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Automatic Sanitizer Sprayer with Liquid Level Indicator and Counter

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Abstract - *In this paper it represents the aim of any place to be free from covid-19 Virus and other contagious diseases which are spreading due to touch and contact with each other by using following automatic sanitization process. This dispenser is contactless and will spray sanitizer for sanitization of hands/whole body while entering into the buildings like Hospitals, Office complexes, shopping Malls, auditoriums, public places, apartments, schools, colleges, places of worship, other public places etc.*

As the global Covid-19 crisis continues to unfold, washing and sanitization of hands have become an absolute necessity in daily affairs. Automatic mist-based sanitizer dispensing systems is very useful resource in the fight against corona virus and contagious diseases. This contact less dispensing system helps to sanitize hands without getting in contact with the sanitizing surfaces and will help to reduce spread through cross contamination.

Key Words: (Covid-19, HC Sr-04 Technology, Counter)

1. INTRODUCTION

Corona Virus disease (Covid19) is wreaking havoc in the world. Ever since WHO announced it as a Pandemic disease and many cities are under lockdown, people are not able to step out of their homes and already thousands have lost their lives [1]. As the global Covid-19 crisis continues to unfold, washing and sanitization of hands have become an absolute necessity in daily affairs [2]. Automatic mist-based sanitizer dispensing systems is very useful resource in the fight against corona virus. This contact less dispensing system helps to sanitize hands without getting in contact with the sanitizing surfaces and will help to reduce spread through cross contamination. This contactless dispensing unit sprays alcohol-based sanitizer when both hands are placed under it. The aerated mist-based formula uses only 5-6ml. of sanitizer ensuring optimum usage. It releases full cone spray mist for 12 seconds in single operation. Contactless technology works on Ultrasonic sensor to ensure zero touch, high operational precision to completely disinfect both hands at once. It could be wall mountable with LEDs displays to indicate on/off status and the progress of the process. The capacity tank ensures longer duration of usage thus eliminating hassle of refilling it frequently. The sanitizer container allows displaying the quantity in it. Poor or inadequate hand washing and/or hand hygiene is known to be problematic in hospital settings, and is a major source of infections contracted while patients are admitted to a hospital. While hand washing and hygiene policies and training are important and can be effective in reducing the spread of infections, the problem of infections due to unsatisfactory hygiene of staff, medical professionals, and even patients continues to be problematic [3]. It is known to place hand washing stations and hand sanitizer dispensers throughout medical facilities including in examination rooms, hallways, lobbies, and even patient rooms. However, such systems are purely mechanical and are incapable of providing an automated means of establishing accountability of good hygienic practices.

The need of touch-less automatic dispenser is identified after observing that it is the point of contact for contamination. In this paper we present a novel design of automatic hand sanitizer dispenser with counter circuit which provide information regarding number of persons in particular building. The circuit includes an ultrasonic sensor HC-SR04. The sensor senses the proximity of hands under the machine. The machine is designed for wall mount at a height of 4ft such that anyone can reach to get sanitizer dispense. The sensor send signal to the microcontroller and the controller takes decision to actuate the pump and valve simultaneously to dispense the liquid sanitizer through a mist nozzle [4,5].

2. Automatic Sprayer Why?

We all know that hand washing is a key component to public and personal health. Hospitals, clinics and other medical facilities benefit from patients, staff and visitors reducing the number of germs and contaminants on their hands. Offices, administrative buildings, foodservice spaces and other workplaces benefit from customers and employees with clean hands. Regular hand washing helps fight the spread of viruses and bacteria that can cause illness, reduce workplace productivity and affect morale.

- Automatic sanitizer sprayer does not have to be touched in order to be activated. This touch less technology reduces that number of germs, bacteria and viruses people come into contact with. Manual sanitizer and bars of soap can harbor the dirt and germs of the last person to use them, spreading them to the next user.

- By this we reduce the spreading of corona virus and many more spreading viruses from one to another person in very efficient and effective way.

- Automatic sanitizer sprayer is operated by sensors that detect the presence of a user. There are no opportunities for germs to be passed between people.

- Complement your automatic sanitizer sprayer with an automatic towel dispenser. The entirely touch less system will keep the people in your workplace safe and healthy.

Control the amount of sanitizer you use with an automatic sanitizer dispenser. Manual sanitizer dispensers can get overused when people pump them or press their buttons multiple times to dispense more soap. An automatic sanitizer dispenser releases a measured amount into the hand of a user. This keeps a cleaner environment by reducing spilling, and saves sanitizer [6].

3. ULTRASONIC SENSOR

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

Figure -1: Ultrasonic Sensor

In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is D = ½ T x C (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second). For example, if a scientist set up an ultrasonic sensor aimed at a box and it took 0.025 seconds for the sound to bounce back, the distance between the ultrasonic sensor and the box would be:

D = 0.5 x 0.025 x 343

Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology. sensors in proximity sensing applications, ultrasonic sensors.

4. MAIN COMPONENTS

I use many components in the circuit designing from which major components are:

Table No. -1: Components of Automatic Sanitizer Sprayer with Counter

Sr. No	Item	Quantity	Remark
??	Microcontroller (Arduino Based)	1	To control the commands and all the instruction
??	Relay	1	To make and break the circuit for pump to run it.
??	Motor/Pump	1	For spraying the sanitizer.
??	Liquid Crystal Display (LCD)	1	To display the information given by microcontroller.
????	Ultrasonic Sensor	1	To sense the object/persons going OUT.
??	Ultrasonic Sensor	1	To sense the object/persons going IN.
??	Ultrasonic Sensor	1	To measure the sanitizer level in the tank.
??	Mist Nozzle	3	To spray the sanitizer.
??	Pipes	As per need	To carry sanitizer to the nozzle.

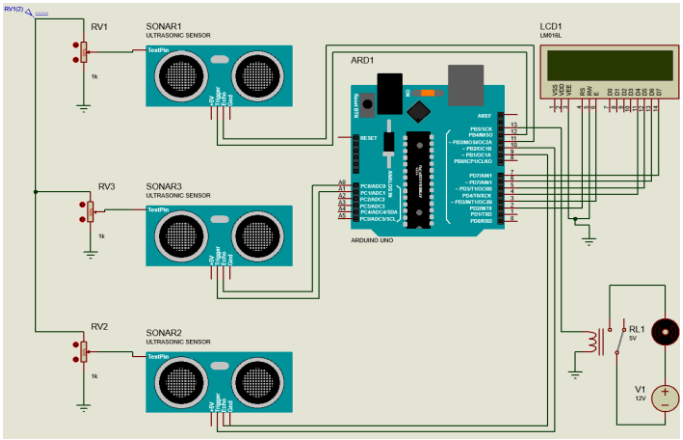

Figure -2: Circuit Diagram of Sanitizer Spray

5. BLOCK DIAGRAM AND ITS WORKING

The circuitry used in Automatic Sanitizer Sprayer with Counter is shown below:

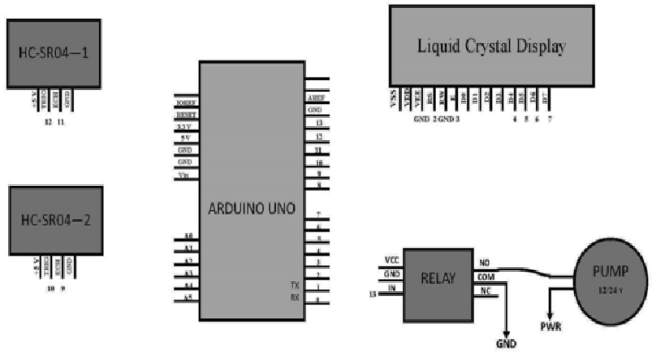

Figure -3: block diagram of automatic hand sanitizer sprayer

In today's world, there is a continuous need for automatic appliances. With the increase in standard of living, there is a sense of urgency for developing circuits that would ease the complexity of life [10].

This circuit have Bi-directional visitor counter Basic concept behind this project is to measure and display the number of persons entering in any room like seminar hall, conference room etc. LCD displays number of people inside the room. We can use this project to count and display the number of visitors entering inside any conference room or seminar hall. This works in a two way. That means counter will be incremented if person enters the room and will be decremented if a person leaves the room and is display the reading on the connected alphanumeric LCD, and when person coming in relay get activated by the microcontroller which complete the circuit of motor to start working i.e. start spraying the sanitizer.

6. COMPONENTS DESCIPTION

6.1 ARDUINO ATmega328 MICROCONTROLLER

The Arduino Uno is an open-source microcontroller based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. Board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

Figure -4: IC ATMEGA328

The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes pre-programmed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

- Technical specifications: -
  - ✓ Microcontroller: MicrochipATmega328P
  - ✓ Operating Voltage: 5 Volts
  - ✓ Input Voltage: 7 to 20 Volts
  - ✓ Digital I/O Pins: 14 (of which 6 can provide PWM output)
  - ✓ UART: 1
  - ✓ I2C: 1
  - ✓ SPPI: 1
  - ✓ Analog Input Pins: 6
  - ✓ DC Current per I/O Pin: 20 mA
  - ✓ DC Current for 3.3V Pin: 50 mA
  - ✓ Flash Memory: 32 KB of which 0.5 KB used by bootloader

- ✓ SRAM: 2 KB
- ✓ EEPROM: 1 KB
- ✓ Clock Speed: 16 MHz

6.2 RELAY

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof[7].

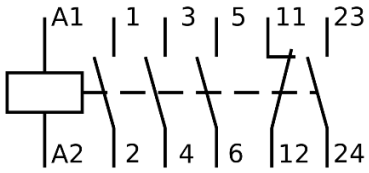

Figure-5: Internal Structure of Relay

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

6.3 PUMP

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action, typically converted from electrical energy into Hydraulic energy. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps.

Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, and come in many sizes, from microscopic for use in medical applications, to large industrial pumps.

Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers and other components of heating, ventilation and air conditioning systems. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis. [8].

✦ **Positive-Displacement Pumps:**

A positive-displacement pump makes a fluid move by trapping a fixed amount and forcing (displacing) that trapped volume into the discharge pipe.

Some positive-displacement pumps use an expanding cavity on the suction side and a decreasing cavity on the discharge side. Liquid flows into the pump as the cavity on the suction side expands and the liquid flows out of the discharge as the cavity collapses. The volume is constant through each cycle of operation.

✦ **Positive-Displacement Types:**

A positive-displacement pump can be further classified according to the mechanism used to move the fluid:

- ✓ Rotary-type positive displacement: internal gear, screw, shuttle block, flexible vane or sliding vane, circumferential piston, flexible impeller, helical twisted roots (e.g. the Wendel kol ben pump) or liquid-ring pumps
- ✓ Reciprocating-type positive displacement: piston pumps, plunger pumps or diaphragm pumps
- ✓ Linear-type positive displacement: rope pumps and chain pumps

✦ **Rotary positive-displacement pumps :**

These pumps move fluid using a rotating mechanism that creates a vacuum that captures and draws in the liquid.

Rotary positive-displacement pumps fall into 5 main types:

- ✓ Gear pumps – a simple type of rotary pump where the liquid is pushed between two gears
- ✓ Screw pumps – the shape of the internals of this pump is usually two screws turning against each other to pump the liquid
- ✓ Rotary vane pumps
- ✓ Hollow disk pumps (also known as eccentric disc pumps or Hollow rotary disc pumps), similar to scroll compressors, these have a cylindrical rotor encased in a circular housing. As the rotor orbits and rotates to some degree, it traps fluid between the rotor and the casing, drawing the fluid through the pump. It is used for highly viscous fluids like petroleum-derived products, and it can also support high pressures of up to 290 psi.

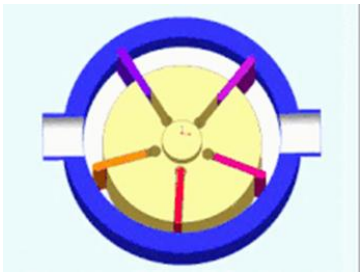

Figure -6: Rotary Fan of Rotary type pump

✦ **Reciprocating Positive-Displacement Pumps**

Reciprocating pumps move the fluid using one or more oscillating pistons, plungers, or membranes (diaphragms), while valves restrict fluid motion to the desired direction. In order for suction to take place, the pump must first pull the plunger in an outward motion to decrease pressure in the chamber. Once the plunger pushes back, it will increase the pressure chamber and the inward pressure of the plunger will then open the discharge valve and release the fluid into the delivery pipe at a high velocity [9].

Pumps in this category range from simplex, with one cylinder, to in some cases quad (four) cylinders, or more. Many reciprocating-type pumps are duplex (two) or triplex (three) cylinder. They can be either single-acting with suction during one direction of piston motion and discharge on the other, or double-acting with suction and discharge in both directions. The pumps can be powered manually, by air or steam, or by a belt driven by an engine. This type of pump was used extensively in the 19th century—in the early days of steam propulsion—as boiler feed water pumps. Now reciprocating pumps typically pump highly viscous fluids like concrete and heavy oils, and serve in special applications that demand low flow rates against high resistance. Reciprocating hand pumps were widely used to pump water from wells. Common bicycle pumps and foot pumps for inflation use reciprocating action [10].

6.4 LIQUID CRYSTAL DISPLAY(LCD)

A fourteen-segment display (FSD) (sometimes referred to as a starburst display or Union Jack display) is a type of display based on 14 segments that can be turned on or off to produce letters and numerals. It is an expansion of the more common seven-segment display, having an additional four diagonal and two vertical segments with the middle horizontal segment broken in half. A seven-segment display suffices for numerals and certain letters, but unambiguously rendering the ISO basic Latin alphabet requires more detail. A slight variation is the sixteen-segment display which allows additional legibility in displaying letters or other symbols.

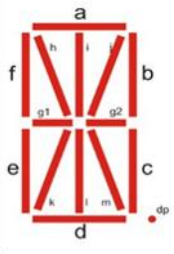

Figure -7: Internal switching of LCD

A decimal point or comma may be present as an additional segment, or pair of segments; the comma (used for triple-digit groupings or as a decimal separator in many regions) is commonly formed by combining the decimal point with a closely 'attached' leftwards-descending arc shaped segment[11,12].

Electronic alphanumeric displays may use LEDs, LCDs, or vacuum fluorescent display devices. The LED variant is typically manufactured in single or dual character packages, allowing the system designer to choose the number of characters suiting the application.

Often a character generator is used to translate 7-bit ASCII character codes to the 14 bits that indicate which of the 14 segments to turn on or off.

6.5 MIST NOZZLE

A spray nozzle is a precision device that facilitates dispersion of liquid into a spray. Nozzles are used for three purposes: to distribute a liquid over an area, to increase liquid surface area, and create impact force on a solid surface.[1] A wide variety of spray nozzle applications use a number of spray characteristics to describe the spray.

Spray nozzles can be categorized based on the energy input used to cause atomization, the breakup of the fluid into drops.[3][4] Spray nozzles can have one or more outlets; a multiple outlet nozzle is known as a compound nozzle. Spray nozzles range from heavy duty industrial uses to light duty spray cans or spray bottles.

6.6 PIPE

A pipe is a tubular section or hollow cylinder, usually but not necessarily of circular cross-section, used mainly to convey substances which can flow — liquids and gases (fluids), slurries, powders and masses of small solids. It can also be used for structural applications; hollow pipe is far stiffer per unit weight than solid members.

In common usage the words pipe and tube are usually interchangeable, but in industry and engineering, the terms are uniquely defined. Depending on the applicable standard to which it is manufactured, pipe is generally specified by a nominal diameter with a constant outside diameter (OD) and a schedule that defines the thickness. Tube is most often specified by the OD and wall thickness, but may be specified by any two of OD, inside diameter (ID), and wall thickness. Pipe is generally manufactured to one of several international and national industrial standards.[1] While similar standards exist for specific industry application tubing, tube is often made to custom sizes and a broader range of diameters and tolerances. Many industrial and government standards exist for the production of pipe and tubing. The term "tube" is also commonly applied to non-cylindrical sections, i.e., square or rectangular tubing. In general, "pipe" is the more common term in most of the world, whereas "tube" is more widely used in the United States.

7. FUTURE SCOPE

I. Size can be increased as per the usage.

II. Tank capacity may be increased as per the number of peoples to be sanitized.

III. Sensor can be upgraded by smart sensor having high range of operation.

IV. It can be used as pesticide sprayer, and germ killing liquid or any type of liquid sprayer.

8. CONCLUSION

In this paper automatic sanitizer sprayer is contact less and will spray sanitizer for sanitization of hand while entering into the building like hospitals, office complexes, shopping malls, auditoriums, public places, apartments, schools, colleges, places of worship, other public places etc. there are very few units manufacturing automatic mist-based sanitizer dispensing machine in India. In the present scenario, it is very much important to equip all public places with automatic sanitizer dispensing unit. Due to spread of Covid-19, there is enough demand for this product.

This project will partially fulfill the aim of my college to be free from COVID-19 and by this sanitizing process will be so easy.

This can be achieved by implementing a circuit consisting of **Ultrasonic Sensor, Microcontroller, Dispenser (Sprayer) Unit, Mist Nozzle, Motor** and some equipment to achieve desired Aim.

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