Thangal Kunju Musaliar College of Engineering

(Government Aided and Autonomous)

Kollam, Kerala

IDEA LAB PROJECT REPORT

Department of Mechanical Engineering

May 2025

Thangal Kunju Musaliar College of Engineering

(Government Aided and Autonomous)

Kollam, Kerala

IDEA LAB PROJECT REPORT

CERTIFICATE

Certified that this is a bonafide record of the group project work done by……
……..……..……..……of ……. Semester, Class Roll No…… in the…… Lab during the year ……

Reg.no : ……
Reg.no : ……
Reg.no : ……
Reg.no : ……
Reg.no : ……

Staff Member:

ASSESSMENT QUESTION

CO4 and CO5	
Mapped POs	CO4: PO1,PO5, PO9 and PO10 CO5: PO1, PO2, PO3, PO4, PO9, PO10, PO12
Assessment Type	GROUP PROJECT
Assessment Question	Identify a real world problem and propose multiple potential ideas to address it. Analyse the ideas and select any one with proper justification. Develop and fabricate a product based on the selected idea. Use suitable electronic documentation tools to prepare and present the report. Publish it in a website.

PROGRAMME OUTCOMES

1. Engineering knowledge : Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis : Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first Principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions : Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems : Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society : Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability : Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics : Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work : Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication : Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance : Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning : Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE OUTCOMES

CO1	Develop project using appropriate Microcontroller Programming languages. [Apply level]
CO2	Develop product using PCB Design and Prototyping concepts. [Apply level]
CO3	Create 2D and 3D models using appropriate tools. [Apply level]
CO4	Create electronic documentation for the system/project using appropriate tools. [Apply level]
CO5	Build useful and standalone system/ project with enclosures. [Apply level]

AUTOMATIC HAND SANITIZER DISPENSER

Santhanan M.M - B24MEC57
Sivadev P.A - B24MEC63
Aamil Ahsen - B24MEC02
Nidhin Krishna - B24MEC46

INDEX

ACKNOWLEDGEMENT

We would like to extend our deepest appreciation to everyone who contributed to the completion of this group project. The success of this endeavor is a result of the collective effort, dedication, and support from various individuals.

First and foremost, we express our sincere gratitude to **DR.HASHIM V**, faculty of IdeaLab Workshop for providing invaluable guidance, encouragement, and constructive feedback throughout the project. Your expertise and mentorship were instrumental in shaping the direction of our work.

We also want to thank each member of our project team for their hard work, collaboration, and commitment. The diverse skills and perspectives brought by them significantly enriched the quality of our project.

This project was a collaborative effort, and the combined contributions of everyone involved made it a rewarding and successful experience.

Thank you.

ABSTRACT

The Arduino-based Automatic Hand Sanitizer Dispenser is a contactless device designed to promote hygiene and reduce the spread of infections. Using an ultrasonic sensor, the dispenser automatically detects the presence of a hand and activates a motor-driven pump to release a precise amount of hand sanitizer. This system eliminates the need for physical interaction with traditional dispensers, ensuring a more hygienic and efficient sanitization process. The project integrates an Arduino microcontroller, an ultrasonic sensor, a small pump, and a power supply into a compact and reliable device. The design offers both ease of use and energy efficiency, making it ideal for high-traffic areas like offices, schools, hospitals, and public spaces. This automatic sanitizer dispenser represents a simple yet effective solution for enhancing hand hygiene practices while minimizing cross-contamination.

INTRODUCTION

In recent years, maintaining proper hand hygiene has become a critical factor in preventing the spread of infections, particularly in public and high-traffic environments. Traditional hand sanitizer dispensers often require physical contact, which can contribute to the transmission of harmful pathogens, counteracting the very purpose they serve. As a solution to this concern, automated systems have emerged to facilitate touch-free operations, ensuring a more hygienic approach to hand sanitization.

This project focuses on the development of an **Arduino-based Automatic Hand Sanitizer Dispenser**, a device designed to dispense hand sanitizer automatically without the need for manual contact. By utilizing an ultrasonic sensor, the dispenser detects the presence of a hand and activates a motorized pump to release the sanitizer, promoting a seamless and hygienic hand sanitization experience. The device leverages affordable components, including an Arduino microcontroller, an ultrasonic sensor, and a small pump, all integrated into a user-friendly design suitable for public spaces like schools, hospitals, offices, and airports.

This automatic dispenser is not only cost-effective but also energy-efficient, making it an ideal solution for institutions seeking to improve hygiene practices while reducing the risk of cross-contamination. By eliminating direct contact, the system contributes to overall public health and well-being, aligning with current global efforts to enhance sanitation protocols in everyday settings.

Components required for the project includes:

- Arduino UNO Board
- Ultrasonic sensor
- Servo motor
- Battery
- Sanitizer bottle

DESIGN

The design of the **Automatic Hand Sanitizer Dispenser** system involves integrating an ultrasonic sensor, a servo motor, and an Arduino microcontroller to automate the dispensing of hand sanitizer. The key components and their roles are:

1. **Ultrasonic Sensor**: Detects the presence of a hand within a predefined range to trigger the dispenser.

2. **Arduino Microcontroller**: Processes input from the sensor and controls the servo motor to dispense the sanitizer.

3. **Servo Motor**: Activates the dispenser mechanism to release hand sanitizer based on commands from the Arduino.

4. **Power Supply**: Provides energy to the components.

5. **Hand Sanitizer Reservoir**: A container holding the hand sanitizer, connected to the dispensing system.

Circuit Diagram:

A simplified circuit diagram represents the system's connections:

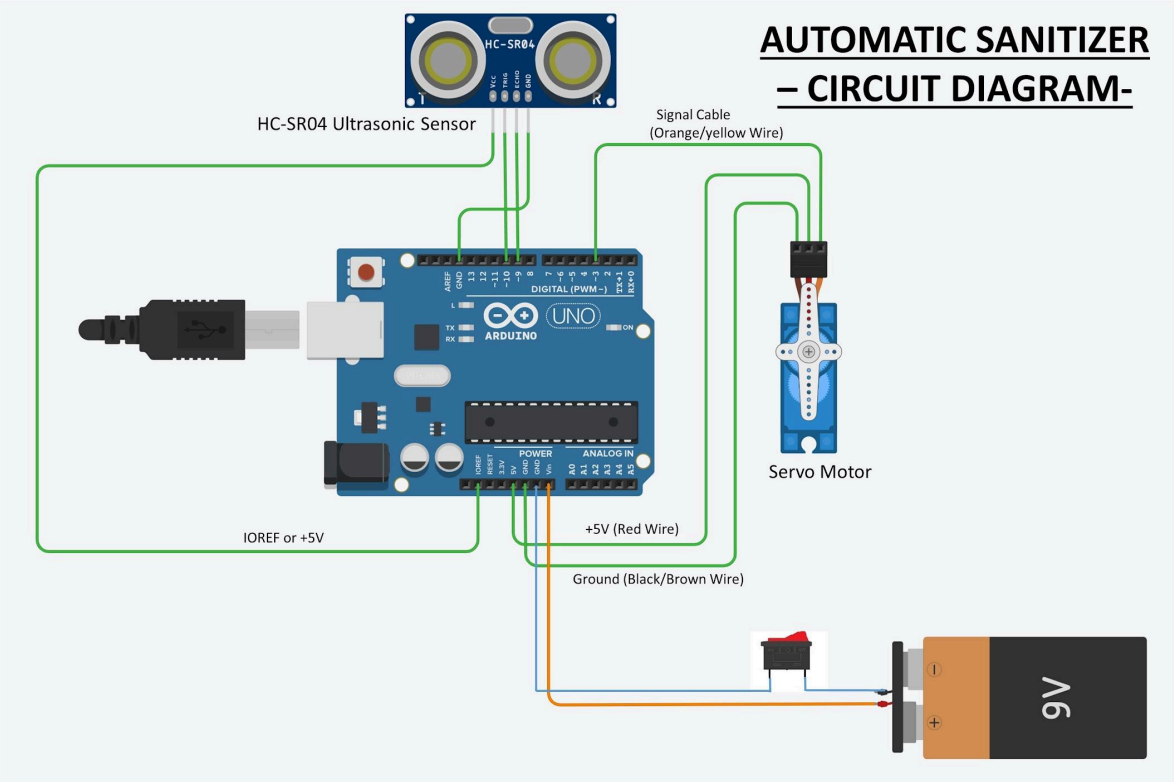
- The ultrasonic sensor is connected to the Arduino's digital pins for sending and receiving signals.

- The servo motor is connected to a PWM (Pulse Width Modulation) pin on the Arduino.

- The Arduino is powered either through a USB connection or an external power source

DESIGN

The circuit diagram of our project:



fig(ii)

IMPLEMENTATION

The implementation of the Automatic Hand Sanitizer Dispenser involves programming the Arduino microcontroller to process data from the ultrasonic sensor and control the servo motor accordingly. The following Arduino code demonstrates how the system operates:

```
#include <Servo.h>

#define trigPin 3
#define echoPin 2
#define servoPin 9

Servo sanitizerServo;

unsigned long lastDispenseTime = 0;
const unsigned long cooldownPeriod = 10000; // 10 seconds cooldown

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  sanitizerServo.attach(servoPin);
  sanitizerServo.write(0); // Servo at rest
  Serial.begin(9600);
}

void loop() {
  long duration, distance;
  unsigned long currentTime = millis();

  // Trigger ultrasonic pulse
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Read echo and calculate distance
  duration = pulseIn(echoPin, HIGH);
  distance = (duration / 2) / 29.1;

  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");

  // Check if hand is detected and cooldown is over
  if (distance < 20 && (currentTime - lastDispenseTime > cooldownPeriod)) {
    sanitizerServo.write(90);     // Dispense
    delay(1000);                   // Wait
    sanitizerServo.write(0);       // Reset servo
    lastDispenseTime = currentTime; // Start cooldown
  }

  delay(300); // Short delay to prevent overload
}
```

This program uses an ultrasonic sensor to measure the distance to a nearby hand. If the distance is within the set threshold, the servo motor activates to dispense the hand sanitizer, waits for a few seconds, and then stops the dispensing mechanism.

RESULTS

CONCLUSION

Sure! Here's the revised description for the **automatic hand sanitizer dispenser** project:

The **Automatic Hand Sanitizer Dispenser** project successfully demonstrates the integration of automation to enhance hygiene and convenience. By utilizing an ultrasonic sensor, Arduino microcontroller, and servo motor, the system enables hands-free operation, making hand sanitizing more efficient and user-friendly.

Key Advantages:

1. Promotes better hygiene by reducing physical contact with the dispenser, ensuring a more sanitary experience.
2. Ensures smooth and precise sanitizer dispensing, providing an easy and efficient hand sanitizing process.
3. Operates with low power consumption, making it cost-effective and environmentally friendly.
4. Suitable for diverse environments, including households, offices, hospitals, and public spaces.

This project showcases the potential of affordable and scalable technology to address common hygiene challenges in daily life. The **Automatic Hand Sanitizer Dispenser** is a step forward in creating cleaner, healthier surroundings through innovative, hands-free solutions.

FUTURE SCOPE

Sure! Here's the revised version for the **automatic hand sanitizer dispenser** with potential improvements:

The **Automatic Hand Sanitizer Dispenser** system can be further enhanced to include additional features and capabilities. Potential improvements include:

1. IoT Integration:

- Enable remote monitoring of the dispenser's status (e.g., low on sanitizer, operational status) through a mobile app or web interface.
- Incorporate cloud storage for data analysis on usage patterns, such as peak sanitizing times and dispenser consumption rates.

2. Refill Alerts:

- Send notifications to users when the sanitizer reservoir is low and requires a refill.
- Provide maintenance alerts when the system needs cleaning or servicing.

3. Energy Efficiency:

- Implement solar panels to power the system, making it energy-independent and eco-friendly.
- Optimize power usage for longer battery life, ensuring the dispenser operates efficiently over time.

4. Multi-Dispenser Support:

- Expand the design to support multiple dispensers in public spaces or larger commercial areas.
- Create a centralized control system to manage and monitor multiple dispensers, providing a scalable solution for large-scale deployments.

5. Advanced Sensors:

- Use infrared or capacitive sensors for more precise hand detection, improving sensor accuracy in diverse environments.
- Integrate additional sensors to monitor temperature or humidity for more customized sanitizing experiences.

6. Enhanced Safety Features:

- Add mechanisms to prevent blockages or jams in the sanitizer dispensing mechanism.
- Include indicators or alarms for system malfunctions, such as when the sensor fails to detect hands or when the servo motor is not functioning properly.

7. User Personalization:

- Allow for custom sanitizer dispensing volumes depending on user preferences (e.g., a short or long spray).
- Integrate a system for users to customize the settings (e.g., sanitizer concentration) for different needs or environments.

By implementing these advancements, the **Automatic Hand Sanitizer Dispenser** can evolve into a smarter, more efficient solution for improving hygiene in public and private spaces. This would create a more robust, sustainable, and user-friendly system for a cleaner and healthier environment.
