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COVID 19 SAFETY SYSTEM – DOOR HANDLE SANITIZER & TEMPERATURE DETECTION

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Abstract: Since December 2019 the world is under tremendous tension, the numbers are increasing day by day, and till date no vaccine has been full proved against the pandemic agent. The COVID-19 virus was unknown to us before it cast its outbreak in Wuhan, China. Being from a large family, a continuous mutation is occurring, forbidding the researchers, microbiologist, pharmaceuticals to search for the cure for the vaccine. Affecting the countries in a chain; China, Italy, Spain, USA, India , Russia, the virus has proved it's strength and subservient a technologically enhanced race. The policies taken worldwide has lessen its affect to some extent but could not eradicate it. Lockdown has economically weaken many nations, and testing of different medicines has also not proven to be satisfactory. The design shows the preventive measure that can be taken during the COVID-19 pandemic in the whole world. Sanitizers have become the most significant commodities right now. By the new rules and regulations given by WHO vigorous sanitization is needed to survive. The design gave the solution for the problem stated. The design introduces an automatic hand sanitizer and temperature sensing system, to keep the hand sanitized whenever a person wants to do it, without a contact with the sanitizing machine. The temperature sensor on touching gives the body temperature of the person.

Keywords: Automatic hand sanitizer, Arduino, ultrasonic sensor, PIR sensors, TMP36, covid-19

I. INTRODUCTION

In early 2020, a virus emerged that was spreading rapidly to several countries. The first case related to the virus was reported in Wuhan, Hubei Province. WHO named this disease the 2019 novel coronavirus (2019-nCoV), then changed its name to Coronavirus Disease (COVID-19) which was caused by the virus of Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-Cov-2). This virus is zoonotic (a virus that is transmitted between animals and humans) and originates from bats. Besides, this virus can also be transmitted from humans to humans. Coronavirus can be transmitted either by air, direct contact, or indirectly. However, it is most commonly spread by droplets. Symptoms caused by this virus include the mild flu, namely a cold, sore throat, cough, fever, and difficulty breathing. In severe cases, Covid-19 can manifest as pneumonia. Patients can develop acute respiratory distress syndrome for a short time and die from multiple organ failure. The existence of this disease has a big impact on both socials and economics. WHO has declared this a pandemic disease and many cities around the world are in a lockdown situation. To prevent the cause of this virus, it can be done by keeping a distance at least 1 meter, avoid going to crowded places, avoid touching the eyes, mouth, and nose when outside, and cleaning hands with soap or alcohol-based hand rub. Providing containers for cleaning fluids in public spaces is a form of Covid-19 prevention, but the provision of containers is currently ineffective because there are parts that are often touched. This could be a point of transmission for Covid-19. Many health actions are carried out using automatic systems including air quality monitoring, hand sanitizers, hand hygiene. Hand sanitizers are an alternative for washing hands during a pandemic. It can be used when and water are not available. Hand sanitizer is also available in several forms such as liquid (spray) or gel. Hand sanitizer is usually made from materials such as alcohol, polyacrylic acid, glycerin, propylene glycol, or plant extracts. The process of killing germs starts with removing the oil on the skin, then the bacteria in the body will come to the surface. Soap or alcohol will kill bacteria after rubbing to your hand. Hand sanitizer is effective against Covid-19. So far, most of the available hand sanitizers do not operate automatically. This project aims to make an automatic hand sanitizer where soap and water can come out automatically. Besides that, automated hand sanitizer will make notification to the owner, if the liquid has run out to the smartphone. The ultrasonic sensor will sense the presence of heat and motion of the object and send data to the microcontroller so that it can activate the pump. If the water height is less than 20 cm, the ultrasonic sensor will send data to controller to the output devices such as smartphones. The results of the hand sanitizer testing that the system can run smoothly with a minimum detection error of transferring data.

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II. BACKGROUND AND MOTIVATION

The motive of the project is, too much hand sanitization is not good for human body as it may cause irritations and can be poisonous if consumed. Instead of hand sanitization if door knobs and objects are automatically sanitized it would increase efficiency to curb the spread of new influenza virus which is transmitted by hand contact.

With the above stated aspects, the design has been done for easy installation of the hardware in every possible places across the globe. The design encompasses few parameters to be calculated and taken as priority, such as

A. Installation of ultrasonic sensor for object detection.
B. Installation of temperature sensor.
C. Installation of Pulse oximeter sensor.
D. Installation of spray pumps/submersible pumps.

Synchronizing all the sensors with microcontroller.

The circuit connection should be done minutely to avoid any kind of fault while working of the device. Proper safety measure has been taken to overcome any kind of fault in consideration of over-voltage , short circuit , excessive current flow etc.

In this COVID-19 pandemic period which is a global outbreak, hand hygiene is the core preventive measure in the spread of the disease as advised by WHO (World Health Organization) which includes washing hands with water and soap regularly, hand sanitizing using hand sanitizers, etc.

Hygiene refers to the practices conducive to maintaining health and preventing disease especially through cleanliness such as washing hands, coughing in the elbow etc. Hand washing helps to prevent any diseases that spread through contact. In order to eliminate most of the germs on the hands, we need to apply a good hand washing practice. In most healthcare settings, alcohol-based hand sanitizers are preferable to hand washing with soap and water because it can be easily tolerated and it is also more effective at reducing bacteria. Hand sanitizer is a liquid, gel, or foam generally used to decrease infectious agents on the hands. A sanitizer is designed to kill germs on skin, objects and surfaces.

This project aims to design and implement a low cost smart hand sanitizer dispenser with door controller. It is based on ATMEGA328P Micro-controller, Thermal temperature sensor and Ultrasonic rangefinder sensor (an ultrasonic sensor is used to check the presence of hands below the outlet of the sanitizer machine), that can help to solve the challenges faced by security guards at different stations such as bank doors, school gates, hospital gates etc.

III. LITERATURE REVIEW

John M. Boyce, M.D.and Didier Pittet, M.D talked about the significance of hand washing with individual cleanliness. For ages, hand washing with cleanser and water has been viewed as a proportion of individual cleanliness. The idea of purging hands with a germicide specialist most likely rose in the mid nineteenth century. As ahead of schedule as 1822, a French drug specialist exhibited that arrangements containing chlorides of lime or soft drink could destroy the foul smells related with human bodies and that such arrangements could be utilized as disinfectants and sterilizers. In a paper distributed in 1825, this drug specialist expressed that doctors and different people going to patients with infectious illnesses would profit by soaking their hands with a fluid chloride arrangement.

R. Monina Klevens, et al., used a multi-step approach and three data sources. The main source of data was the National Nosocomial Infections Surveillance (NNIS) system, data from 19902002, conducted by the Centers for Disease Control and Prevention. Information from the National Hospital Discharge Survey (for 2002) and the American Hospital Association.

Design and Development of Arduino Based Contactless Thermometer Here Arduino UNO, MLX90614 temperature sensor, OLED Display and a battery is used for developing this system. The thermometer built here has a wide range of -70 to 380˚C temperature measurement, has a resolution of 0.02 with an accuracy of 0.5˚C and is accessed by 2 wire serial SM Bus compatible protocol. Unlike traditional thermometers, the proposed thermometer does not need any contact to measure the temperature. When the Arduino is powered on, the MLX90614 measures the temperature of the body/object in its range. The range is provided by a led/IR light for accurate target of desired object or body. This temperature is displayed using OLED.

Automated Social Distancing Gate with Non-Contact Body Temperature Monitoring using Arduino Uno The incoming person's body temperature is measured using MLX90614ESF-BAA- 000-TU-ND non-contact IR temperature sensor

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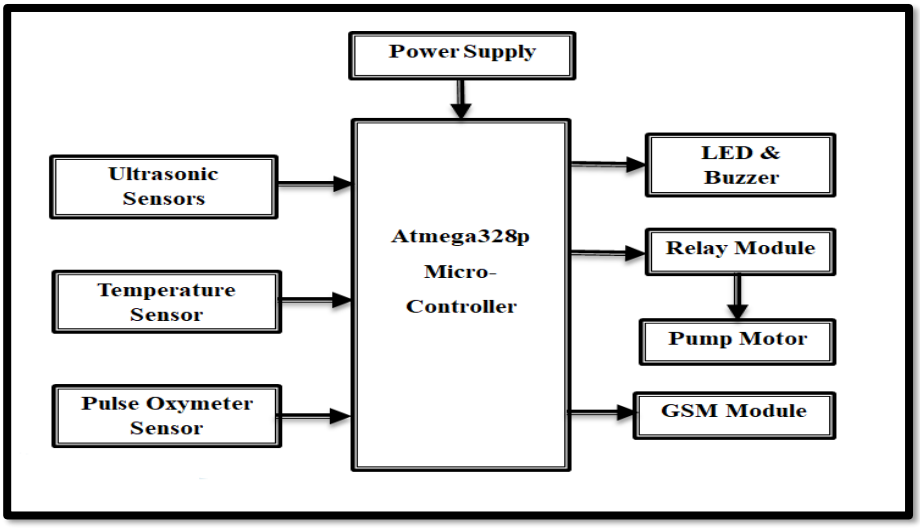
and the temperature is displayed on a 4x20 blue LCD as soon as IR sensor GP2YOA21YK detects the forehead at a distance of 150cm. A buzzer of 0.5 watt, 8 ohms is used to notify the detection of abnormal temperature i.e., 37.5 degree Celsius or above.

Also a speaker is used to indicate the same. MLX90614ESF-DCx versions of the infrared thermometer sensor can be used instead of MLX90614ESF-BAA-000-TUND for better accuracy. Design of a contactless body temperature measurement system using Arduino Here an Arduino CT uno controller, a type of Arduino mega controller is used to monitor the temperature parameters. Two sensors LM 35 as S1 and MLX-90614 as S2 are used for temperature measurement. LM35 is a contact type sensor and gives a precise output in the range -55 degree C to 150-degree C. Whereas the MLX-90614 is a contactless sensor. The S1 senses the ambience temperature where output voltage is directly converted into temperature in Celsius and S2 senses the human body temperature through PWM output pins. The esp.-WIFI shield is a programmable microcontroller that is used to transfer and monitor the collected temperature data both wired and wirelessly and also displays the data in the online portal.

Design of Automatic Hand Sanitizer with Temperature Sensing Here there are two systems which work simultaneously, the first one is automatic sanitizer and second is the temperature sensing. The ultrasonic sensor PING SEN136B5B is used to detect the range of the human and the PIR sensor is used to monitor the motion of the human. The range of PIR sensors is 5 to 12m. Any detection of humans will activate the sanitizer pump1 and the sanitizer is sprayed and a blower is used to spread the sanitizer to the surroundings. Ultrasound sensor has a range less than 30m, any detection of human hand in that range will activate pump2 which sanitizes the hands using a DC motor. Temperature sensor TMP 36 senses the temperature as soon as the contact is made, the sensor displays the temperature on the LCD display in Fahrenheit. A RGB led is made to glow green when the temperature is normal else it is made to glow red when the temperature is higher than normal and a piezo electric buzzer is used for the same. The system has an efficient automatic sanitizing development but fails to provide a contactless temperature measuring unit, which can lead to spreading of infection.

IV. DESIGN DEVELOPMENT AND SPECIFICATION

1. Block diagram : As we switch on the device , the sensors attached to the controller gets activated. We have two systems to work simultaneously to each other. First the automatic sanitizer and secondly the contacted temperature sensing. The ultrasonic sensor is attached to the controller for detection of human/object ranging. Any detection in the specified range will activate the sanitizer and it will sanitize the surroundings with activation of spray pump 1 accompanied with a blower so that the sanitizer reaches the surrounding . The ultrasonic sensor on the other side has been specified with a range of less than 30cm, any movement especially hand near(<30cm) the device will activate the spray pump 2 and the sanitizer reaches the hand through a small pipe.



2. **Atmega328p microcontroller**

It is an open source microcontroller based computing platform used for easy programming and synchronizing of different analog and digital sensors and it is also capable of sending and receiving data over the internet. It is built up with 8-bit Atmel AVR or 32- bit Atmel ARM microcontrollers. It provides a comfortable design platforms for hobbyists, students and professional designers.

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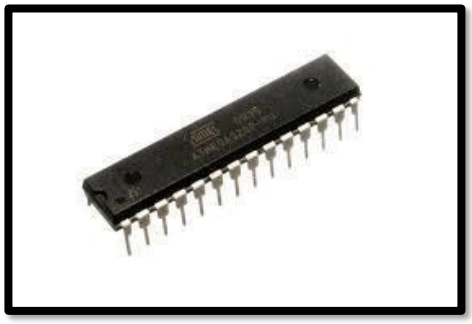

3. Ultrasonic Sensor

The ultrasonic range sensor (HC–SR 04) has a range of 3cm - 400 cm. The sensor operates by transmitting an ultrasound and receiving the echo as it bounces back against an obstacle after a certain time and calculates the distance of the object accordingly. The sensors sends the ultrasound and senses the echo with the same pin.

4. Pulse Oximeter Sensor

The MAX30100 is an integrated pulse oximetry and heart-rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.

5. DC Motor/ Submersible Spray Pump

The motor/pump is used to spray the sanitizer on the hand after the sensors give required signal. 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, 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.

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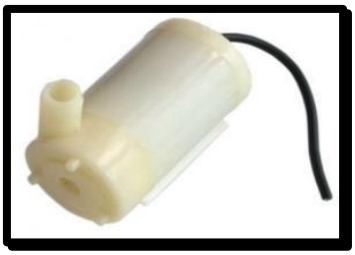

6**. GSM Module**

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.

There are various cell sizes in a GSM system such as macro, micro, pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.

7. **Temperature Sensor MLX90614**

Our latest infrared temperature measurement module is the MLX90614. This sensor measures the surface temperature by detecting infrared radiation energy and wavelength distribution. The IR temperature probe consists of an optical system, photoelectric detector, amplifier, signal processing and output module. The optical system collects the infrared radiation in its field of view and the infrared radiation energy is converted in to corresponding electrical signals when converging on the photoelectric detector. After being processed by the amplifier and signal processing circuit, the signal is converted in to a temperature value. The MLX90614 is self calibrating and has a low noise amplifier integrated in to the signal processing chip. The chip itself is a 17 bit ADC and DSP device, giving accurate and reliable results.

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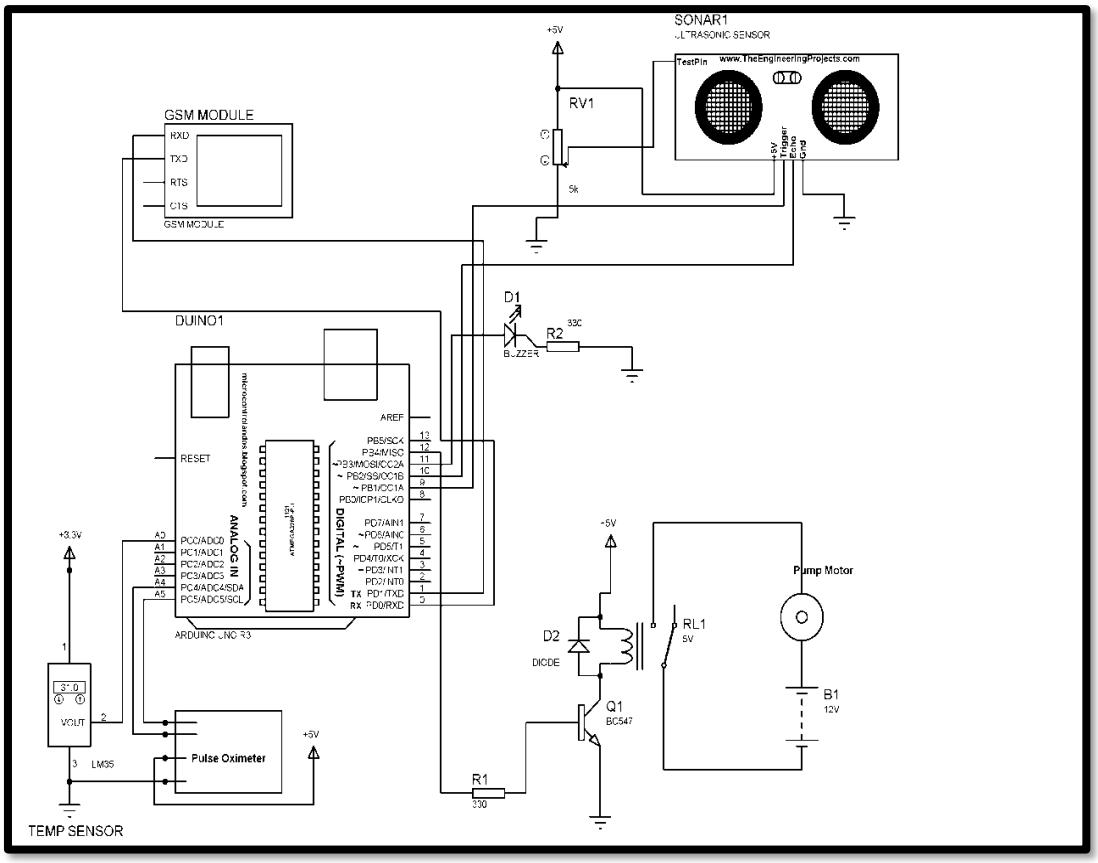
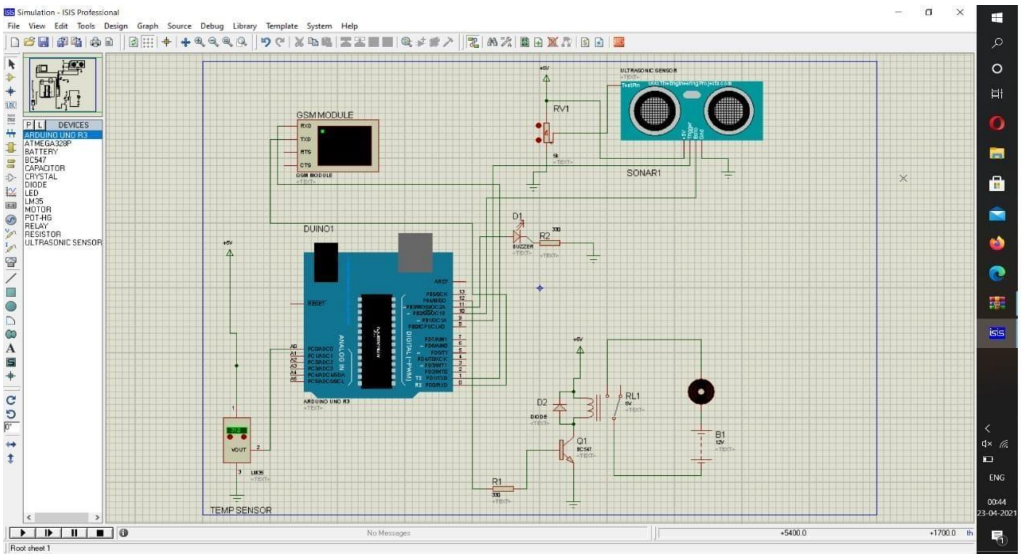
Circuit Diagram:



V. IMPLEMENTATION

1. The following figure is the basic circuitry of assembled components namely: Atmega microcontroller, GSM module, Ultrasonic Sensor, Temperature Sensor, Buzzer and a DC motor pump connected to a relay circuit. It is shortly divided into analog inputs like temperature sensor and digital outputs like GSM module, buzzer, DC motor pump and digital input like Ultrasonic sensor.



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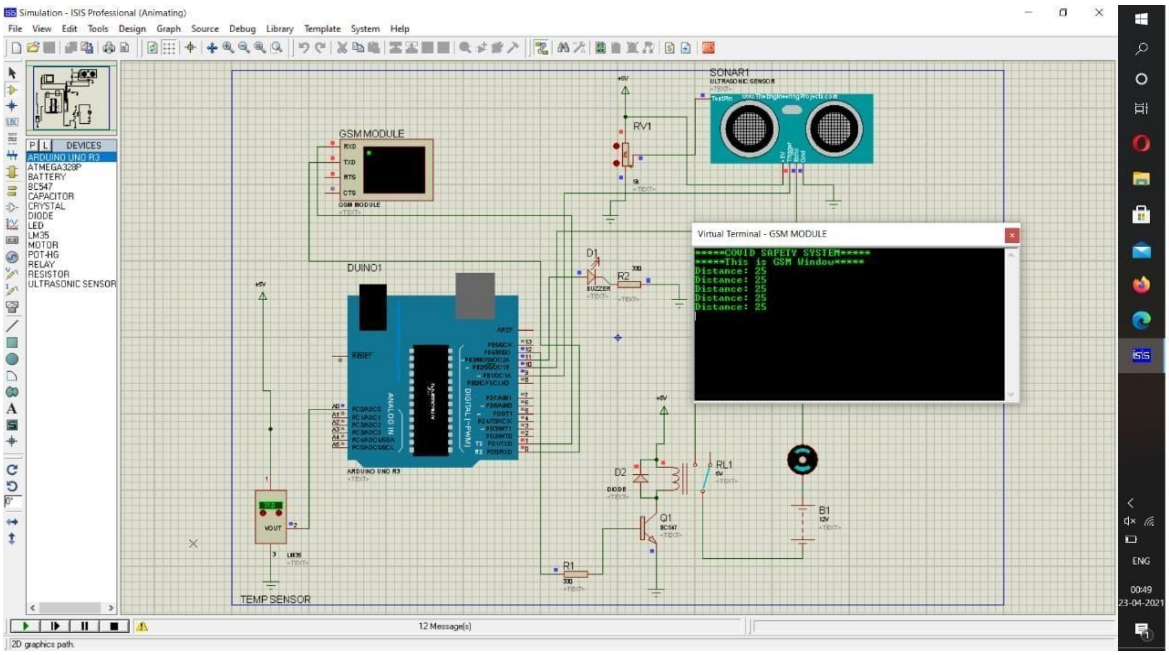
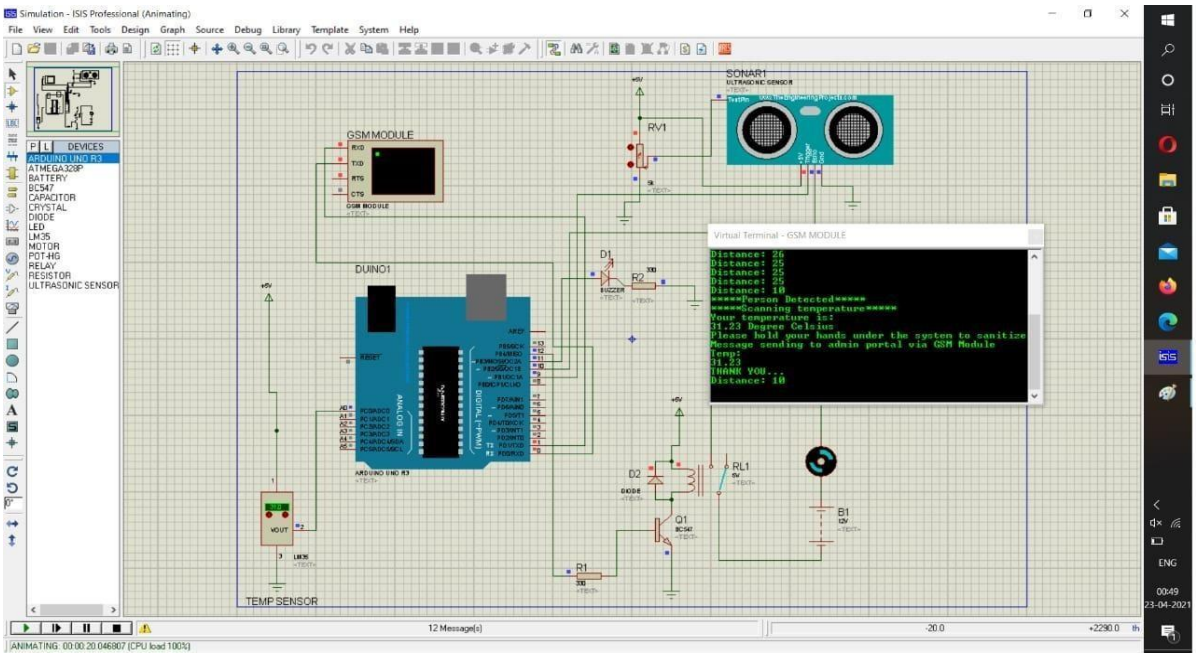
2.Distance gets printed on GSM module when the simulation is on run mode. Continuous monitoring of obstacle distance is done till threshold value is reached.



3. When person's hand gets detected the GSM module's visual terminal displays the temperature detected by temperature sensor and a system generated message.



VI. RESULT

The following figure is the basic circuitry of assembled components namely:
Atmega microcontroller, GSM module, Ultrasonic Sensor, Temperature Sensor, Buzzer and a DC motor pump connected to a relay circuit. It is shortly divided into analog inputs like temperature sensor and digital outputs like GSM module, buzzer, DC motor pump and digital input like Ultrasonic sensor. Distance gets printed on GSM module when the simulation is on run mode. Continuous monitoring of obstacle distance is done till threshold value is reached. When person's hand gets detected the GSM module's visual terminal displays the temperature detected by temperature sensor

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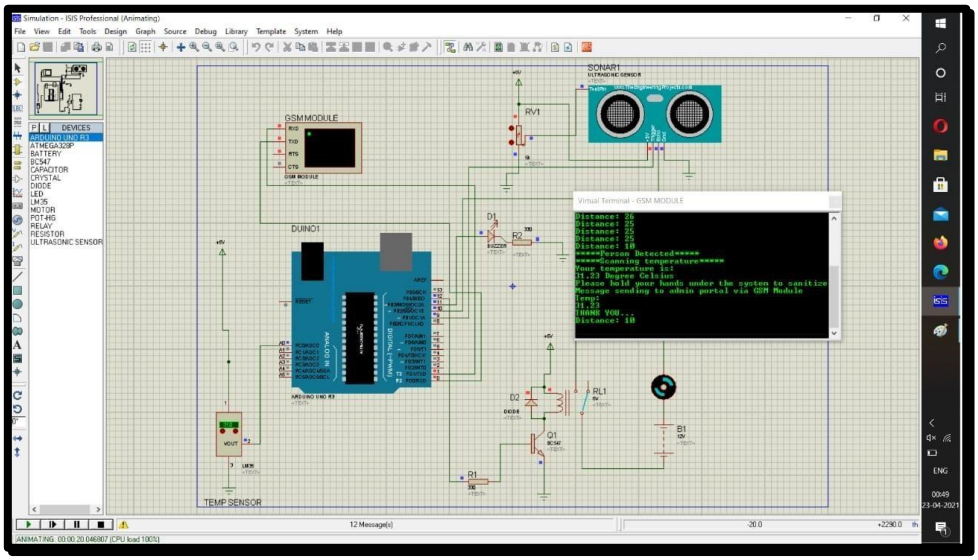
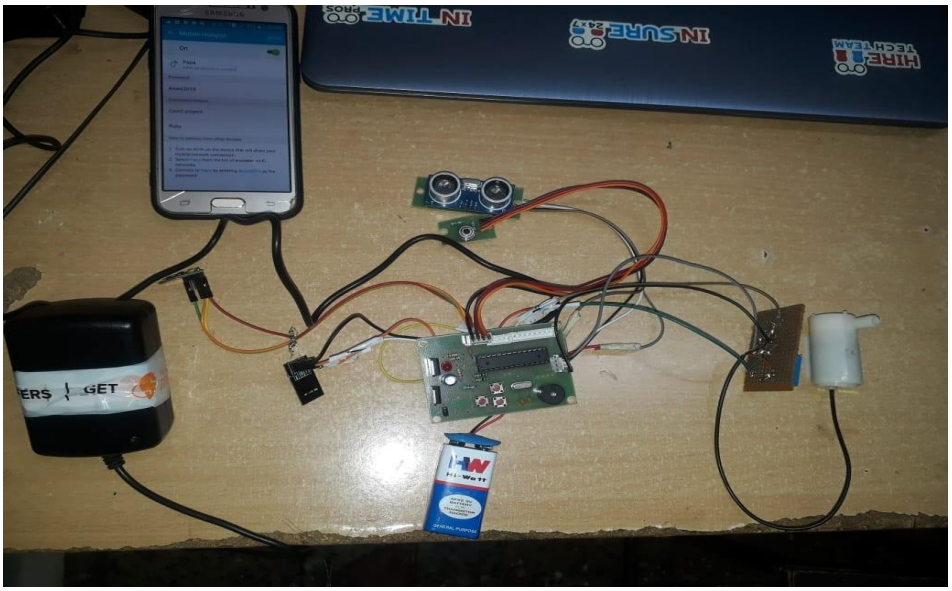
and a system generated message.

As per the block diagram we have interfaced temperature sensor MLX60915, Pulse sensor max30100, ultrasonic sensor HC-SR 04, GSM Module and led with arduino microcontroller as shown in below figure.





MLX sensor senses temperature of human and without any physical touch and microcontroller senses those signals and gives output of hand's temperature over I2C protocol. Ultrasonic sensor is mainly used to detect any object or person is detected in front of system to start the process. Pulse sensor senses the oxygen level of user and stores this all information in local variable and then start to dispense sanitizer by turning pump motor on. When sanitization is completed and if temperature and oxygen level of user is beyond threshold level then this information will be sent to the Admin department via SM module. For this admins mobile number should be loaded in controller's code.

If you want to wash your hands, place your hands within 15 cm from the ultrasonic sensor. According to Arduino program, this will switch on the relay module. The submersible water pump is connected to the relay module and an external power supply. The external power supply can be adjusted to provide the appropriate voltage. The water pump is switched on and the water is pumped from the container to your hands through a tube, which is modeled as the faucet in this prototype.

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Voltage and current specification:

ATMEgA328P

- Operating Voltage:
  - 1.8 - 5.5V for ATmega328P
- Temperature Range:
  - -40°C to 85°C
- Low Power Consumption at 1 MHz, 1.8V, 25°C for
  - Active Mode: 0.3 mA
  - Power-down Mode: 0.1 µA
  - Power-save Mode: 0.8 µA (Including 32 kHz RTC)

MAX30100

- Ultra-Low Shutdown Current: (0.7µA, typ)
- Continuous Input Current into Any Terminal: ±20mA
- VDD = 1.8V, VIR_LED+ = VR_LED+ = 3.3V, TA = +25°C

MLX90615

- Factory calibrated in wide temperature range:
- 40…85˚C for sensor temperature and
- 40…115˚C for object temperature
- High accuracy of 0.5°C over wide temperature range (0...+50°C for both TA and TO)
- High (medical) accuracy calibration
- Measurement resolution of 0.02°C

Ultrasonic

- Supply voltage: 5V (DC)
- Supply current: 15mA.
- Modulation frequency: 40Hz.
- Output: 0 – 5V (Output high when obstacle detected in range).

Relay 5V

- Trigger Voltage (Voltage across coil): 5V DC.
- Trigger Current (Nominal current) : 70mA.
- Maximum AC load current: 10A @ 250/125V AC.
- Maximum DC load current: 10A @ 30/28V DC.

VII. ADVANTAGES AND APPLICATIONS

Advantages:

1. The most significant advantage of sanitizer dispenser is the hands-free usage.
2. This machine is user-friendly.
3. This machine does not require any high-end skills nor does it require massive amount of strength for operation purpose.
4. Almost all parts required for the manufacturing of this dispenser can be obtained from the industrial waste discarded by fabrication, construction, production, manufacturing factories.
5. This machine is portable and does not require much space. It can easily be placed in cramped-up places.

Limitations:

1. Storage of liquid sanitizer might be a limitation for our system.
2. Poor metallic storage container is very armful for user.

Applications:

1. Medical observance Devices
2. Fitness Assistant Devices
3. Wearable Devices
4. This system is used at many places like schools, Restaurants, Offices, Religious places, Industries, etc.

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VIII. CONCLUSION AND FUTURE SCOPE

Conclusion:

Our model 'Temperature monitoring system with built in sanitising system' is proposed considering the human life at risk of the covid-19 infection spreads. This is fully automatic, use of this hybrid system at the entrance of the various crowded places can reduce the man work who is also subjected to risk. Spread of infection is under control due to no contact. Since controlling the doors are also automated, it is ensured that every individual follows the rules accordingly. Generally 75 and 100 millimeters of mercury (mm Hg) is the range of blood oxygen level. The pulse oximeter generally shows the reading between 95 and 100 percent. If the blood level of oxygen saturation on the device is less than 90 per cent, then it is considered harmful. As shortness of breath is considered a key symptom of coronavirus infection, people are using a pulse oximeter to check the level of oxygen in their blood.

This is a cost efficient and an all-in-one model and hence does not require any multiple systems to support the model. This model suits the need for every organization to maintain the temperature record of the employees daily along with automatic intimation to the higher authority in case of increased temperature of any individual through the GSM module which is a great advantage.

Future Scope:

In future, we can use IOT concept to store large amount of people's data on server which is needed in offices, institutes, etc.

By providing camera interfacing to tis system, we can also store user's image along with his/her temperature and oxygen reading to the server.

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