades when exposed to the environment. Degradation period : 6-24 months
-Polylactic Acid is principally made through two different processes: condensation and polymerization. The most common polymerization technique is known as ring-opening polymerization.

Limitations :
1] Unsuitable for High Temperature Applications
2] More brittle than ABS

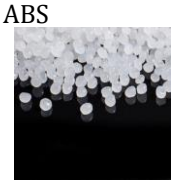


Figure 8: PLA

2] Acrylonitrile-butadiene-styrene (ABS):

-ABS plastic is a terpolymer formed from non-renewable sources and it is non-biodegradable .
-It is fabricated by the polymerization process of styrene & acrylonitrile in the presence of polybutadiene.
-ABS has a low melting point, which enables its easy use in the injection molding process and 3D printing.
-It also has high tensile strength and is very resistant to physical impacts and chemical corrosion, which allow the finished plastic to withstand heavy use and adverse environmental conditions.

Limitations :
1] It's inherently more toxic plastic than PLA.
2] ABS is a non-biodegradable and petroleum based polymer.

Figure 9: ABS

Properties	PLA	ABS
Melting Temperature	157 -170°C	200°C
Tensile Strength	61-66 Mpa	40 Mpa
Flexural Strength	48 -110 Mpa	75 Mpa
Modulus of Elasticity	3750 Mpa	2600-3000 Mpa
Density	0.00105 kg/mm^3	0.00125 kg/mm^3
Elongation at Break	7%	50%
Izod Impact Strength	26 J/m	34 J/m

ASSEMBLY PROCEDURE :

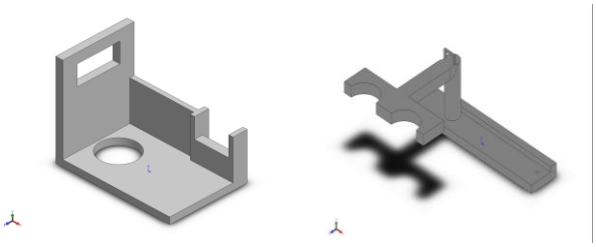


Figure 10: Base and Lever part

Take the ASD_base and mount it on the Sanitizer bottle once removing the sanitizer pump. guarantee it fits or trim the outlet if required. The stl model is formed with embedded tolerance to permit for decent work once created on a median 3D printer. Mount the Sanitizer pump and guarantee it all appearance swish. take away the pump and therefore the ASD_base from the bottle for any operations. Take the SG90 servo motor and use the "cross" formed arm. Mount it on the motor with the tiniest screw that accompanies the motor set. Mount the SG90 servo motor on the ASD_base at the fork position and mark its position on the ASD_base through its mounting holes.

Then take away the SG90 servo motor and drill the pads employing a one.5 millimeter drilling bit for the pilot hole. Re-mount the SG90 in position and use the 2 larger mounting screws that accompany the motor so as to make rib holes and stabilize the motor in its final position on the ASD_base. make sure that the motor at the orientations can permit the outer section of the arm to maneuver a hundred and eighty degrees within the vertical direction. Mount the full assembly on the bottle and work the pump once more.

Take the ASD_lever part, mount the inaudible sensing element and mark its position. take away the U/S sensing element and use the one.5 millimeter drilling bit to open clearance holes. Remount the U/S sensing element and victimization the fish wire stabilize it in position. Stabilize the ASD_lever so the U/S holder is in AN upright position and use a three.2 millimeter drilling bit drill fastidiously on the most holder axis. guarantee eccentricity of the outlet. create a pilot hole for steering.

Screw the 12mm M4x0.5 bolt all the means in, feat it sticking concerning half-dozen millimeter. This bolt is employed to calibrate the pump flow. be at liberty to experiment and change it for variable pump dosing. Assemble the ASD structure by slotting the ASD_lever component into the highest rectangular hole of the ASD_base. Get the fish wire through the ASD_lever finish hole and round the SG90 servo motor arm; the third hole from the rotor center offers the most effective force results. be at liberty to experiment here conjointly and obtain a needing pump standardization. check the pump operation manually to confirm swish lever operate.

The next factor would be to attach the Arduino nano with the SG90 servo motor and therefore the U/S sensing element. Use the corresponding part of the complete property diagram below to create this.

Fig 9 illustrates the circuit diagram.

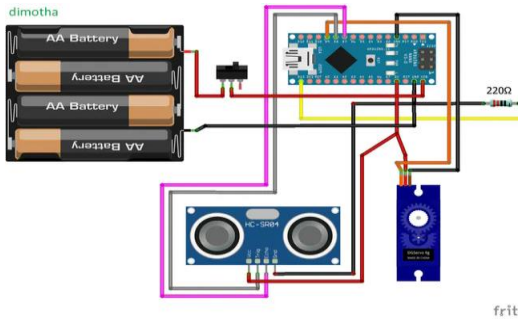
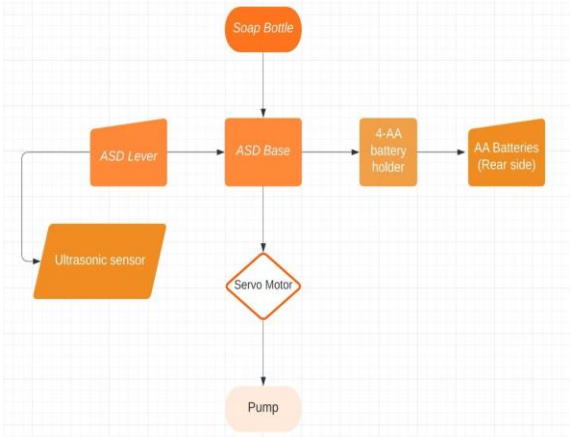


Figure 11: Circuit Diagram

Currently that the essential mechanism is established and connected to the Arduino nano microcontroller, currently load the sanitizing program to validate the right operation of the mechanism. Conclude the assembly by grouping the jump wires and affixing them with the cable strips. affixed the Arduino UNO on the ASD_lever by a number of the fishing nylon wire. Here the automated Sanitizer Dispenser is prepared.

ASSEMBLY OVERVIEW



Note : ASD - Automatic Sanitizer Dispenser

5.Upgradation

This device has been upgraded by including features given below:

1)Reminder program:

As mostly the device would be located at the entrance, so the user would be reminded to use sanitizer when entering. PIR sensor and buzzer are being used to fulfill the job, here PIR sensor is used to detect the motion of humans at entrance, as soon as motion is detected the buzzer would be activated and start to buzz this how it would remind them to use sanitizer.

2)Auto-Sleep Mode :

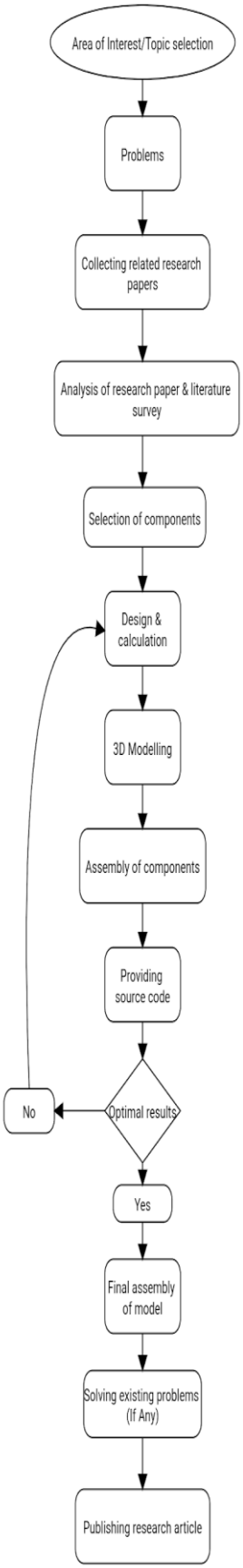
1)Wake up : As we are going to use a PIR sensor to detect human motion , as soon as it senses the motion , it will send the interrupt signal to Pin D2 , this is a nudge to turn on the Arduino that controls the main circuit.

2) Sleep Mode : Once the Arduino turns ON the main circuit , it will continue to remain in ON state , but if it remains unused for predetermined time e.g . Say for 10 mins it is needed to switch Arduino in sleep mode ; a program is used to put Arduino in sleep mode.

6. COST ANALYSIS TABLE :

SR .NO	COMPONENTS	QUANTITY	COST (IN RS.)
I	ARDUINO NANO	I	340
2	SG 90 TOWER PRO MICRO SERVO MOTOR	I	150
3	ULTRASONIC SENSORS	I	200
4	JUMPER WIRE	MULTIPLE	80
5	SLIDE SWITCH, SPDT-CO	I	70
6	RESISTOR 220 OHM	I	79
7	PIR SENSOR	I	195
8	BUZZER	I	20
9	AA BATTERIES	4	126
10	4X BATTERY HOLDER	I	196
			TOTAL COST : RS. 1500

7.Methodology Flow Chart



Conclusion

The research paper says that non-contact dispensing is important to prevent pathogens, infection from spreading. Hence good hand hygiene is most important and must be part of our daily life, and all these essential tasks are accomplished by using a Touchless Automatic Sanitizer dispenser. The main aim to design and develop this device is to make sanitization easier and contactless, that would ensure the care & safety of every individual in these days and future days too.

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References and notes

1. J. Hilburn, B. Hammond, E. Fendler, M. Groziak Use of alcohol hand sanitizer as an infection control strategy in acute care facilities, American Journal of infection control , Vol 31(2), PP: 109-115, April 2003.
2. S.Mitsuboshi, M.Tsugita, "Impact of alcohol-based hand sanitizers,antibiotic consumption, and other measures on detection rates of antibiotic resistant bacteria in rural Japanese hospitals", Journal of Infection and Chemotherapy, Vol 25 , Issue 3, PP: 225-228, March 2019.
3. S.Eiref, M.Leitman, W.Riley, " Hand Sanitizer Dispensers and Associated Hospital Acquired Infections: Friend or Fomite?". Surgical Infections, Vol 13, No. 3,PP:137-140,Jun 2012.
4. Leo Louis, "Working Principle of Arduino and Using it as a Tool for Study and Research". International Journal of Control, Automation, Communication and System (IJCACS), Vol.1, No.2, April 2016.
5. A.Sarkar, "Design of Automatic Hand Sanitizer with Temperature Sensing", International Journal of Innovative Science and Research Technology, Volume 5, Issue 5, PP:1269-1275,May-2020
6. Rakshith.L, "A Novel Automatic Sanitizer Dispenser". International Journal of Engineering Research & Technology(IJERT), Vol 8, Issue 14, PP:126-127, Aug 2020.
7. A.Sharma, " Review on Automatic Sanitizer Dispensing Machine". International Journal of Engineering Research & Technology(IJERT),Vol 9, Issue 7, PP:725-726, July 2020.
8. L.Phan, D.Maita, D.Mortiz, S.Bleasdale, R. Jones, "Environmental Contact and Self-contact Patterns of Healthcare Workers: Implications for Infection Prevention and Control". Clinical Infectious