TOUCHLESS FAUCET WITH AUTOMATIC DOOR CONTROL SYSTEM FOR COVID-19 USING IOT (INTERNET OF THINGS)

Submitted to Sri S.Ramasamy Naidu Memorial College, Sattur.

Affiliated to the Madurai Kamaraj University, Madurai in the partial fulfillment of the requirements of the degree of

B.Sc Computer Science

By

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled **"TOUCHLESS FAUCET WITH AUTOMATIC DOOR CONTROL SYSTEM FOR COVID-19 USING IOT (INTERNET OF THINGS)"** is a bonafide work done by **E.RISHIKA (UCS190624), S.JEYALAKSHMI (UCS190609)** submitted to the Department of Computer Science, Sri S.Ramasamy Naidu Memorial College, Sattur, in partial fulfillment of the requirements of the award of the **DEGREE OF BACHELOR OF COMPUTER SCIENCE.**

Mr.G.SUBRAMANIAN	Dr.K.KRISHNAVENI
Assistant Professor	Associate Professor
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Submitted for Viva –voce held on _____

INTERNAL EXAMINER **EXTERNAL EXAMINER**

DECLARATION

DECLARATION

I hereby declare that the project work entitled **"TOUCHLESS FAUCET WITH AUTOMATIC DOOR CONTROL SYSTEM FOR COVID-19 USING IOT (INTERNET OF THINGS)** submitted to **SRI S.RAMASAMY NAIDU MEMORIAL COLLEGE, SATTUR**. This is a record of original work done by me under the guidance and supervision of **Mr.G.SUBRAMANIAN**, Assistant Professor and that this project work has not formed the basis for the award of any Degree/Diploma/Associate ship/Fellowship or any similar title.

Place: Sattur **Signature of the Candidates**

Date:

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

Primarily, we thank God who has given us power and knowledge to complete the project successfully.

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S. NO	TABLE OF CONTENT	PAGE NO

ABSTRACT

COVID-19 is a serious pandemic at this moment. The corona virus is spreading quickly and easily between humans. There are ways to curb the spread of this virus and one way is to sanitizing the hands for 20 seconds. Sometimes, if the person carelessly touches the faucet - which could be contaminated - after washing his/ her hands, he/she has a higher chance of contracting this corona virus disease. It is safe to wash hands before entering the premises. The person could be wearing face masks when they go to public places but their hands may not be clean. Even if he/ she clean their hands, they could touch the surface which was touched by a virus carrier. The virus carrier's hands would be contaminated. Corona virus could exist on a contaminated surface from several hours to days depending on the environmental conditions such as humidity and temperature. Since the door lock system is automated, one need not have to touch the door handle. The door is controlled by a motor driver that is connected to the circuit. If any person comes near the door, then the sensor detects the body movement to send logic signals to the microcontroller that delivers respective pulses to switch the relay with a fixed time delay to operate the motor.

INTRODUCTION

Hand washing has always been one of most effective ways of keeping diseases at bay. It is a simple act that pays in dividends when it comes to keeping ourselves healthy and safe. Hand washing is also one of the key cornerstones of COVID-19 prevention. Now more than ever as we embrace the new normal and live with COVID-19, hand hygiene needs to become an integral part of our daily routine and our lives, as we live through this pandemic, and beyond, to protect us from diseases,' said Dr Poonam Khetrapal Singh, Regional Director, WHO South-East Asia Region.

With COVID-19 transmission mainly spreading between people through direct, indirect (through contaminated objects or surfaces), or close contact with infected people via mouth and nose secretions, washing hands with soap and running water is of critical importance. To stop the spread of COVID-19, along with other COVID appropriate behaviors, the practice of hand washing at regular intervals is a must, after coughing or sneezing, when caring for the sick, after using the toilet, before eating, while preparing food and after handling animals or animal waste. Hand washing after touching common surfaces such as doorknobs or handles, or after one comes back home from visiting a public place will keep ourselves and others around us safe.

"Promoting hand hygiene at all levels of health care is also critical. Hand hygiene, a very simple action, is well accepted to be one of the primary modes of reducing health care-associated infection and of enhancing safety.

Fig 1.1 Practice of hand washing

Fever is one of the body's first reactions to infection and is common in illnesses like influenza and COVID-19. Monitoring body temperature, even when we're healthy, can help detect disease early. Part of the brain called the hypothalamus continually adjusts the body temperature to maintain an optimal environment for body functions. Body temperatures vary with gender, age, overall health, and environmental factors. A normal temperature is around 98.6 degrees

Fahrenheit, although recent studies indicate a slightly lower average. When the immune system detects the presence of a virus in your body, it signals the hypothalamus to turn up the heat, creating a fever, a hot and hostile environment that weakens the virus and stimulates your immune response. A temperature higher than 100° F can indicate that the body is fighting an infection. By regularly monitoring the body temperature and learning what is normal, we can immediately detect higher temperatures. This might be an early warning sign that we're about to get sick, and to take immediate measures to protect others. This is critical for diseases like COVID-19 where we are contagious several days before showing any symptoms at all.

If fever or any abnormalities are noticed, stay home, monitor the symptoms, and call a doctor if needed. If we must go out, be sure to wear a cloth face mask and stay at least six feet away from others. By understanding our own individual body temperature, noticing changes that might indicate an infection, and taking immediate measures to prevent spreading it to others, we can help family, friends, and co-workers stay safe, healthy, and productive.

Fig 1.2 Monitoring body temperature

This system monitors body temperature and ensures whether people sanitize their hands, only then the person is permitted to enter inside any premises.

2.1. STATEMENT OF THE PROBLEM

Quarantine alone may not be sufficient to prevent the spread of covid 19, hand hygiene is also quite necessary. If someone touches the surface which was touched by a virus carrier, there is a high chance that the person could also get infected and the spread is also increased.Coronavirus could last on a contaminated surface from several hours to days depending on the environmental conditions such as humidity and temperature.

2.2. OBJECTIVE

In our project, a person will only be granted access once he/ she washes his/ her hands. The person could be wearing face masks when they go to public places but their hands may not be clean. Even if he/ she clean their hands, they could touch the surface which was touched by a virus carrier. The virus carrier's hands would be contaminated. Corona virus could last on a contaminated surface from several hours to days depending on the environmental conditions such as humidity and temperature. By washing your hands before entering the premises, this way of spreading corona virus could be prevented.

In this project, we have made a prototype to wash hands safely with automatic door control system. We have made a touchless faucet so that you do not have to touch the surface of the faucet and is automatic. The prototype is cheap - only costs around $11 to build - and easy to make. This faucet is automatic and could also prevent wasting water when not in use.

We made this prototype using the resources at my home as we could not go out due to the lockdown in my country. You are allowed to remake this project or even improve it, but you could also try to convert any container of water into a faucet. We would suggest you to use a solenoid water valve instead of the submersible water pump. The tube is modelled as the faucet in this prototype. This model could be used in malls, offices and your home. This model could be used in places with automatic sliding doors or automatic door system, by replacing the single channel relay module with solid state relay module.

This prototype could also be used as an automatic alcohol-based hand sanitizer dispenser, but when using the hand sanitizer, the container should be closed as the alcohol could evaporate.

3. SYSTEM SPECIFICATION

3.1. HARDWARE REQUIREMENTS

The components used in the project are explained in detail. This elucidates the working of our project in real environment. The disadvantages of the existing system and advantages of the proposed system are also pointed.

3.1.1. COMPONENTS USED

The components used in the project are listed below

- Arduino UNO
- Ultrasonic Sensor
- LM35 Temperature sensor
- Servo Motor
- Submersible Pump
- Relay Module
- LCD

3.1.2. ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The 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.

Fig 3.1 Arduino UNO

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 preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer.

TECHNICAL SPECIFICATIONS

Microcontroller: Microchip ATmega328P

Operating Voltage: 5 Volts

Digital I/O Pins: 14 (of which 6 can provide PWM output)

PWM Pins: 6 (Pin # 3, 5, 6, 9, 10 and 11)

UART: 1

I2C: 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 boot loader

SRAM: 2 KB

EEPROM: 1 KB

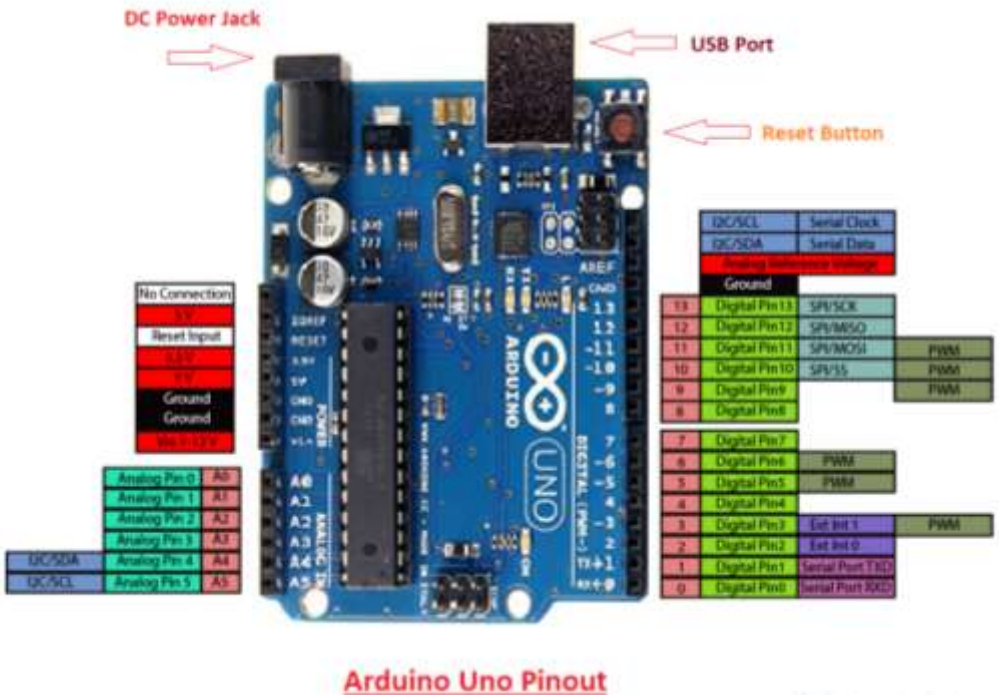
Clock Speed: 16 MHz

Length: 68.6 mm

Width: 53.4 mm

Weight: 25 g

Power Sources: DC Power Jack & USB Port



Arduino Uno Pinout

Fig 3.2 Pin Configurations of Arduino UNO

GENERAL PIN FUNCTIONS

LED There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.

VIN The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.

3V3 A 3.3volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND Ground pins.

IOREF This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.

Reset Typically used to add a reset button to shields that block the one on the board.

COMMUNICATION:

The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a in file is required. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows serial communication on any of the Uno's digital pins.

AUTOMATIC (SOFTWARE) RESET:

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

3.1.3. ULTRASONIC SENSOR

The Ultrasonic Sensor is used to measure the distance with high accuracy and stable readings. It can measure distance from 2cm to 400cm or from 1 inch to 13 feet. It emits an ultrasound wave at the frequency of 40 KHz in the air and if the object comes in its way then it will bounce back to the sensor. By using that time which it takes to strike the object and comes back, you can calculate the distance. The ultrasonic sensor has four pins. Two are VCC and GND which will be connected to the 5V and the GND of the Arduino while the other two pins are Trig and Echo pins which will be connected to any digital pins of the Arduino. The trig pin will send the signal and the Echo pin will be used to receive the signal. To generate an ultrasound signal, you will have to make the Trig pin high for about 10us which will send a 8 cycle sonic burst at the speed of sound and after striking the object, it will be received by the Echo pin.

Fig 3.3 Ultrasonic Sensor

Pin No	Pin name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

Fig 3.4 Pin description of Ultrasonic sensor

HC - SR04 SENSOR FEATURES

The features of HC - SR04 Ultrasonic sensor are,

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered :< 15°
- Operating Current :< 15mA

WORKING PRINCIPLE

This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

$$\text{Distance} = \text{Speed} \times \text{Time}$$

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below.

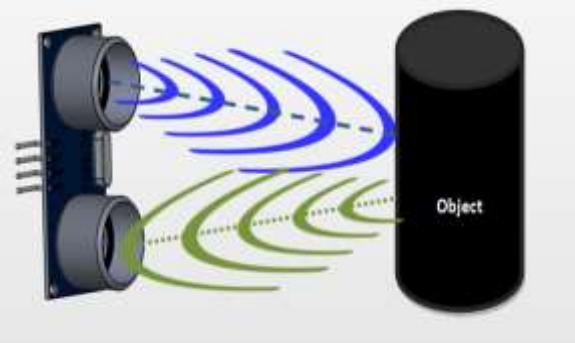


Fig 3.5 Ultrasonic receiver module

Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor.

HC-SR04 distance sensor is commonly used with both microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc.Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver

will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information the distance is measured as explained in the above heading.

3.1.4. LM35 TEMPERATURE SENSOR

LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases. The sensor will perform sensing when the temperature changes every 1ºC temperature will show a voltage of 10 mV. In placing the LM35 can be affixed with adhesive or can be cemented on the surface but the temperature will be slightly reduced by about 0.01ºC being absorbed in the surface temperature. In this way the expected difference between the air temperature and the surface temperature can be detected by a sensor LM35 same temperature as the surrounding, if the surrounding air temperature is much higher or much lower than the surface temperature, the LM35 is the surface temperature and the temperature of the surrounding air.

The long distance necessary liaison which is not affected by interference from the outside, so use the cable sheath is earthed so that it can act as an antenna receiver and deviation therein, can also act as a rectifier which corrects in such cases, using the method of bypass capacitors from Vin to be earthed. LM35 sensor working principle as follows

• The ambient temperature in the detection using the IC part temperature sensitive

• The ambient temperature is converted into electrical voltage by a circuit in the IC where the temperature change is proportional to the output voltage changes.

• Every change of 1°C would produce a change in output voltage of 10mV

Vout is a scalable sensor output voltage linearly with the measured temperature, which is 10 mill volts per 1 degree Celsius. So, If Vout = 530mV, then the measured temperature is 53 degrees Celsius. If Vout = 320mV, then the measured temperature is 32 degrees Celsius. The output voltage can be directly fed as input to the signal conditioning circuit such as the operational amplifier circuit and filter circuits, or other circuits such as voltage comparator circuit and circuit Analog-to-Digital Converter.

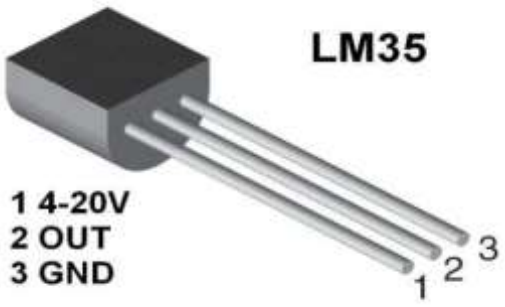


Fig 3.6LM35 *Temperature sensor*

3.1.5. SERVO MOTOR

A servo motor is an electromechanical device that produces torque and velocity based on the supplied current and voltage. A servo motor works as part of a closed loop system providing torque and velocity as commanded from a servo controller utilizing a feedback device to close the loop. The feedback device supplies information such as current, velocity, or position to the servo controller, which adjusts the motor action depending on the commanded parameters.

Fig 3.7 Servo motor

Servo motors are available in an extensive variety of types, shapes and sizes. The term servo was first used in 1859 by Joseph Facort, who implemented a feedback mechanism to assist in steering a ship with steam to control the rudders. A servo motor is part of a servo mechanism consisting of three key elements – a motor, a feedback device, and control electronics. The motor can be AC or DC, brushed or brushless, rotary or linear, and of any size. The feedback device can be a potentiometer, Hall-effect device, tachometer, resolver, encoder, linear transducer, or any other sensor as appropriate. Completing the servo system is the control electronics that powers the motor and compares the feedback data and command reference to verify that the servo motor is operating as commanded. There are many types of servo motor applications, from simple DC motors used in hobby applications (such as model airplanes) to sophisticated brushless motors driven by complex motion controllers used for multi-axis machining centers. One example of a

common servo mechanism is a vehicle cruise control that consists of an engine (the motor), a speed sensor (feedback), and electronics to compare the vehicle speed with the set speed. If the vehicle slows down, the sensor feeds this data to the electronics which, in turn, increases the gas to the engine to step up the speed to the desired set point – a simple closed loop system.

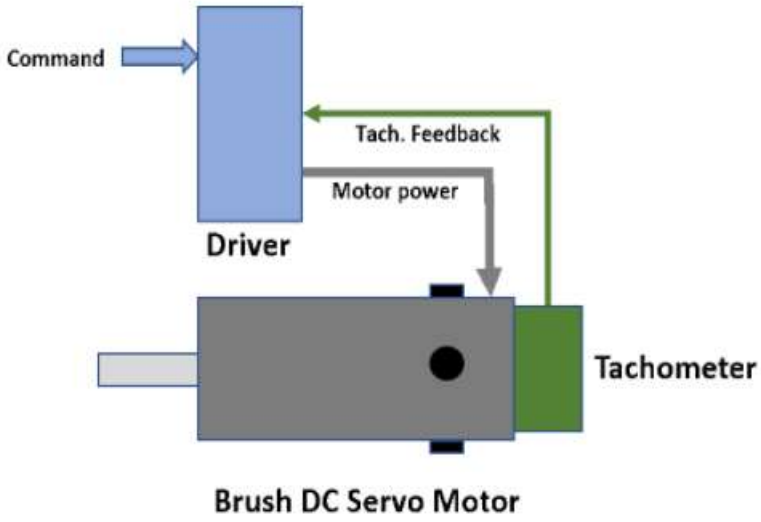


Fig 3.8 DC Servo motor

A simple industrial servo motor consists of a permanent magnet DC motor with an integral tachometer that provides an output voltage proportional to speed. The drive electronics delivers the necessary voltage and current to the motor based on the voltage fed back from the tachometer. In this example, a commanded speed (represented as a command reference voltage) is set in the driver, then the circuitry in the driver compares the tachometer feedback voltage and determines if the desired speed has been accomplished - known as a closed velocity loop. The velocity loop is monitoring the commanded velocity and tachometer feedback, while the driver adjusts the power to the motor to maintain the desired commanded velocity. In a more sophisticated servo motor system, multiple embedded loops are tuned for optimal performance to provide precision motion control. The system consists of current, velocity, and position loops that utilize precision feedback elements. Each loop signals the subsequent loop and monitors the appropriate feedback elements to make real time corrections to match the commanded parameters.

The base loop is the current or torque loop. Current is proportional to torque in a rotary motor (or force in a linear motor), which provides acceleration or thrust. A current sensor is the

device that provides feedback related to the current flowing through the motor. The sensor sends a signal back to the control electronics - typically an analog or digital signal proportional to the motor current. This signal is subtracted from the commanded signal. When the servo motor is at the commanded current, the loop will be satisfied until the current drops below the commanded current. The loop will then increase current until the commanded current is reached, with the cycle continuing at sub second update rates. The velocity loop works in the same fashion with voltage proportional to velocity. The velocity loop sends the current loop a command to increase current (thus increasing voltage) when the velocity falls below the commanded velocity. The position loop accepts a command for a PLC or motion controller, which in turn provides a velocity command that is fed to the velocity loop, which in turn commands the required current to accelerate, maintain, and decelerate the motor to move to the commanded position. All three loops work in optimized synchrony to provide smooth and precise control of the servo mechanism.

3.1.6. SUBMERSSIBLE PUMP

A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation's, a problem associated with a high elevation difference between the pump and the fluid surface. Submersible pumps push fluid to the surface, rather than jet pumps, which create a vacuum and rely upon atmospheric pressure. Submersibles use pressurized fluid from the surface to drive a hydraulic motor down hole, rather than an electric motor, and are used in heavy oil applications with heated water as the motive fluid.

Working principle:

Electric submersible pumps are multistage centrifugal pumps operating in a vertical position. Liquids, accelerated by the impeller, lose their kinetic energy in the diffuser, where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of radial and mixed flow pumps. In the HSP, the motor is a hydraulic motor rather than an electrical motor, and may be closed cycle (keeping the power fluid separate from the produced fluid) or open cycle (mingling the power fluid with the produced fluid down hole, with surface separation). The pump shaft is connected to the gas separator or the protector by a mechanical coupling at the bottom of the pump. Fluids enter the pump through an intake screen and are lifted by the pump stages. Other parts include the radial bearings (bushings) distributed along the length of the shaft, providing radial support to the pump shaft. An optional thrust bearing takes up part of the axial forces arising in the pump, but most of those forces are absorbed by the protector's thrust bearing. There are also screw-type submersible pumps, there is a steel screw which is used as a working element in them. The screw allows the pump to work in water with a high sand content and other mechanical impurities.

Fig 3.9Submersible pump

3.1.7. RELAY

The relay is the device that opens or closes the contacts to cause the operation of the other electric control. It detects the undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area through ON or OFF.

Electromagnetic relay consists of

- Electromagnet
- Mechanically movable contact
- Switching points
- Spring

COM: Common pin

NO: Normally open – there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin and power is provided.
NC: Normally closed – there is contact between the common pin and the normally closed pin. There is always connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuit is opened and there is no supply provided to the load.

WORKING PRINCIPLE:

A simple relay consists of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and one or more sets of contacts. The movable armature is hinged to the yoke and linked to one or more set of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.

When electrical current is passed through a coil, it generates a magnetic field that in turn activates the armature. This movement of the movable contacts makes or breaks a connection with the fixed contact. When the relay is de-energized, the sets of contacts that were closed ,open and breaks the connection and vice versa if the contacts were open. When switching off the current to the coil, the armature is returned, by force, to its relaxed position. This force is usually provided by a spring, but gravity can also be used in certain applications. Most power relays are manufactured to operate in a quick manner.

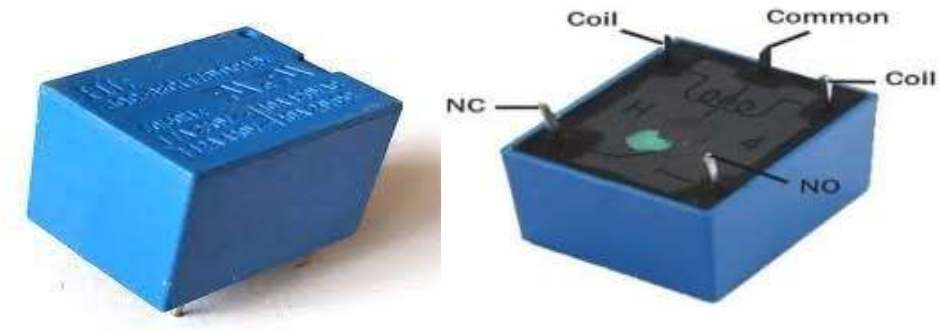


Fig 3.10 Relay

3.1.8. LIQUID CRYSTAL DISPLAY

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits &devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc...

Fig 3.11 LCD

FEATURES OF LCD:

The operating voltage of this LCD is 4.7V-5.3V

- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8pixel box
- The alphanumeric LCDs contains alphabets & numbers
- It’s display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters

LCD PIN CONFIGURATIONS:

Pin1	Ground or Source Pin is used to connect the GND terminal of the microcontroller unit or power source.
Pin2	V_{cc} or Source Pin issued to connect the supply pin of the power source.
Pin3	V_o or V_{EE} or Control Pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
Pin4	Register Select pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
Pin5	Read or Write pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
Pin 6	Enable or Control pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
Pins 7-14	These data pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
Pin15	Positive pin of the LED is connected to +5V.
Pin 16	Negative pin of the LED is connected to GND.

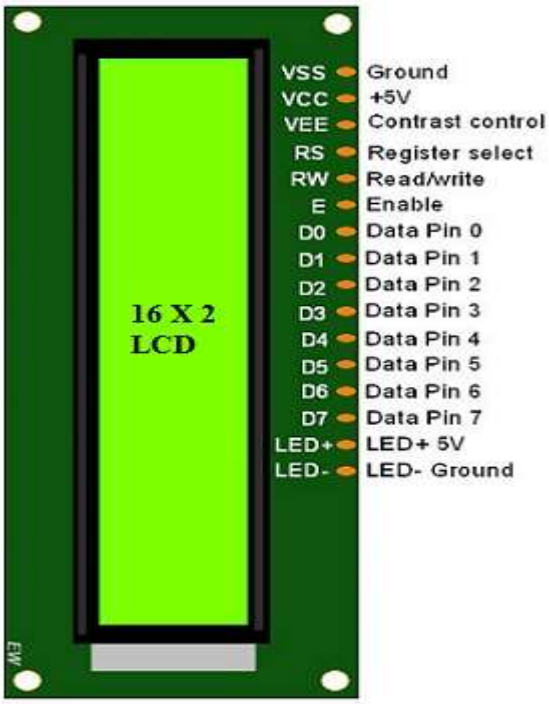


Fig 3.12 LCD pin configurations

REGISTERS OF LCD:

A 16×2 LCD has two registers like data register and command register. The RS (register select) is mainly used to change from one register to another. When the register set is '0', then it is known as command register. Similarly, when the register set is '1', then it is known as data register.

COMMAND REGISTER:

The main function of the command register is to store the instructions of command which are given to the display. So that predefined tasks can be performed such as clearing the display, initializing, set the cursor place, and display control. Here commands processing can occur within the register.

DATA REGISTER:

The main function of the data register is to store the information which is to be exhibited on the LCD screen. Here, the ASCII value of the character is the information which is to be exhibited on the screen of LCD. Whenever we send the information to LCD, it transmits to the data register, and then the process will be starting there. When register set =1, then the data register will be selected.

SPECIFICATIONS

RESOLUTION:

The resolution of an LCD is expressed by the number of columns and rows of pixels (e.g., 1024×768). Each pixel is usually composed 3 sub-pixels, a red, a green, and a blue one. This had been one of the few features of LCD performance that remained uniform among different designs. However, there are newer designs that share sub-pixels among pixels and add Quattron which attempt to efficiently increase the perceived resolution of a display without increasing the actual resolution, to mixed results.

SPATIAL PERFORMANCE:

For a computer monitor or some other display that is being viewed from a very close distance, resolution is often expressed in terms of dot pitch or pixels per inch, which is consistent with the printing industry. Display density varies per application, with televisions generally having a low density for long-distance viewing and portable devices having a high density for close-range detail. The Viewing Angle of an LCD may be important depending on the display and its usage, the limitations of certain display technologies mean the display only displays accurately at certain angles.

TEMPORAL PERFORMANCE:

the temporal resolution of an LCD is how well it can display changing images, or the accuracy and the number of times per second the display draws the data it is being given. LCD pixels do not flash on/off between frames, so LCD monitors exhibit no refresh-induced flicker no matter how low the refresh rate.[164] But a lower refresh rate can mean visual arte facts like ghosting or smearing, especially with fast moving images. Individual pixel response time is also important, as all displays have some inherent latency in displaying an image which can be large enough to create visual artifacts if the displayed image changes rapidly.

COLOR PERFORMANCE:

There are multiple terms to describe different aspects of color performance of a display. Color gamut is the range of colors that can be displayed, and color depth, which is the fineness with which the color range is divided. Color gamut is a relatively straight forward feature, but it is rarely discussed in marketing materials except at the professional level. Having a color range that exceeds the content being shown on the screen has no benefits, so displays are only made to perform within or below the range of a certain specification.[165] There are additional aspects to LCD color and color management, such as white point and gamma correction, which describe what color white is and how the other colors are displayed relative to white.

BRIGHTNESS AND CONTRAST RATIO:

Contrast ratio is the ratio of the brightness of a full-on pixel to a full-off pixel. The LCD itself is only a light valve and does not generate light; the light comes from a backlight that is either fluorescent or a set of LEDs. Brightness is usually stated as the maximum light output of the LCD, which can vary greatly based on the transparency of the LCD and the brightness of the backlight. Brighter backlight allows stronger contrast and higher dynamic range (HDR displays are graded in peak luminance), but there is always a trade-off between brightness and power consumption.

3.1.9. BUCK CONVERTOR.

A **buck converter** (**step-down converter**) is a DC-to-DC power converter which steps down voltage (while drawing less average current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) typically containing at least two semiconductors (a diode and a transistor, although modern buck converters frequently replace the diode with a second transistor used for synchronous rectification) and at least one energy storage element, a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter).[1] It is called a buck converter because the voltage across the inductor "bucks" or opposes the supply voltage.[2]

Switching converters (such as buck converters) provide much greater power efficiency as DC-to-DC converters than linear regulators, which are simpler circuits that lower voltages by dissipating power as heat, but do not step up output current.[3]

The efficiency of buck converters can be very high, often over 90%, making them useful for tasks such as converting a computer's main supply voltage, which is usually 12 V, down to lower voltages needed by USB, DRAM and the CPU, which are usually 5, 3.3 or 1.8 V.

Fig 3.13 Buck convertor

3.2. SOFTWARE REQUIREMENTS

The software requirements and the program uploaded in Arduino UNO is described.

3.2.1. TINKER CAD:

Tinker cad is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

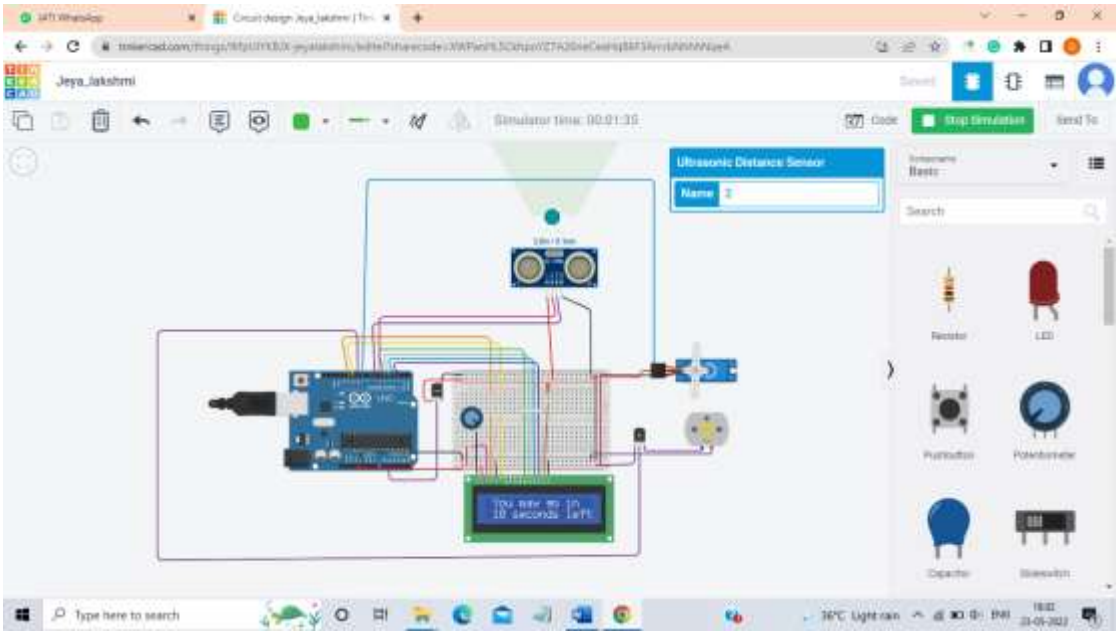


Fig 3.14

3.2.2. ARDUINO IDE:

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards.

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as **Windows, Mac OS X, and Linux**. It supports the programming languages C and C++. Here, IDE stands for **Integrated Development Environment**.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

The Arduino IDE will appear as:

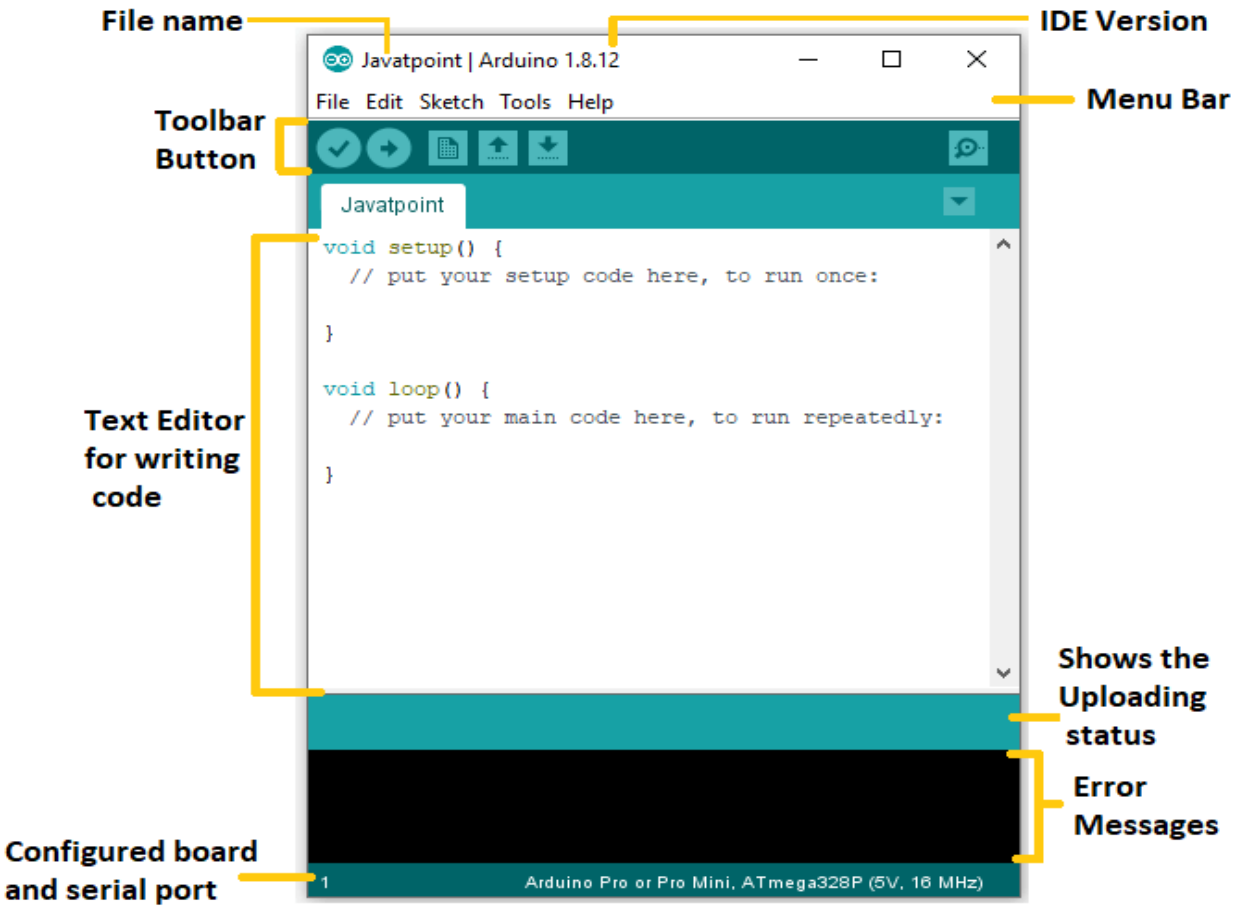

File name
IDE Version
Javatpoint | Arduino 1.8.12
File Edit Sketch Tools Help
Menu Bar
Toolbar Button
Javatpoint
void setup() {
// put your setup code here, to run once:
}
void loop() {
// put your main code here, to run repeatedly:
}
Text Editor for writing code
Shows the Uploading status
Error Messages
Configured board and serial port
1
Arduino Pro or Pro Mini, ATmega328P (5V, 16 MHz)

Fig 3.15

4. PROJECT DESCRIPTION

This project consists of ultrasonic sensor, LM35 temperature sensor, submersible pump, relay module and servo motor. This ensures that people with normal body temperature and also those who sanitizes their hands are permitted inside the premises. An ultrasonic sensor is mounted on the sanitizer storage tank which senses the presence of hands. Once it detects, “Hands detected” will be shown on LCD and it signals the relay to turn on which further turns on the submersible pump. The pump operates and the sanitizer is supplied for 5 seconds. After sanitizing, the status “You are safe now” is displayed. Then the person needs to stand in front of the door where LM35 temperature sensor is mounted. It detects the body temperature and if it is normal, then the servo motor is rotated by 90̊and the door is left open for 30 seconds. If the temperature detected by the temperature sensor is higher, the servo motor does not operate and the status “Temperature is High” and “You are not permitted in” is displayed. Suppose the person is standing in front of the door for temperature detection without even sanitizing the hands, the status “Wash hands for grant access” is displayed. Thus, this allows people inside the premises only if both conditions are satisfied and thereby controlling the spread.

4.1. ADVANTAGES

- This model could be used in places with automatic sliding doors or automatic door system, by replacing the single channel relay module with solid state relay module.
- Because of its modern appearance, it attracts attention which can increase hand hygiene compliance.
- It is very easy to install and use, particularly for people that struggle to reach over countertops to access the dispenser.
- It delivers a standardized dose of hand soap or sanitizer.
- It eliminates common contact point where germs can be transferred.
- Contactless hand sanitizer dispensers usually have a sleek and stylish design. They also add a modern appeal to places they are installed in.
- Besides hand sanitizer, the dispenser's structure also works for other liquids like lotion, laundry detergent etc.
- The wide range of responsibilities widens the use of dispenser to various locations.

4.2. DISADVANTAGES

- Powers supply is must for the working of this project.
- Consider touch-free dispensers only in prominent locations that have reasonable supervision and frequent attention by maintenance staff.
- The installation process of automatic doors mandates the need of a professional technician in order for it to be accurate and efficient.

4.3. APPLICATIONS

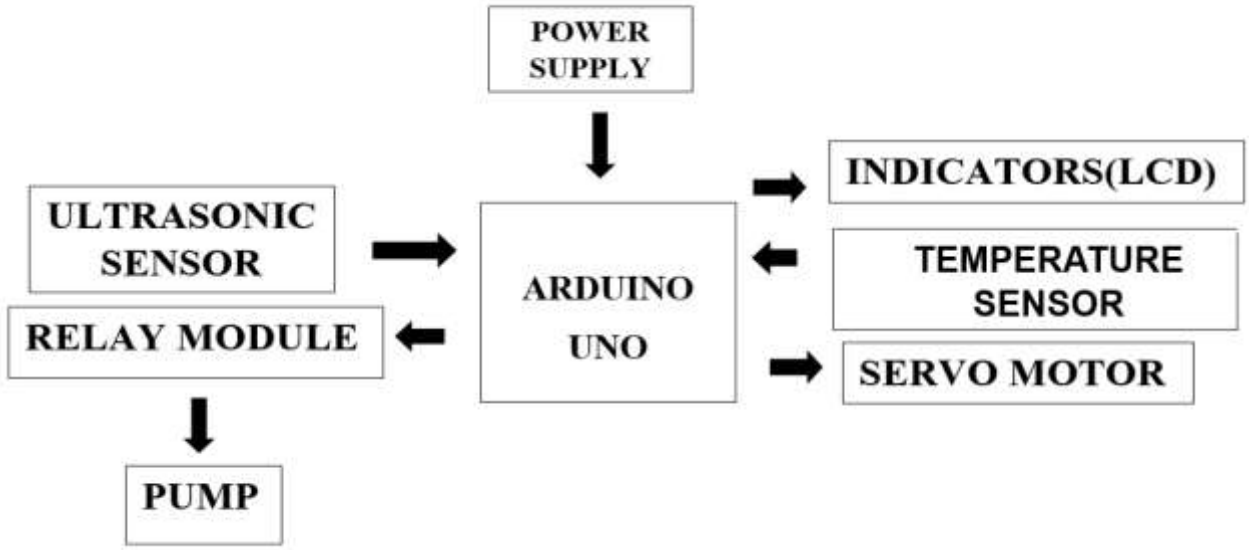
This project can be installed at every crowded place such as

- Malls
- Railway stations
- Education premises
- Industries
- Hotels
- Bus terminals

5. SYSTEM DESIGN

5.1. SIMULATION MODEL

Fig 5.1 Block Diagram of Touch less Faucet with Automatic Door Control System



5.2. BLOCK DIAGRAM

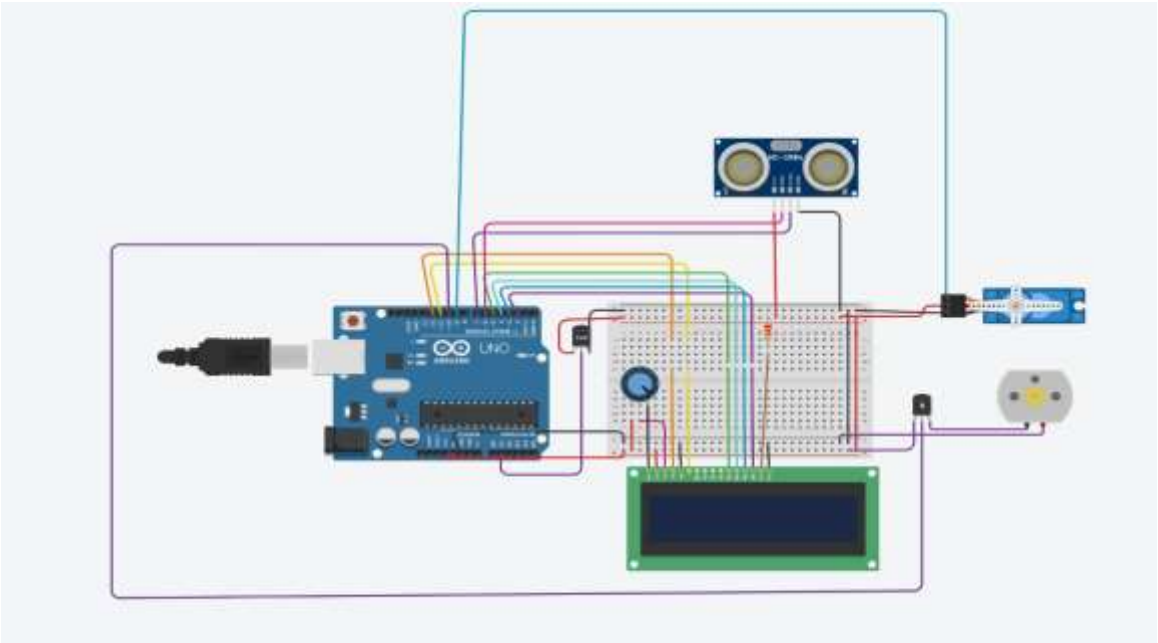


Fig 5.2 Simulation setup

6. CONCLUSION

By installing this prototype in real time, the spread of covid virus can be literally minimized. It is not expected that how soon we will get out of this pandemic. Hence maintaining hygiene is very important to lead a happy and healthy life. It is our responsibility to protect ourselves and our closed ones during this pandemic situation by maintaining hygiene.

FUTURE SCOPE

This project at present prevents the spread of Covid-19 by monitoring only the temperature and hand sanitization. In future, this system can be integrated with face mask detection and social distancing. To implement this, a neural network model is to be created with sensor Flow and training it on a dataset of both people who are wearing facemasks and people who are not. This face recognition algorithm will detect the facemasks on people's faces using the trained model. And we can use ultrasonic sensor to detect the space between the people, if it is less than 3metres in distance, a buzzer will be given. Also we can allow limited number of people to be in a hall if the number of people exceeds the limited number door will be closed and when someone left the hall the new member will be allowed to enter the hall. we can have a database connected with the sensor to count the number of people entered the hall, when it reaches the specified limit door will be closed, when people leave the hall the new member will get the access.

7. BIBLIOGRAPHY

[1] Duraisamy Sathya & Pugalendhi Ganesh Kumar, 'Secured Remote Health Monitoring System, IET Healthcare Technology Letters', vol. 4, issue. 6, pp. 228-232, 2017.

[2] R. L. A. Kuranov and V. Pisarevsky, An empirical analysis of boosting algorithms for rapid objects with an extended set of Haarlike features, Intel Technical Report MRLTR-July 02-01, 2002.

[3] R. Lienhart and J. Maydt, An extended set of Haar-like features for rapid object detection, presented at the IEEE International Conference on Image Processing, 2002.

[4] Y. Freund and R. E. Schapire, Experiments with a new boosting algorithm, in Proc. 13th International Conference on Machi International Journal of Pure and Applied Mathematics Special Issue 4535 4536

REFERRED WEBSITES

- *https://create.arduino.cc/projecthub/RucksikaaR/touchless-faucet-with-door-control-system-for-covid-19-7de89a*
- *https://create.arduino.cc/projecthub/DKARDU/how-to-make-non-touch-automatic-door-open-close-system-a0cbcf?ref=tag&ref_id=door&offset=3*
- *https://www.researchgate.net/publication/327023036_Auto_Opening_Door_and_Car_Identification*

8. APPENDIX

8.1. SCREEN LAYOUTS

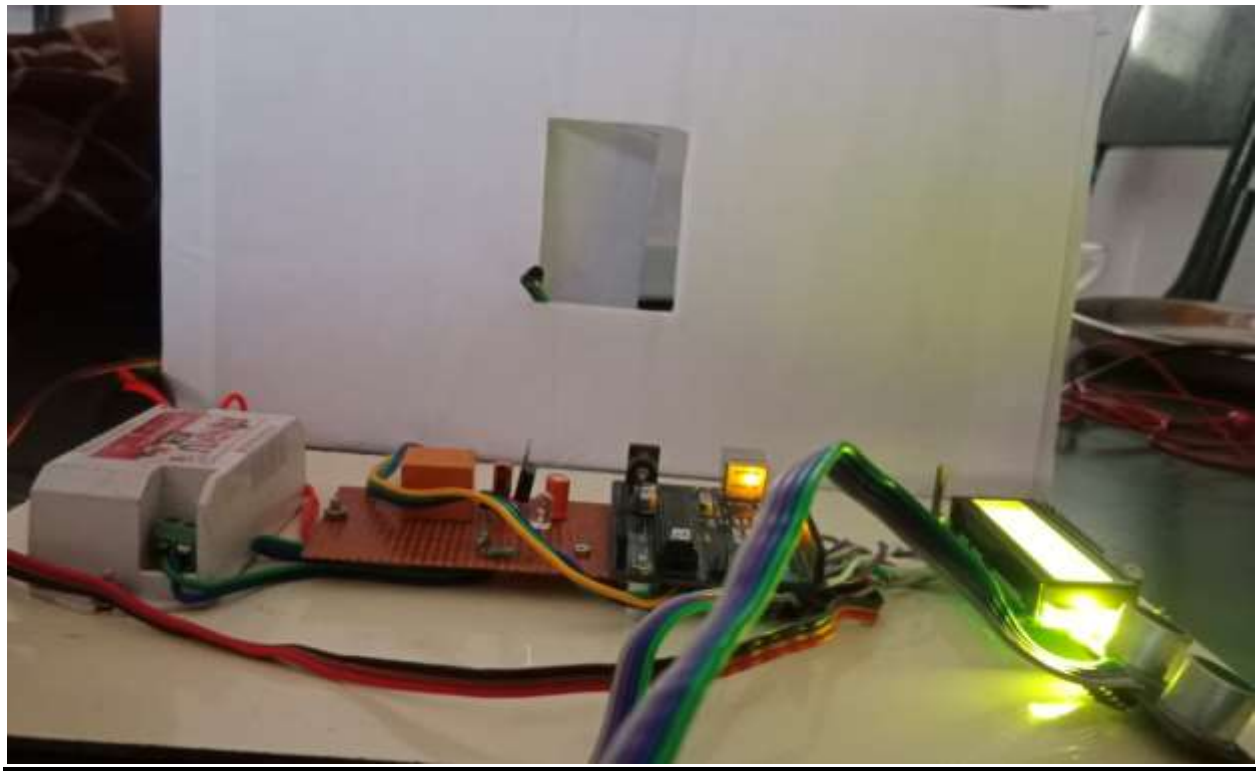


Fig 8.1 Touchless faucet with door control system

8.2. WRITINGSKETCHES

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension.ino. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right and corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. Arduino Language is user friendly and for programming is merely a set of C/C++ functions that can be called from your code.

8.3. ALGORITHM

Step 1	Including the required Header files
Step 2	Defining pins for sensors
Step 3	Initializing the variables with appropriate datatypes
Step 4	Initializing the library for LCD with the numbers of the interface pins
Step 5	Set up the LCD's number of columns and rows
Step 6	Defining the pin modes using pin Mode function
Step 7	Configuring the trigger pin of ultrasonic sensor as HIGH and LOW at the required time
Step 8	If the ultrasonic sensor detects the hands, then the State variable is assigned to 1
Step 9	Calculating the distance from the sensor
Step10	If the calculated distance is between 2 to 4 cm, the LCD displays the required status and the relay signals the submersible pump to turn ON
Step 11	Calculating the distance from the temperature sensor
Step 12	If the State=1 and the temperature is between 97˚F to 99˚F,the LCD shows the required status and the servo motor rotates by 90˚
Step 13	If the State=1 and the temperature is greater than 99˚, the LCD shows “Temperature is High” and the servo motor does not operate
Step 14	If the State=0, the LCD shows “Wash your hands to grant access” and the relay does not operate
Step 15	Again the process repeats from step 7

8.4. SAMPLE SOURCE CODE

```
#include <LiquidCrystal.h>

#include <Servo.h>

#define trig 9

#define echo 8

Servo servo;

float valuec,valuef;

int tmp = A0;

int state;

long duration;

int distance; // initialize the library with the numbers of the interface pins

LiquidCrystallcd(2, 3, 4, 5, 6, 7);

void setup() {

// set up the LCD's number of columns and rows

lcd.begin(16, 2);

Serial.begin(9600);

lcd.print("Wash your hands");   // Print a message to the LCD.

lcd.setCursor(0,1);

lcd.print("before you enter");

servo.attach(10);

pinMode(trig, OUTPUT); // Set the trigger pin as OUTPUT

pinMode(echo, INPUT); // Set the echo pin as INPUT

pinMode(tmp,INPUT);

pinMode(10, OUTPUT);
```

```
Serial.begin(9600);
}
void loop()
{
float mv,mvc,valuec;
digitalWrite(trig, LOW);
delayMicroseconds(5);
digitalWrite(trig, HIGH); // Set the trigger pin HIGH to send the ultrasonic wave (pulse)
delayMicroseconds(10);
digitalWrite(trig, LOW);
duration = pulseIn(echo, HIGH); // Calculate time taken (in microseconds) for the pulse emitted by the trigger pin to reach the echo pin.
distance = (duration/2) * (331.3/10000); // Calculate the distance from the sensor to the obstacle in cm, using the speed of sound in air(m/s) and the time taken (stored in duration variable)
delay(1000);
  if(distance>2 && distance<5)
{ // If you place your hands within 5 cm
lcd.clear();
lcd.setCursor(1,0);
lcd.print("Hands detected");
lcd.setCursor(0,1);
lcd.print("Wash hands-10s");
digitalWrite(11, HIGH);
delay(3000); // Wait for 1000 millisecond(s)
digitalWrite(11, LOW);
```

```
    state=1; // Assign state variable to 1
delay(1000); // Delay period of 1 second must be used to prevent clicking of the relay module
lcd.clear();
lcd.print("You are safe now");
delay(1000);
lcd.clear();
  }
valuec = analogRead(tmp);
  mv = (valuec*5000)/1024;
mvc = mv/10;
valuef=((mvc*9)/5)+32;
Serial.print(mvc);
Serial.print(valuef);
  if((state==1)&&(valuef<=99))
{ // If you place your hands in front of the IR sensor after washing your hands
lcd.clear();
lcd.setCursor(1,0);
lcd.print("You may go in");
lcd.setCursor(1,1);
lcd.print("30 seconds left");
servo.write(90);
delay(20000); // The door will be opened for 10 seconds
servo.write(0);
lcd.clear();
```

```
lcd.print("Wash your hands");
lcd.setCursor(0,1);
lcd.print("before you enter");
delay(3000);
    state=0;
   }
else if((state==1)&&(valuef>99))
{ // If you do not wash your hands before you enter
lcd.clear();
lcd.print("  Temperature");
lcd.setCursor(0,1);
lcd.print(" is High");
delay(5000);
lcd.clear();
lcd.print("You are not");
delay(1000);
lcd.setCursor(0,1);
lcd.print("Permitted in");
    state=0;
   }
  else if(state==0)
  {
lcd.clear();
lcd.print("Wash your hands");
```

```
lcd.setCursor(0,1);
lcd.print("to grant access");
delay(3000);
  }
}
```

8.3. REPORTS

All the components are interfaced with the Arduino UNO, a microcontroller unit and the code required for ultrasonic sensor, LM35 temperature sensor, servo motor, LCD and relay module is loaded into the microcontroller via Arduino IDE. Fig 8.2 shows the complete hardware setup of touchless faucet with door control system.

Fig 8.2 Touchless faucet with door control system

Case 1: When ultrasonic sensor detects the target, it sends signal to the Arduino via echo pin and then the LCD displays the below status for 10 seconds. As per the given condition the sanitizer is let out of the faucet for five seconds through submersible pump which is connected to the relay.

Fig 8.3 LCD status 1

Case 2: When the temperature sensed by LM35 is normal then the servo motor is operated for the opening of door and the below status is displayed on LCD.

Fig 8.4 LCD status 2

Case 3: When the temperature of the person is high then the servo motor does not operate and the door is not opened. And then the LCD displays the below status.

Fig 8.5 LCD status 3