AUTOMATIC HAND SANITIZER USING ULTRASONIC SENSOR

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AUTOMATIC HAND SANITIZER USING ULTRASONIC SENSOR

A Project Report
submitted in partial fulfillment of the
requirements for the award of the degree of

Bachelor of Technology
in
Electronics and Communication Engineering

by

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APPROVAL SHEET

This project report entitled **AUTOMATIC HAND SANITIZER USING ULTRASONIC SENSOR** by **Ms. Kulakarni Sai Pragna**, **Mr. Dharma Saketh Reddy, Mr. Marri Sudheer Kumar** is approved for the award of the Degree Bachelor of Technology in Branch **Electronics and Communication Engineering**.

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Abstract

Since 2019 due to the global spread of COVID Washing hands regularly with alcohol-based hand sanitizer or soap and water, every day to prevent infection and disease has become mandatory. However, it is easier to use alcohol-based hand sanitizer. But automatic disinfection dispensers are extremely user-friendly as they work without touching and are 100% safe to use. Generally, automatic hand sanitizer uses ultrasonic or infrared sensors to detect the hand. When we turn on the sanitizer dispenser only 10-30%of the sanitizer or water touches our skin, the rest flows through the first layer of the water. Our system takes it to the next level by using a fog dispenser to make it more efficient. The main controller of the project is an ARDUINO microcontroller, SR04 Ultrasonic sensor, timer buttons, LCD display, mist maker, and UV Lamp. The UV lamp gives more efficiency in sanitizing.

Keywords— Arduino, Mist Maker, LCD Display, Ultrasonic Sensor, UV Lamp, Microcontroller, sanitization.

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List of Abbreviations

LCD	Liquid Crystal Display
UV	Ultra Violet
USB	Universal Serial Bus
LED	Light Emitting Diode
EEPROM	Electrically Erasable Programmable Read-Only Memory
SRAM	Static Random Access Memory

Chapter-1
Introduction

1.1 Introduction

Since the start of the COVID-19 pandemic in 2019, everyone is suggested to clean their hands very frequently to reduce the spread of the disease. COVID-19 virus is spread when people breathe in air contaminated by droplets/aerosols and small airborne particles containing the virus. Infected people exhale those particles as they breathe, talk, cough, sneeze, or sing. COVID-19 virus can also be spread through physical contact with surfaces. To reduce the spread of the virus through droplets and airborne particles masks are used and to reduce the spread of the virus through contact with surfaces we need to regularly wash our hands to kill the virus. But a problem arises here with washing hands frequently that is we can't wash our hands neatly wherever we want. When we wash our hands with soap and water only 10-30% of water touches our skin and the rest flows down. Also, some soaps may not properly disinfect your hands. This might lead to lots of water wastage, which can start another pandemic- "Water Scarcity". To solve this problem, "sanitizer" has come into the scene. Sanitizer is a liquid, foam, or gel generally used to kill many viruses/bacteria/microorganisms. Sanitizer helps kill germs up to 99% on the applied surface. So sanitizer is the most efficient way to clean hands safely.

Disinfecting our hands properly and frequently is very important to fight against the pandemic using the methods efficiently. In using sanitizer, there are also some problems to be solved. Using the liquid form of sanitizer leads to lots of sanitizer wastage and we are not sure about the proper disinfection of our hands. To solve this problem, our machine goes a step forward saving the sanitizer using a fog-based system and assuring more safety. The main controlling device of the system is the ARDUINO microcontroller. UV lamp, timer buttons, LCD display, mist maker, and SR04 ultrasonic sensor are interfaced with the microcontroller. In this system, the user needs to set the time using the timer buttons and insert his/her hands into the machine, as soon as the ultrasonic sensor detects the hands automatically turns on the UV lamp and switches on the mist makers to dispense the sanitizer fog and the status of the process is displayed on the LCD display. The system gives the audio alert when the person removes the hands from the system displaying process is not yet finished. After the completion of the process for the provided time, it displays completed on LCD.

1.2 Overview

The combination of software and hardware to perform a specific is known as embedded system. The main devices used in embedded systems are microcontrollers and microprocessors.

Microprocessors are the general purpose processors which simply accepts the input , process it and give the output whereas microcontrollers not only accept the data as input but also manipulate it, control it, and interface the data with various devices and thus giving the final outputs.

The project "**Automatic Hand Sanitizer using Ultrasonic Sensor"** by using Arduino is the exclusive project which detects the hands inside the machine using an ultrasonic sensor, switches on the UV light for disinfection, and based on the selective time the system sanitizes the hands. If the person removes the hands from the working machine then the system gives the alerts in the form of a buzzer. The status of the project will display on LCD. To perform, this intelligent task microcontroller is loaded with embedded C language.

1.2.1 Features

- Automatic hand detection using SR04 Ultrasonic sensor.
- Audible alerts using Buzzer.
- Displaying process status using LCD display.
- System works based on the Selective Time.
- Mist maker is used to generate fog sanitizer.
- UV lamp is used to kill the germs.
- Relays are used for switching operation.
- The whole task is achieved using ARDUINO microcontroller.

1.3 History

After COVID-19 hit the world in 2019, hand sanitizer has become a major part of everyone's life for safety. In some way, sanitizer is one of the heroes in fighting against covid.

To reduce the spread of the virus, sanitizer should be used frequently and make it pocket-friendly small bottles of sanitizers have come into use to use anywhere. Individual users used small bottles of sanitizer with a pump or a nozzle. When we press the pump or squeeze the bottle the sanitizer is released through the nozzle. According to the studies, the virus can stay alive on various surfaces and is spreading fastly through contact. So to reduce the spread of the virus even sanitization is preferred contactless. If these sanitizer bottles are used in public places there will be contact with the sanitizer bottles and also among the people which leads to high chances for the virus to spread. People were really about the contact with the surfaces even sanitizing.

Fig 1.1: Pump Bottle Sanitizer

To reduce these chances of the virus spreading through contact, contact-less sanitization is required. In order to overcome the above problem and to reduce the chances of hand contact with the surfaces to sanitize we have come up with another model. In this model sanitizer bottle is placed in a stand and need to be operated with legs. Bottom of the stand has some extension, when this bottom part of the sanitizer is pressed with the leg, it presses the top of the sanitizer bottle, and the sanitizer is dispensed through the nozzle. This model is safer than the previous hand pump bottle.

Even with this model people are not feeling safe and are aiming for complete contactless sanitization.

Fig 1.2: Hand Sanitizer Using Leg Pump

A pure contactless sanitizer is developed to address all of these issues. This device employs an ultrasonic sensor to find hands. Once a hand is recognized, a servomotor is activated, rotating a pump that releases a sanitizer from a nozzle and performs sanitizing. This device's battery operation is the sole drawback, and we should always have a backup source. Additionally, the majority of the sanitizer that is released each time a hand is identified and detected is squandered.

Fig 1.3: Contactless Hand Sanitizer

1.4 Existing Method

In the existing method, we have an automatic hand sanitizer dispenser using an SR04 Ultrasonic sensor. In this system hands should be placed under the nozzle, when the ultrasonic sensor detects the hands, the sensor sends the input to the microcontroller ARDUINO-NANO. The Arduino-nano microcontroller has a program to access data from the sensor as the input, sends a signal, and drives the motor pump to pump the sanitizer liquid to the water pass hose, also the LED indicator turns on indicating that the sanitizer dispensation is in process. The sanitizer liquid is dispensed through a small pipe in front of the appliance.

1.4.1 Components used

- SR04 ultrasonic sensor
- ARDUINO-NANO microcontroller
- Motor pump
- Motor driver
- Charger
- Battery
- LED

1.5 Block Diagram

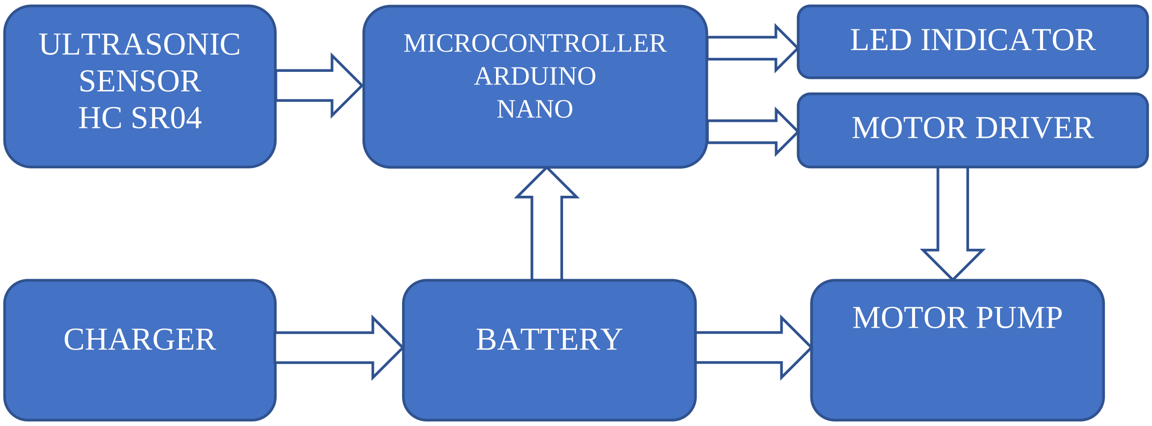

Fig 1.4: Block Diagram of Existing System

Here hands should be placed under the nozzle, as soon as the ultrasonic sensor detects the hands, the sensor sends the input to the microcontroller ARDUINO-NANO. The Arduino-nano microcontroller has a program to access data from the sensor as the input, sends a signal, and drives the motor pump to pump the sanitizer liquid to the water pass hose, also the LED indicator turns on indicating that the sanitizer dispensation is in process. The sanitizer liquid is dispensed through a small pipe in front of the appliance.

1.6 Problem Identification and Solution

With this existing method, there are high chances of facing several problems related to disinfection rate, safety, usage of sanitizer, etc. In this existing method, by using liquid sanitizer lots of sanitizer is wasted. When the liquid sanitizer is dispensed, only some amount of sanitizer touches the surface of your hands, and the remaining flows down over the first layer of the sanitizer on the hands, which may also make the area so messy. The existing system also does not know when to stop dispensing, hence wastage of sanitizer is more. Another problem is the fewer safety measures. Using sanitizer germs are killed, but there are chances of less safety and the need to increase the safety measures for complete disinfection of germs on hands. Also, there are chances for less safety due to human-made errors like removing the hand before complete disinfection or not placing hands properly. In such cases, proper disinfection does not happen and high chance for less safety. One can not know whether his/her hands are properly sanitized or not. These problems may become the major reasons for the fewer safety measures.

To overcome all these problems we have come up with some solutions to reduce the wastage of sanitizer, increase safety measures and reduce human-made errors. First, to reduce the wastage of sanitizer we introduced mist makers in our system consuming 95% less sanitizer. These mist makers convert the liquid form of sanitizer to the form of fog. By using the sanitizer in the form of fog, a very less amount of sanitizer is used to disinfect and hence wastage is very less. To increase the disinfection rate and safety measures we have introduced the UV lamp in our system. UV lamps are used very often to reduce the spread of viruses or bacteria by disinfecting them. Hence using UV lamp safety is improved. And to reduce human-made errors we introduced timers and buzzers into our system. The timers are used as the timer input to the system and based on the timer input the system runs. We have inserted four timer buttons for 5 seconds, 10 seconds, 15 seconds, and 20 seconds. If the hands are removed from the systems within the given time or hands are not detected, using the buzzers audio alerts are given indicating that the process is not yet finished. So using these timers and buzzers system makes sure for proper and complete disinfection.

Chapter-2

Literature Survey

In [1] Srihari, M. M. (2020), described about the contactless automatic hand sanitizer dispenser. The key element used for hand detection in this method is the IR sensors. When the hand is placed under the nozzle of the sanitizer bottle, the IR sensor detects the hand and the motor pumps the sanitizer liquid into the hand. To control the flow of the sanitizing liquid, the motor is connected to an RC timed delay setup, and the pipe is connected to a reducer. The system includes three different control modes, and the white LED is utilized to let the user know that the setup is operational and the battery is being used. Red LED is used to signal to the user that the battery is charging. The user can tell the battery is fully charged by the use of a green LED. It has an On/Off switch that allows you to run the entire arrangement off of batteries. The setup is convenient for the user, who also saves money and energy.

In [2] Anandu Ajayan, Sunitha Beevi. K. (2020), explained the design and development of a low-cost automatic sanitizer dispenser are discussed in this study. Its structure is created to allow for cost savings while maintaining stability. The presence of the hand is typically detected by ultrasonic or infrared sensors in an automatic sanitizer dispenser. The issue with ultrasonic sensors is that they are more expensive than infrared sensors and need a microprocessor to function properly. However, the infrared sensor has a drawback in that it has a variable sensitivity to sunlight. The traditional infrared sensor architecture is changed to address the aforementioned issue, allowing for the employment of a frequency-specific infrared receiver in place of the transmitter LED's infrared pulses at a certain frequency.

In [3] Jeet Vora, Jaineel Purani, Vipin Shukla (2020), explained about a realistic, affordable circuit for the operation and control of a final control element (valve) is suggested in this paper. The circuit described in the paper makes use of a 555 timer IC for accurate time monitoring and an Infrared (IR) proximity sensor for object recognition and triggering. The proposed system is designed to be tested in soap and hand sanitizer dispensers placed in public areas, in this example, on university property. Due to the use of soap and sanitizer dispensers in public spaces, it may be particularly successful in reducing the danger of the spread of Covid-19, and the time monitoring functionality of the suggested design enables the end-user to ensure the World Health Organisation (WHO) recommendations for hand hygiene. In the end, theoretical ideas are supported.

In [4] Iman Fushshilat, Dewi Kurnia Sari, Yoyo Somantri (2020), explained about the touch and contact are ways to spread viruses like COVID-19. There are WHO rules to clean or disinfect hands routinely to decrease the gamble of disease. The sanitizer bottle would have to be dispensed and stored manually. To lessen the risk posed by contact, we propose a novel touchless sanitizer machine design in this paper. With the assistance of an ultrasonic sensor, the system is able to detect proximity and transmit a signal to the microcontroller. The pump and solenoid valve is actuated as well as the sensor data is processed by the controller. The sanitizer fluid apportions through the fog spout.

In [5] Rahul Santhosh; R. Mahalakshmi (2020), they explained about the significance of using contactless hand sanitizer dispensary systems was realized during the initial COVID-19 pandemic outbreaks. Using locally available materials and basic components, a hand sanitizer dispenser that uses alcohol-based sanitizer and is based on an infrared (IR) sensor was developed. In public areas where contactless sanitization is required, these inexpensive devices can be utilized. This inventive undertaking work was finished with an expense of not as much as INR 700.

Chapter – 3
Methodology

3.1 Embedded Systems

3.1.1 Introduction

It is a medley of peripherals, memory, and computer processors. It is a straightforward computer without a display. They have power over numerous items that we frequently utilise in our daily lives. Using real-time computer techniques, embedded systems manage the machine's physical processes. Earlier Microprocessors are the foundation of embedded systems. However, the majority of embedded systems nowadays are based on microcontrollers, even though complicated systems frequently include microprocessors. Because embedded systems are made to carry out specific functions, it is the designer's job to lower the product's price and size while also boosting its performance. The embedded system ranges in size from tiny household appliances to the watch we wear on our wrists. Embedded devices include.

Fig: 3.1 A modern example of an Embedded system

The programming for an Embedded system is different from regular programming i.e. PC programming. Programming in Embedded systems is a challenge because of the low memory space and slow processors and at the same time, they need to work on the efficiency of the output. The main characteristic of an Embedded system is to dedicate itself to a particular task that requires powerful processors.

3.1.2 Tools

Embedded systems comprise various tools like compilers, assemblers, and debuggers for the development of the system software. Some of the tools are:

- Developers use a computational notebook for mathematics when the system uses Digital signal processing.
- Some custom compilers and linkers are used for specialized optimization hardware.
- Embedded systems may also have their language or a design tool or sometimes may add some extra features for existing languages.
- GNU software development tools

As the embedded system is growing day by day the tools and operating systems are also migrating into machinery for better use. For example, our systems or components require software that is provided by a third-party manufacturer.

3.1.3 Resources

Embedded systems have a low-cost processor. Also, the programs in Embedded systems are needed to be written more effectively to obtain better outputs. One of the major problems seen in Embedded systems during programming is issues like memory. To reduce the cost of Embedded systems, they usually have low memory. So to overcome those issues some memory techniques are used. For example, many of the Embedded processors don’t have hardware i.e. FPU (Floating-Point Processing Unit).

3.1.4 Need for Embedded Systems

Embedded systems have become a part of one's life. The products which we use in our day-to-day activities use embedded computers. In the past decade, the use of microcontrollers and microprocessors has increased rapidly. In simple terms, one can say that embedded systems have taken over one's common lives making it modern and easier. They are used to provide a real-time response to the situation. Many embedded computers have their features and many of the software come with some pre-defined libraries. In the view of implementation, the computer and embedded systems are not the same. The important elements of embedded systems are reliability and debugging.

3.1.5 Debugging

Debugging is performed at different levels. The debugging process includes whether the debugged system is close to the actual system, inspecting the memory, does the main application slows down. The things that are inspected in the debugging process are memory, registers, etc.

Some of the debugging techniques are:

- Interactive resident debugging, uses a simple shell that is provided by the embedded operating system.
- Software debuggers do not need any hardware modification but they need to save storage space.
- In-Circuit Debugger(ICD), is a hardware device that connects the microprocessor to its interface using some hardware components like JTAG. But in this process, some of the debugging features are restricted.
- A complete emulator gives control over all the hardware and software allowing the emulator to control and modify any specifications.

3.1.6 Reliability

Embedded systems depend on machines that have a long life and are dedicated to performing specific functions or tasks for a long time without giving any errors. So here the software is developed more carefully for this specific condition. The software which is used in embedded systems is very different from regular programming. Also at the same time, some hardware components like disk drives, switches, etc. are avoided because of their low life span.

Below you can see some common reliability issues:

- When any problems arise the system cannot be shut down completely which leads to incomplete repairs of the system. So once a system undergoes any repair it cannot be repaired completely.
- The system needs to run continuously at its full capacity. When the functionality of a system is reduced it leads to the inefficiency of the system making it useless.
- When the system is forced to shut down then the whole money invested in that system is lost.

Some techniques which are used to reduce errors:

- Watchdog timer is used to reset and restart the system until the software notifies the subsystems of the watchdog.
- By creating a TCB (Trusted Computing Base) results in a more secure and reliable environment.
- Hypervisor is a device that is used to provide protective encapsulation for subsystems. Encapsulation keeps one subsystem to interfere from another subsystem.
- Immunity-aware programming is a programming style that helps programmers to produce more reliable codes which are used in embedded systems. The main aim of programmers is to produce more reliable and portable firmware.

3.2 Embedded Software Architectures

National Electrical Manufacturers Association released ICS 3-1978, which is the standard for programmable microcontrollers, which also contains computer-based controllers like single board computers and numerical and event-based controllers.

Many types of software architecture are in use today:

3.2.1 Simple Control Loop

In this technique, the monitor and input devices are set in a loop. The loop monitors the sub-routines and manages hardware and software. So it is called a simple control loop or programmed input-output.

3.2.2 Interrupt Controlled System

Most of the embedded systems are controlled by interrupts. That means the tasks which are performed are activated by different kinds of tasks or events. This system is designed if the system needs a low latency. This system runs a simple task in a main loop. The interrupt system sometimes adds extra tasks to the main system.

3.2.3 Cooperative Multitasking

It is very similar to the simple control loop system the only difference is that the loop is hidden inside the API. In this multitasking technique, the programmer defines some tasks and every task a new environment to run. When a task is idle it is known as an idle routine. In this technique adding new software is easy i.e. writing a new task and adding it to the queue.

3.2.4 Preemptive multitasking or multi-threading

In this system, a little code controls its movement between tasks and threads based on a timer. Depending on the functionality number of complexities required are changed in parallel. When a code is written sometimes it can damage the data of another task. In order to overcome that problem the programs are designed and tested carefully and also the shared data must be synchronized.

3.2.5 Microkernels and Exokernels

The microkernel provides memory and switches to the CPU for many execution threads. Large-scale operations like file systems, network interfaces, etc. are managed by user-mode processes.

Normal subroutine calls are used by exokernels to communicate. Application programmers are extended by the system's hardware and software.

3.2.6 Monolithic Kernels

Monolithic kernels are large kernels with special abilities that are adapted to be suitable for the specific embedded environment. By this kernel, the programmer gets a similar environment of programming like windows or Linux. These kernels are more expensive than regular kernels. Even if the kernels are expensive they are increasing rapidly. The main applications of these kernels are wireless routers and GPS navigation systems. Because of the complexity of the kernels they are very much low predictable and more reliable.

3.2.7 Additional Software Components

In many embedded systems they mot only have a main operating system with an extra layer of software components. These software components contain different protocols like CAN, FTP, HTTPS, and HTTP. They also contain extra storage capabilities FAT and flash memory managing systems. If the system has extra features like audio and video then the system needs to have its related drivers and code in that system. Monolithic kernels contains most of these features. In order to add some extra features in the monolithic kernels they are needed to be added externally using hardware components.

3.3 Real-Time Embedded Systems

The embedded systems perform some tasks or activities that are meant to be done by specific systems. These embedded systems perform tasks at specific time. So they are known as real-time embedded systems. There are two types of embedded systems.

3.3.1 Hard Real-Time Embedded Systems

In hard real-time embedded system if the task is delayed even by a little time then it leads to damage in the system and entire equipment in the entire system

Example: In a hardware system if the task of any component is delayed by even a little time, then automatically the whole system is damaged. The damage that occurred to the system is physical and the whole system is damaged.

3.3.2 Soft Real-Time Embedded Systems

The soft real-time embedded system is in the software of that system. In this mechanism, the hardware of the system is not affected.

Example: In a TV remote even if the function of the system is delayed by some milli or microseconds it will never cause any damage to the system or its hardware components. But the only difference in the system that the output is delayed by some milli or micro seconds.

3.4 Network Communication Embedded System

The embedded system plays a major role in the part of communication. The embedded system plays important role in interfacing communication and network.

Example:

- One of the examples of a network communication embedded system is a web camera which is connected to a computer by which the transfer of images or videos is made easy with the help of an internet connection to the computer.

- Also take an example of a camera that is connected to a door lock. By using this we can capture everyone who comes near the door. It doesn't only capture the images of the person but also shares the images to the desktop or a mail to the registered person's mail. Fig 3.2 depicts the network communications in embedded systems.

Fig 3.2 – Network Communication Embedded Systems

3.5 Different Types of Processing Units

In an embedded system the CPU i.e. Central Processing Unit can be any one of the following which are microprocessors, microcontrollers, and digital signal processing.

- Microcontroller is a low-cost device. Commonly used as a processor to perform actions or tasks. One of the advantages of the microcontroller is that the device has the components like memory, ADC, serial communication interfaces, etc.
- Microprocessor is a device similar to a microcontroller that has more features and advantages. The microprocessor is used at the place when there is a greater

requirement. It also contains many external components like memory, hard disk, input-output ports, etc.

- Digital signal processing is used at places where the main applications require processing of signals.

3.6 Applications of Embedded Systems

3.6.1 Consumer Applications

Consumer applications include devices like microwave oven, VCD players, etc.

Fig 3.3 – Automatic Coffee making equipment

3.6.2 Office Automation

Office Automation includes systems like fax machine, modem, etc.

Fig 3.4 – Fax Machine

Fig 3.5 – Printing Machine

3.6.3 Industrial Automation

Nowadays many industries are using embedded systems for making their tasks. Embedded systems are taking over manpower in industries to perform operations like checking temperature, voltage, monitoring systems, etc. Based on the acquired results the system is programmed to perform specific tasks according to the needs.

Fig 3.6 - Robot

3.6.4 Computer Networking

Embedded systems uses routers etc. for networking connections.

Fig 3.7 – Computer Networking

Chapter 4
Implementation

4.1 Proposed Method

In this proposed method we are introducing the timer buttons, LCD, Mist maker, and UV lamp along with other components that have already been present in the existing method. These tools may help full to improve the accuracy.

4.2 Block Diagram

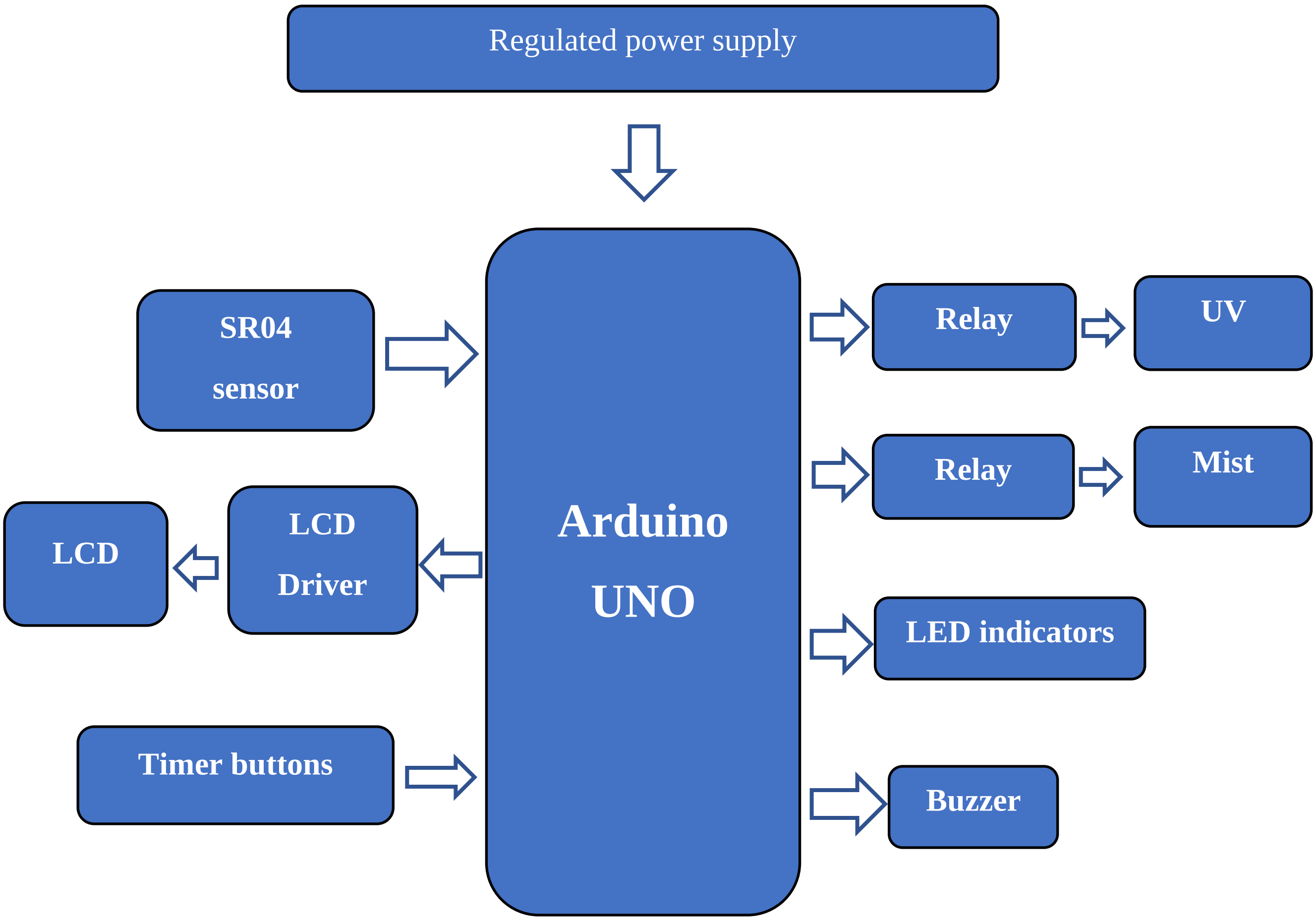

Fig 4.1: Block Diagram of Proposed method

The main blocks of this project are:

- Regulated power supply
- Arduino controller
- Fog Maker
- UV Lamp
- Buzzer
- LCD Display
- Timer Buttons
- Realys
- Ultrasonic Sensor

4.2.1 Micro Controller (Arduino UNO)

Fig 4.2: Arduino UNO

The Arduino Uno is a microcontroller board featuring the ATmega328 from the AVR family. There are 14 digital I/O pins, 6 analog pins, and a 16 MHz ceramic resonator. Access to USB connection, power outlet, and reset button. The software is supported by many libraries, which makes programming easy.

4.2.2 Regulated power supply

An IC-regulated power supply (RPS) is an electronic circuit designed to provide a constant DC voltage to the load regardless of the fluctuations of the load. The main function of the electronic controller is to convert alternating current (AC) to constant current (DC). RPS is used to ensure that the output stays constant if the input changes. Also known as linear power supplies, these power supplies allow AC input and provide stable DC output.

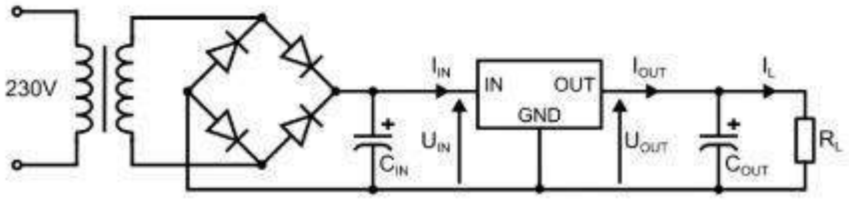

Fig 4.3: Regulated Power Supply

Block Diagram of Regulated Power Supply

The block diagram of power control usually includes a step-down transformer, rectifier, DC filter, and voltage regulator. The Structure and operation of electronic control devices are discussed below.

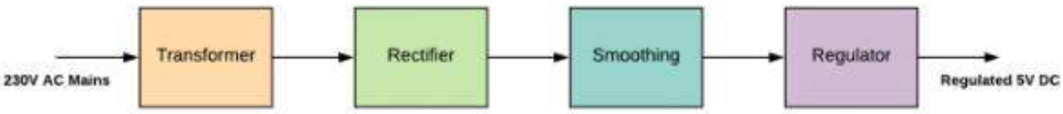

Fig 4.4: Block Diagram of Regulated Power Supply

Transformer and AC Supply

Electrical power can be used to provide the required power of the correct voltage

Force the main source such as a battery. The inverter converts the AC power to the required voltage and its main function is to step up and down. For example, transistor

radios use a step-down transformer and CRTs use a step-up transformer.
The transformer

is isolated from the power line and must be used without voltage change.

Rectifier

An electrical device called a rectifier is used to change direct current to direct current. With the use of a bridge rectifier or neutral guided secondary winding transformer, it can be either a full-wave or a half-wave rectifier. However, the rectifier's o/p is different.

Filter

The basic purpose of a filter in a regulated power supply is to level ac deviations from the corrected voltage. Capacitor filter, inductor filter, LC filter, and RC filter are the four types of rectifiers.

Voltage Regulator

A voltage regulator in a voltage regulator is important to maintain a constant DC output voltage by providing load and line requirements. Therefore, we can use voltage regulators such as Zener, transistors, or 3-pin integrated regulators. SMPS switched-mode power supplies can be used to transmit large loads with small voltages in the power supply.

4.2.3 Ultrasonic sensor

Ultrasonic sensors use ultrasonic waves (operating at 40 KHz) over the acoustic range of the human voice to measure the distance between their transmitter and the obstacles in front of them. The main transmitter emits ultrasonic without reflection from the target and is received by the receiver module. The distance between the sensor and the target can be calculated using the time-of-flight rule and knowing the speed of sound (~340 m/s).

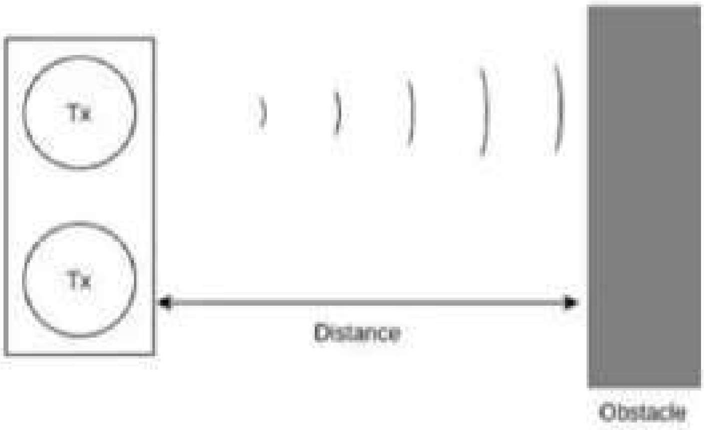

Fig 4.5 Working of Ultrasonic Sensor

The HC-SR04 is a well-liked sensor among programmers. A line that follows the sensor's line of sight is the working region of the field of vision. The sensor must include interrupt and echo pins in addition to a 5V power supply. The Echo pin receives a loud ultrasonic pulse that was emitted by the Trigger pin and records the time interval between the two events. The module's crystal oscillator is what generates the clock pulse. Ultrasonic sensors can detect the distance between the water surface or glass since sound cannot be emitted across the air-other media barrier.

Fig 4.6: Ultrasonic Sensor

When set HIGH, the HC-SR04 module's trigger pin does not immediately produce an ultrasonic wave. Instead, when the Trigger pin is dropping (after being set HIGH), a burst of 8 ultrasonic waves is released from the transmitter. The trigger pin HIGH pulse must be HIGH for at least 10 microseconds in order to activate the ultrasonic pulse burst.

4.2.4 Ultrasonic Principle

Ultrasonic sensors periodically emit short, high-frequency pulses of sound. They move at the speed of sound in the air. If they hit an object, they must be reflected in the sensor as an echo signal, and the sensor itself calculates the distance to the target based on the time delay between sending the signal and receiving the echo.

Ultrasonic sensors are very good at rejecting background noise, as the distance to an object is determined by measuring the time of flight rather than the intensity of the sound.Identify almost any audio device regardless of color. Even transparent material or thin foils are no problem for ultrasonic sensors.

The Micro sonic ultrasonic sensor is designed for target distances from 30mm to 10m and measurements can be accurately determined because the measures flight time. Some of our sensors can solve problems with less than 0.18mm accuracy. The Ultrasonic Sensor can see through dust and ink mist. Even a thin layer of the sensor membrane will not affect its operation.

With a dead space of only 30 mm and a very narrow spread, the sensor has today found all new applications for measuring liquids in yogurt jars and test tubes, and scanning bottles in container volume - no problem with our sensor. It is even believed that only lines appear.

4.2.5 Ultrasonic Sensor Timer Diagram

There are 5 connection pins on the SRF004 ultrasonic range finder. The SRF004's 5V and 0V ground connectors are wired up with a power supply. (Note that for the PICAXE system to function properly, BOTH the "Mode" (hole 4) and "0V Ground" (hole 5) connectors MUST be connected to 0V. When creating connections, take care not to overheat the solder connection pads, which could lead to damage.

An output pin on the PICAXE is connected to the SRF004 Trigger Input.

A PICAXE input pin is linked to the SRF004 Echo Output.

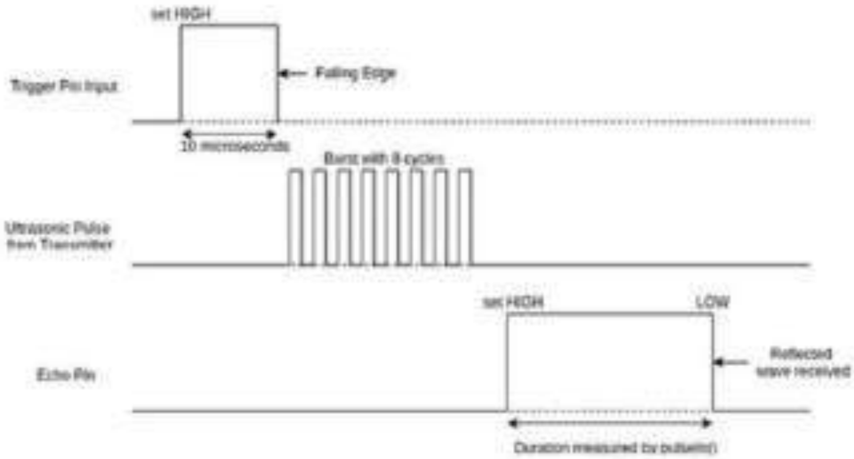

Fig 4.7: Timing Diagram of Ultrasonic Sensor

4.2.6 LCD Display

One of the most common devices connected to microcontrollers is the LCD. Some of the more common LCDs associated with many microcontrollers are 16x2 and 20x2 Displays. This means 2 lines of 16 characters and 2 lines of 20 characters, respectively.

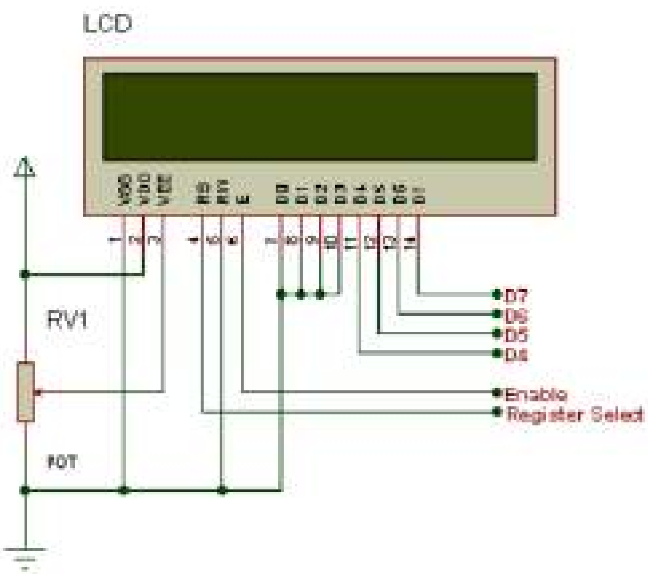

Fig 4.8: LCD Display

Table 4.1: Pin Description of LCD

Pin no	Name	Description
Pin no 1	VSS	Power supply (GND)
Pin no 2	VCC	Power supply (5v)
Pin no 3	VEE	Contrast adjust
Pin no 4	RS	0= instruction input 1= data input
Pin no 5	R/W	0= write to LCD module 1= read from LCD module
Pin no 6	EN	Enable signal
Pin no 7	D0	Data bus line 0 (LSB)
Pin no 8	D1	Data bus line 1
Pin no 9	D2	Data bus line 2
Pin no 10	D3	Data bus line 3
Pin no 11	D4	Data bus line 4
Pin no 12	D5	Data bus line 5
Pin no 13	D6	Data bus line 6
Pin no 14	D7	Data bus line 7(MSB)

The LCD needs 3 control lines and 4 or 8 I/O lines for the bus. This allows the user to choose whether the LCD will operate with a 4-bit bus or an 8-bit bus. If using the 4-bit bus, the LCD must have a total of 7 data lines (3 control lines plus 4 lines for the bus). If an 8-bit bus is used, the LCD will require a total of 11 data lines (3 control lines and 8 buses).

The three control lines are named EN, RS, and RW respectively.

4.2.7 Relay

A relay is a type of electrical switch. Most relays use a solenoid to operate the switch, but other modes of operation are also used. Relays find applications where one circuit needs to be controlled with a low-power signal or where multiple circuits need to be controlled with a single signal. The original relay is used in the long-distance telephone circuit, it transfers a signal from one circuit and retransmits it to other circuits. The outside line was widely used in telephone exchanges and early computers to perform transactions. A type of relay that can control the high voltage required to directly drive the motor is called a contactor. Solid-state relays control the power supply using semiconductor material, which causes light to switch instead of moving the parts. A relay with calibrated operating characteristics and possibly more than one operating coil is used to protect electrical circuits against overload or failure; In today's power systems these functions are performed by devices also known as "protection relays".

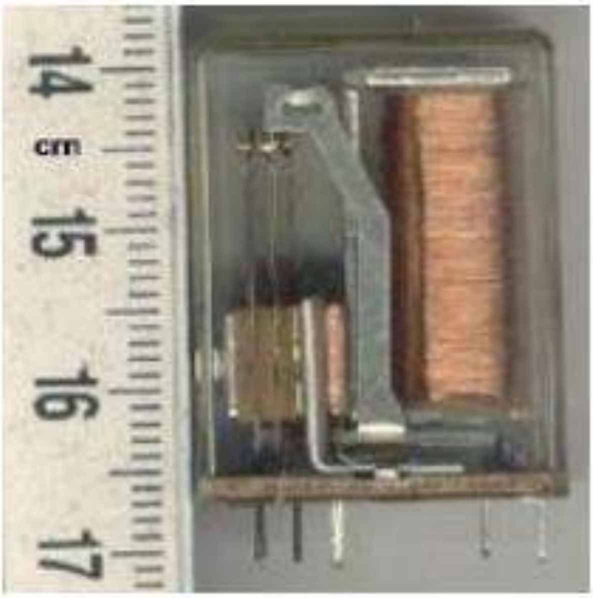

Fig 4.9: Relay

Relay Driver

Since most chips (op-amps, etc.) cannot supply the current required to operate the relay coil, a transistor is typically required, as illustrated in the image below. Use BC 109C or anything comparable. A resistor of approximately 4k7 should work fine. When the current running through the coil is abruptly turned off, a high voltage "back emf" is created that must be short-circuited by the diode.

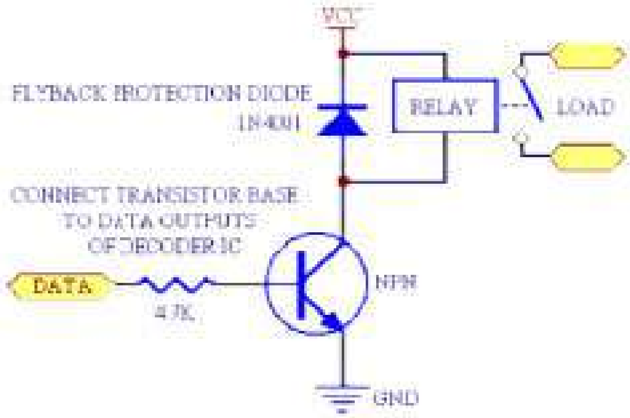

Fig 4.10: Relay Circuit

4.2.8 Control Buttons

A button (also spelled push button) or a button is a simple on-off mechanism used to control a part of a machine or process. Buttons are usually made of hard material, plastic, or metal. The surface is usually flat or finger-shaped to fit a human finger or hand for easy pressing or pushing. The knobs are mostly adjustable, but many non-knobs are wrong (due to their housing) and need a spring to return to the tension-free state. Different people use different terms to push the button, such as pushing, pressing, crushing, and piercing.

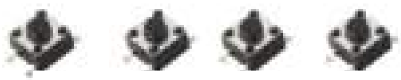

Fig 4.11: Control Buttons

- The control button used in the project is a button connected to Arduino.
- Different buttons when pressed generate different data for the Arduino.
- These buttons are used to select the time like 5,10,15,20 seconds for dry hand wash.

4.2.9 UV Lamp

- Ultraviolet lamp for disinfection of home or similar places.
- Ultraviolet radiation is air, water, and a non-porous disinfectant. UV radiation has been used successfully for many years to reduce diseases such as tuberculosis. For this reason, UV light is also often referred to as electric light.

Fig 4.12: UV Lamp

4.2.10 Mist maker

- Sanitizer helps to kill the ham full virus.

Fig 4.13: Mist Maker

4.2.11 Buzzer

The sound of the piezoelectric sound generator is the piezoelectric diaphragm. The piezoelectric diaphragm consists of a piezoelectric ceramic plate and a metal plate (brass or stainless steel, etc.) with electrodes on both sides. Attach the piezo plate to the metal plate using adhesive. request DC. Due to the piezoelectric effect, the voltage between the piezoelectric diaphragm electrodes will cause any distortion. For malformed piezoelectric elements, the deformation of the piezoelectric element expands in the radial direction. And the piezoelectric membrane bends in that direction. The metal plate does not expand with the piezoelectric material. Conversely, when the Piezo drive contracts, the piezo diaphragm bends in that direction. Thus, when AC voltage is applied between the electrodes, it bends again, creating sound waves in the air.

A standard transistor interface circuit is used to connect the buzzer. Note that if different components are used for the buzzers, the 0V rails of each component must be connected to provide input to them.

If you are using batteries as power, remember that the piezo siren draws less current than the buzzer. Audible alerts also have only one "pitch", whereas the Piezo Siren can sound at many different pitches.

To switch on the buzzer -high 1

To switch off the buzzer -low 1

Fig 4.14: Buzzer

4.3 Software Implementation

Step 1:

Install Arduino IDE in your personal computer or laptop. Also install all the required libraries as per your requirement.

Fig 4.15: Arduino Logo

Step 2:

Now open the Arduino IDE and type the code in the given workspace.

Fig 4.16: Code

Step 3:

Now run the code, if any error rises regarding library install the required library.

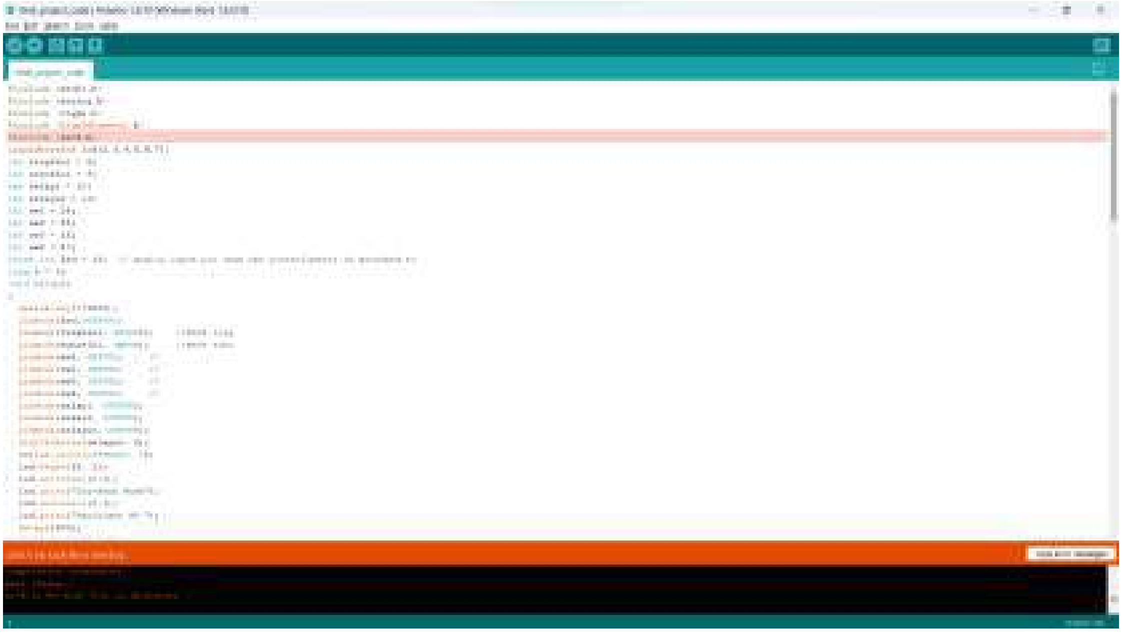

Fig 4.17: Library Error in Arduino

Step 4:

Now in the tools menu select the option Board and in the boards section select the board that is used.

Fig 4.18 : Tools Menu

Step 5:

After selecting the board, now select the port option and select a port which is suitable for your device.

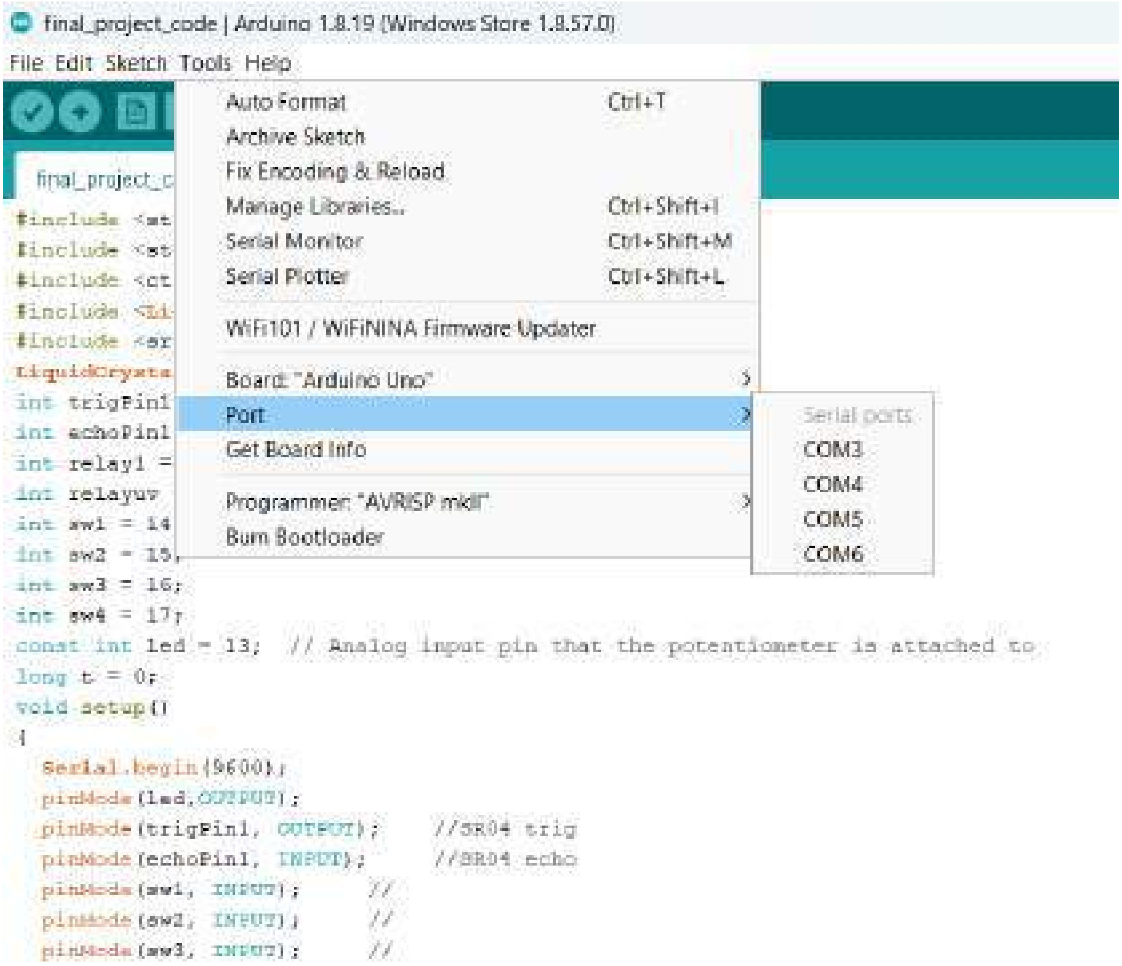

Fig 4.19: Port Selection

Step 6:

If there is any mistake in selecting the port. Go to the device manager in the ports section and check the ports which are used for serial communication.

Fig 4.20: Port Selection in Device Manager

Step 7:

Now paste your code inside the blink workspace and run the code if the LED in the Arduino UNO blinks it indicates that the connection is established.

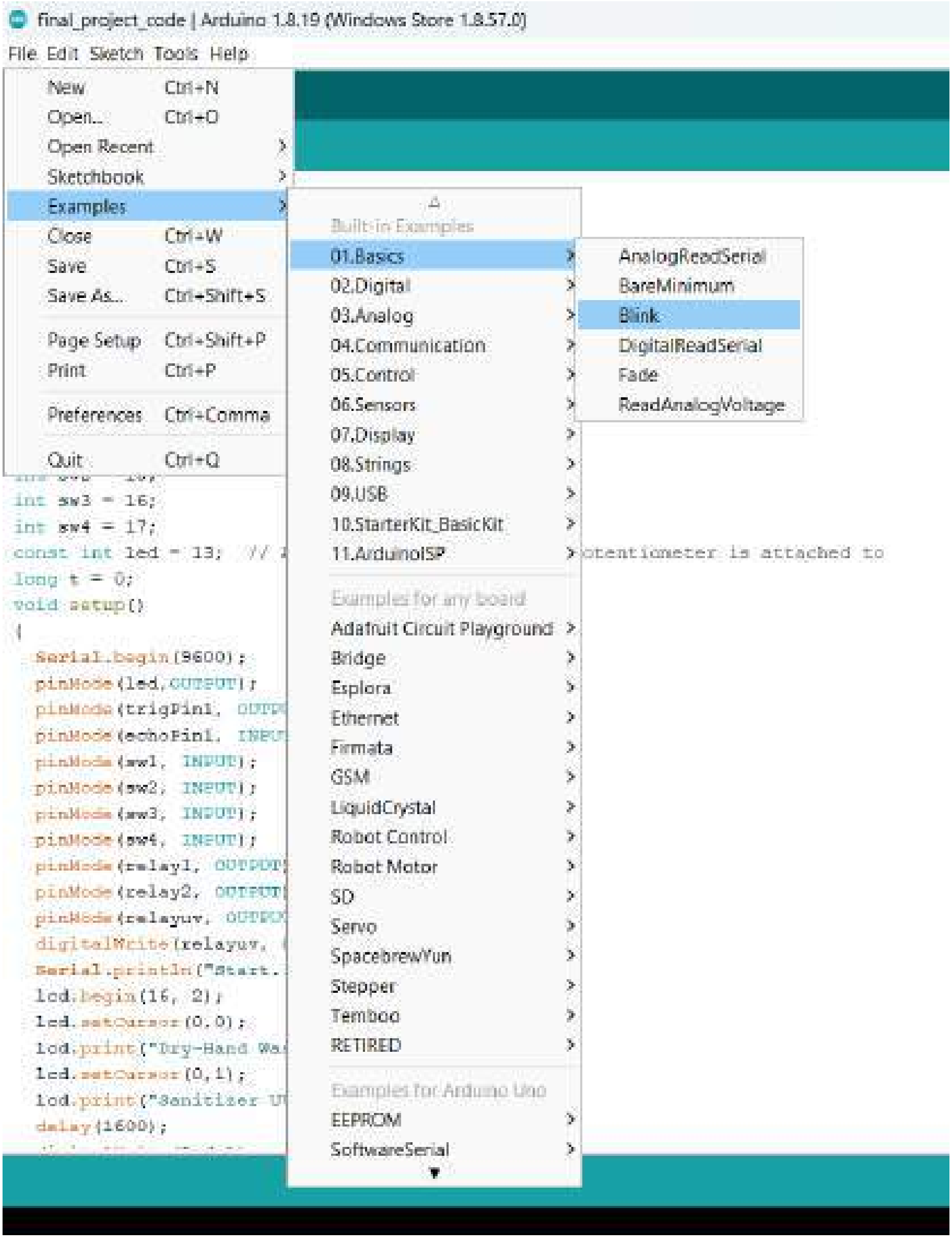

Fig 4.21: Blink checking of code

Fig 4.22: Blink Workspace

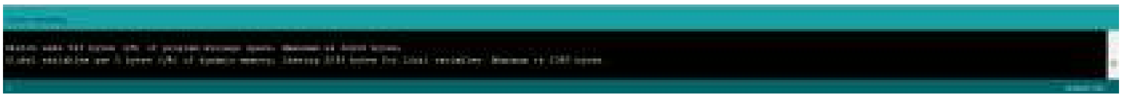

Fig 4.23: Output message

Step 8:

Now connect the USB cable from laptop or pc to the Arduino board and select the upload option and dump the code into the Arduino board.

Fig 4.24 Arduino connected to Laptop

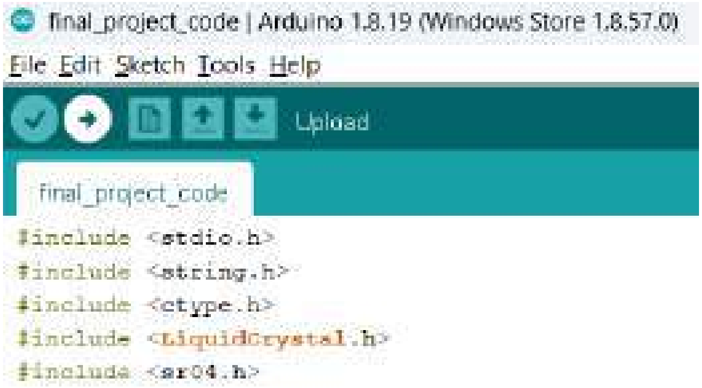

Fig 4.25: Upload option

Chapter – 5
Results and Discussion

Step 1:

Connect the wires from the circuit to the Ultrasonic Sensor, Fog dispenser, and UV light. Below the figures indicates the wires connected from the circuit board to the Ultrasonic sensor, Fog dispenser, and UV light.

Below are figures which indicate the connections Fig 5.1 shows all the three connections from the circuit to the components, Fig 5.2 represents the connection from the Ultrasonic sensor inside the tunnel to the Arduino UNO, Fig 5.3 represents the connection from the relay to the UV light, Fig 5.4 represents the connection from the relay to the Fog dispenser.

Fig 5.1: Wire connections from circuit to the components

Fig 5.2: Wire connections from Arduino to Ultrasonic sensor

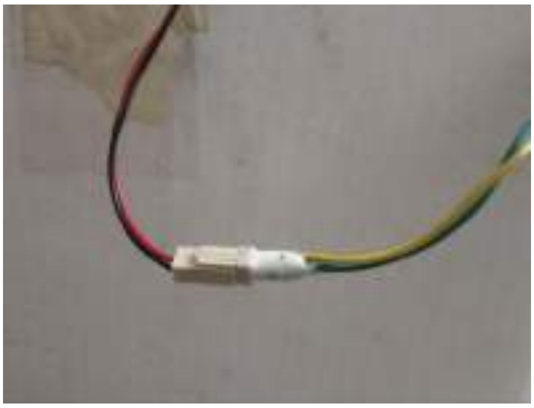

Fig 5.3: Wire connection from relay to UV light

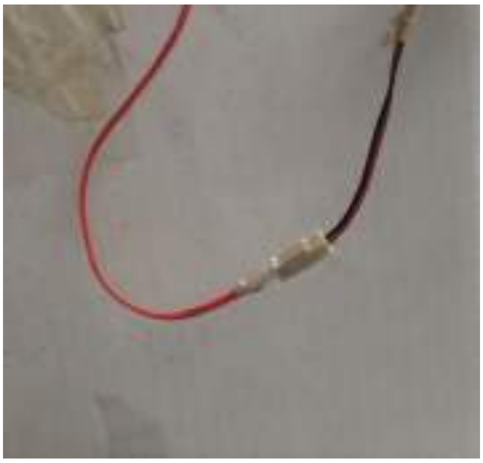

Fig 5.4: Wire connection from relay to fog dispenser

Step 2:

Insert the plug in the socket and turn on the switch. Then the buzzer sound is activated indicating that the circuit is turned on. Then the message is displayed on the LCD display.

Below there are some images that helps us in better understanding of the equipment the Fig 5.5 represents the green light which indicates the system is turned on, Fig 5.6 shows the message displayed on the LCD screen when the system is turned on, Fig 5.7 shows the message displayed on the LCD screen when the timer input is not given.

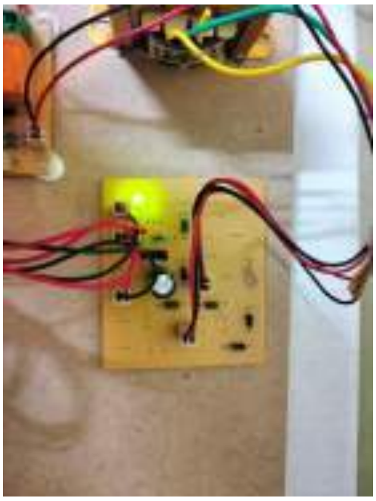

Fig 5.5: Indication that circuit is ON

Fig 5.6: First message displayed on LCD screen

Fig 5.7: Message displayed when no input is given

Step 3:

Now select one of the timers i.e., 5 seconds, 10 seconds, 15 seconds, 20 seconds. Then the message is updated on the LCD display.

Below are the figures that explains the control flow of the components Fig 5.8 shows the timers which are used in the circuit, Fig 5.9 shows the image of the LCD display when the timer 5 seconds is selected, Fig 5.10 shows the image of the LCD display when the timer 10 seconds is selected, Fig 5.11 shows the image of the LCD display when the timer 15 seconds is selected, Fig 5.12 shows the image of the LCD display when the timer 20 seconds is selected.

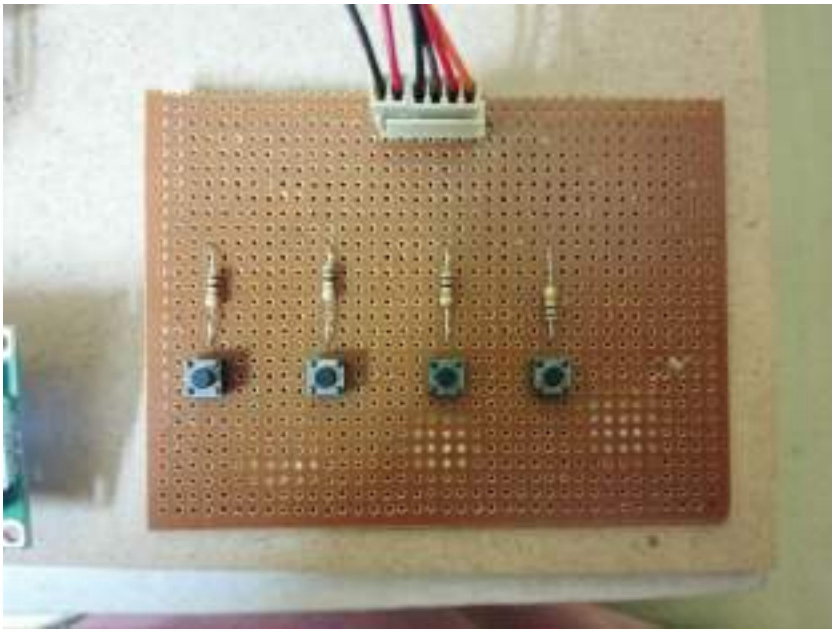

Fig 5.8: Timer Buttons

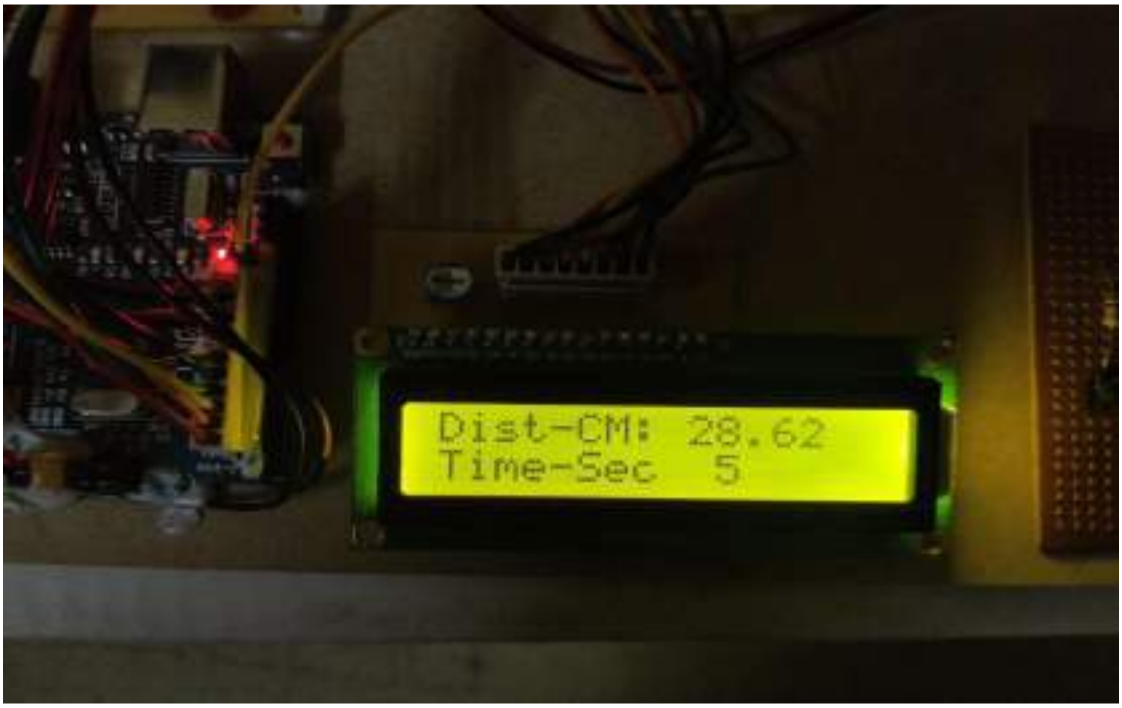

Fig 5.9: Timer when 5 seconds is the input

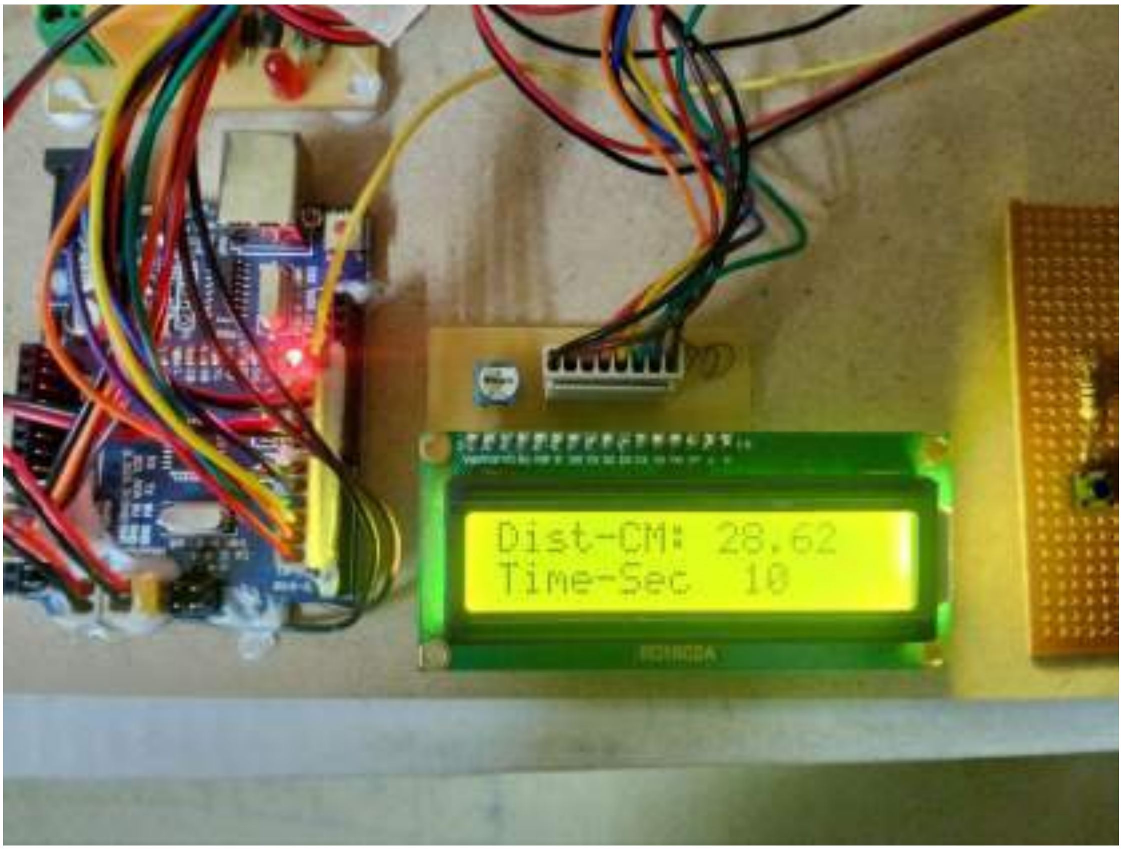

Fig 5.10: Timer when 10 seconds is the input

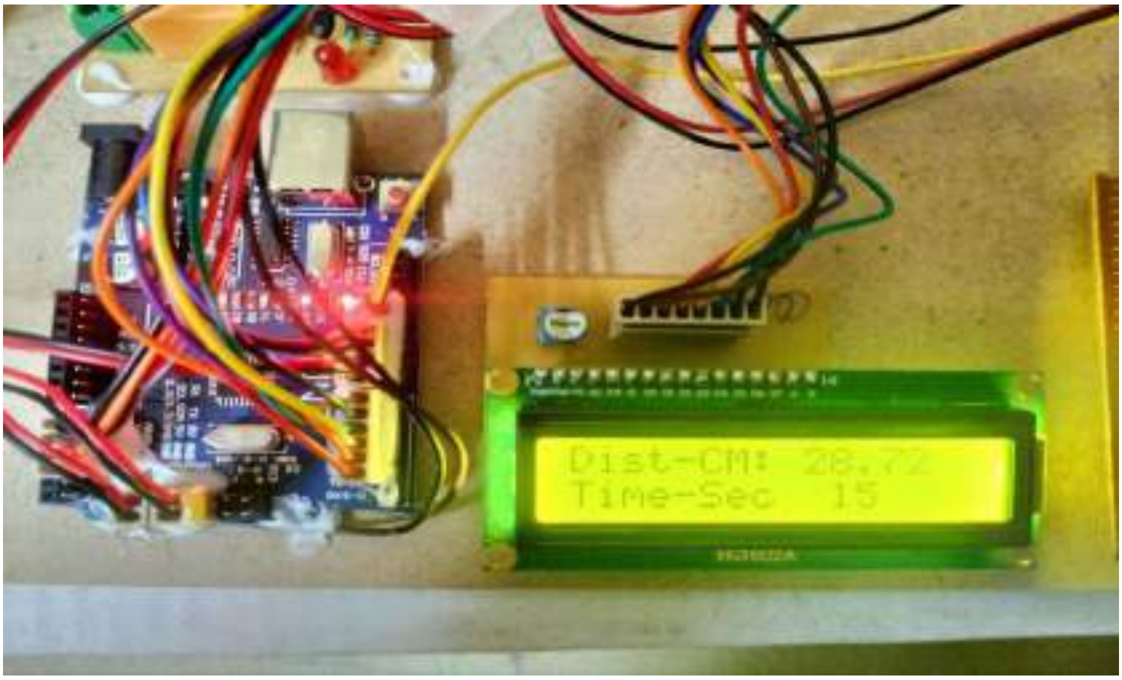

Fig 5.11: Timer when 15 seconds is the input

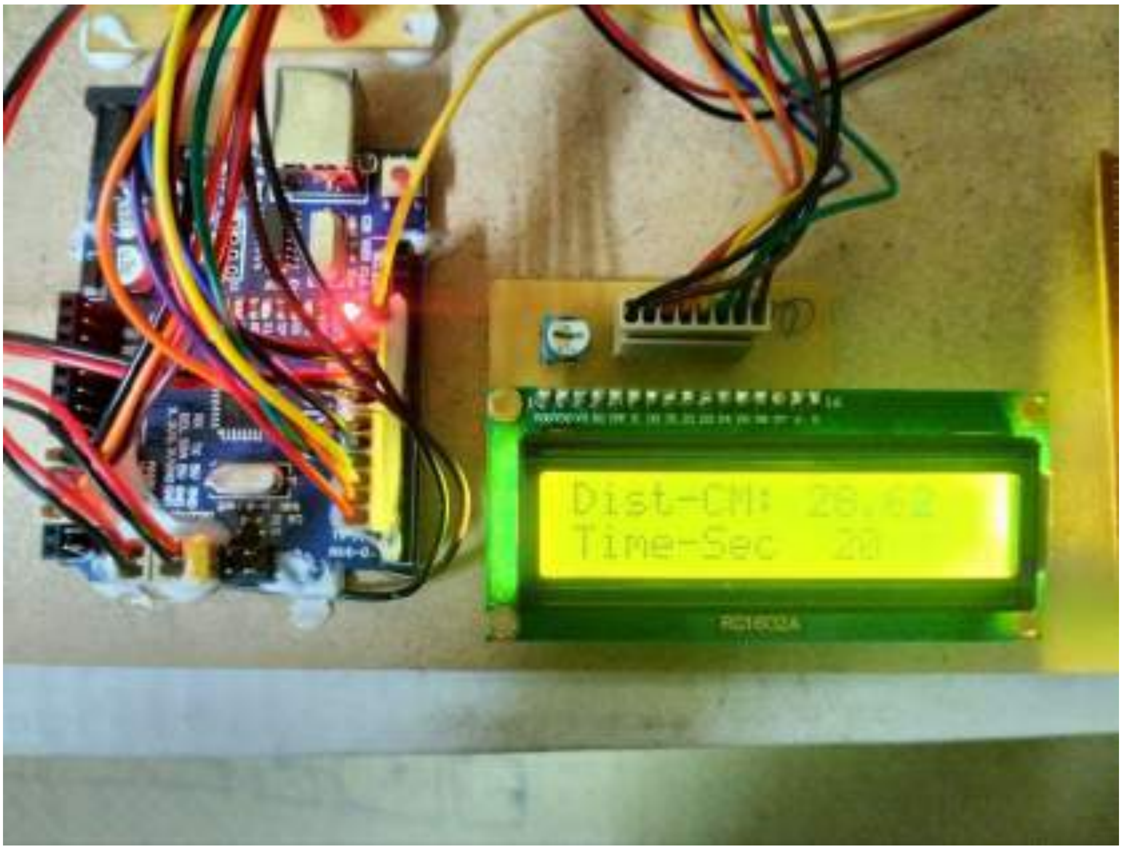

Fig 5.12: Timer when 20 seconds is the input

Step 4:

Now place your hands inside the tunnel and a new message is displayed on the LCD screen.

Below the images the scenario when the sanitization process is started Fig 5.13 shows when the hands are placed inside the sanitization tunnel, Fig 5.14 shows the new message that is displayed on the LCD screen.

Fig 5.13: Hands placed inside the box

Fig 5.14: Message displaying that system is ON

Step 5:

Now the sanitizer is dispensed using the Fog dispenser and the UV light is turned on. Fig 5.15 shows the image inside the sanitization tunnel during the sanitization process.

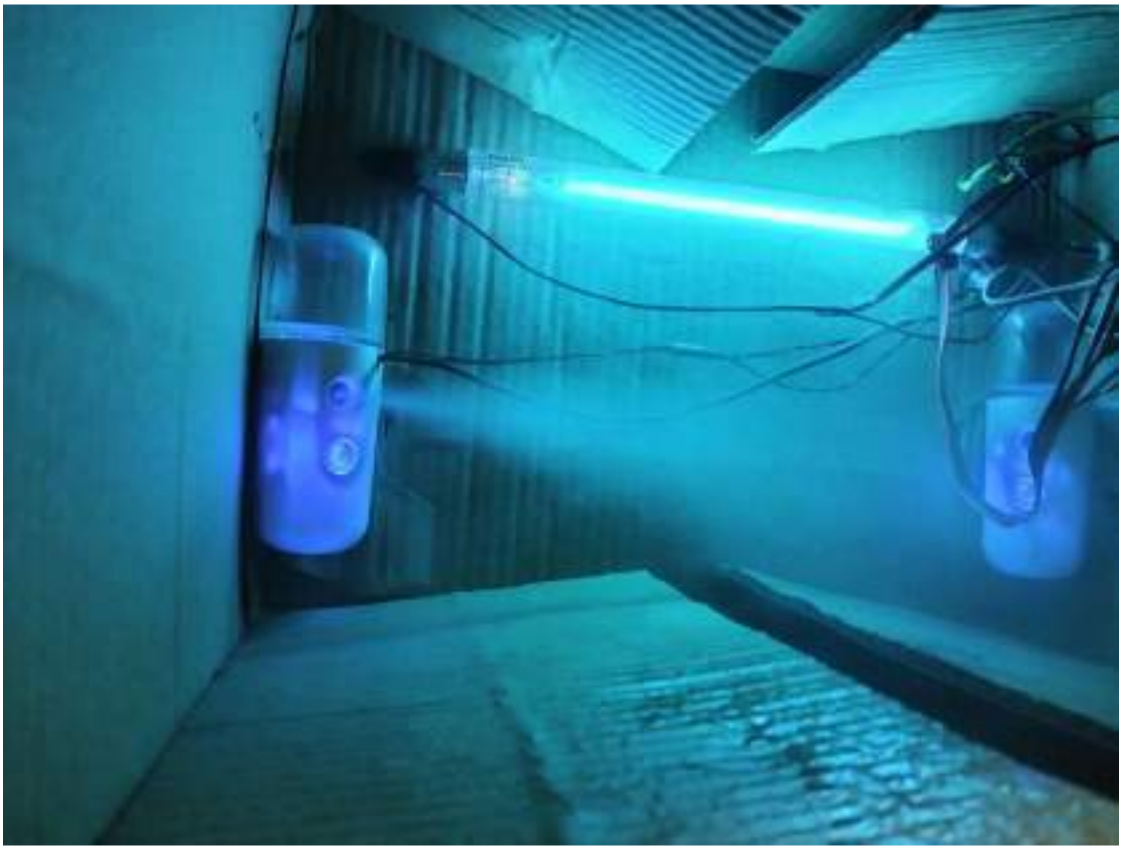

Fig 5.15: Action performed inside the box

Step 6:

The process is continued until the timer becomes 0. The countdown is displayed on the LCD display.

Below Fig 5.16 represents the series of images where the LCD screen displays the time countdown for the sanitization process of 5 seconds.

Fig 5.16: Sanitization process timer countdown

Step 7:

If the hands are removed before the timer becomes 0 then the timer is paused and the buzzer is activated indicating the sanitization process is incomplete.

The Fig 5.17 shows the buzzer and Fig 5.18 shows that the sanitizer is stopped when hands are removed.

Fig 5.17: Buzzer

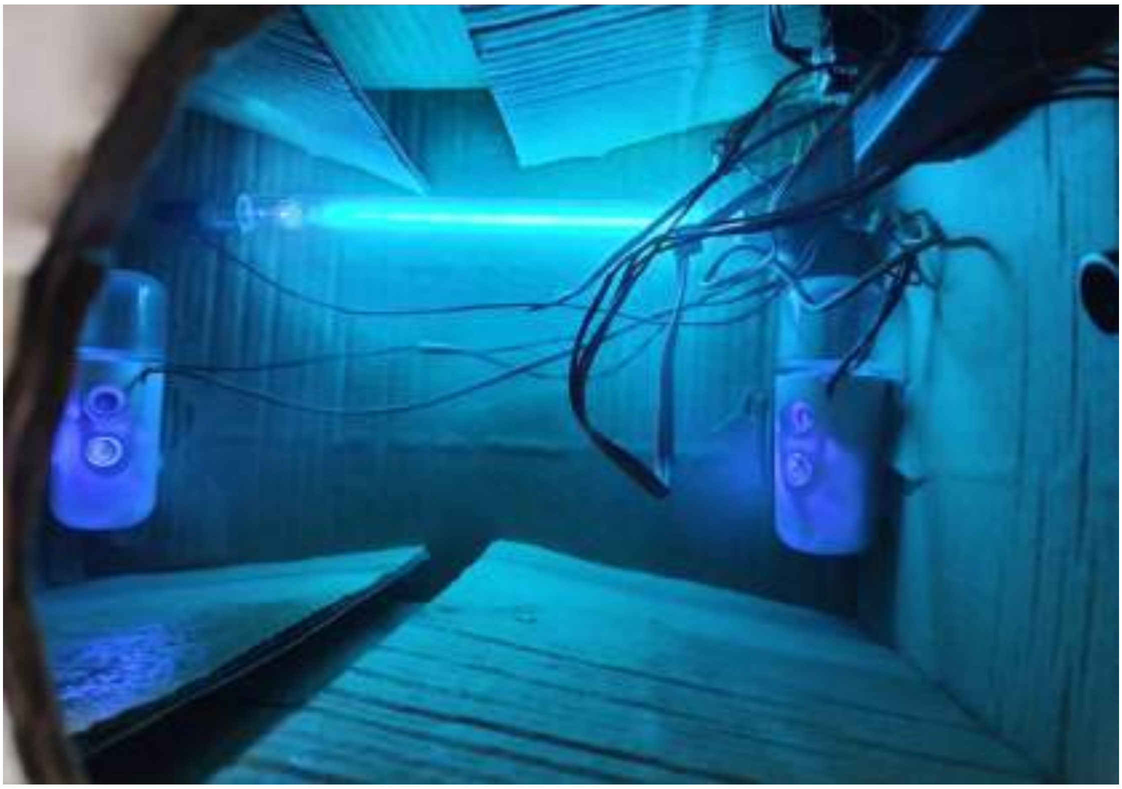

Fig 5.18: Sanitization process when the hands are removed during sanitization

Step 8:

When the whole process is finished. After the total sanitization process, the message is displayed on the LCD display.

Below Fig 5.19 shows the final message that is displayed on the LCD screen after the sanitization process.

Fig 5.19: Final Message

Chapter – 6
Conclusions and Future Scope

6.1 Conclusions

We can conclude from all the above chapters that we achieved all the desired results. The main aim of this project is to improve the sanitization process by having minimal contact between people and having a high rate of sanitization. Finally, we achieved all these. Minimal contact is obtained using sensors and timers, which the machine runs even when someone is not there to control it. The sanitization is improved by using UV light by which the rate of protection is drastically increased. For the system to run or perform the sanitization process we are going to need two sets of inputs.

1. Timer input which is need to be given manually.
2. Hands that are placed inside the tunnel or box for sanitization.

6.2 Objectives Achieved

- Automatic hand detection using an ultrasonic sensor.
- Visible alerts using LCD display.
- Audible alerts using BUZZER.
- Machine works based on the Selective Time.
- Mist maker is used to generating fog sanitizer.
- UV light is used to kill the virus.
- Relay is used for switching operations.
- Task is achieved using an Arduino microcontroller.

6.3 Applications

- Mall and theatre
- Chemical factories
- Schools
- Crowd places
- Hospitals

6.4 Advantages

- Automatic operation.
- Easy to use.
- Up to 95% sanitizer is saved.
- Effective hand wash.
- More safety features.
- Alerts using buzzer and LCD display.

6.5 Future Scope

The future scope of the project is when we attach a mask detection and temperature sensor. It can be used at the entrance of shopping malls or any crowded places like industries, or schools in order to prevent the spread of any viruses or diseases by isolating the people.

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