VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM-590014

IOT Laboratory(22MCAL37)

Mini-Project Report on

"AUTOMATIC HAND SANITIZER SYSTEM"

A Mini-project report submitted in partial fulfillment of the requirements for the award of the degree of **Master of Computer Application** of Visvesvaraya Technological University, Belgaum.

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Affiliated to Visvesvaraya Technological University, Belagavi and Approved by AICTE, New Delhi, NAAC A+

2023-2024

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(Affiliated to Visvesvaraya Technological University, Belagavi and Approved by AICTE, New Delhi) CE, CSE, ECE, EEE, ISE, ME Courses Accredited by NBA, New Delhi, NAAC A+

DEPARTMENT OF MASTER OFCOMPUTER APPLICATION

CERTIFICATE

This is to certify that the Mini-Project on IOT Laboratory entitled **"Automatic hand Sanitizer System"** has been successfully carried out by **SHOBHA D S (1DT22MC025) and VENKATESH S D (1DT22MC026)** bonafide students of **Dayananda Sagar Academy of Technology and Management** in partial fulfillment of the requirements for the award of degree in **Master of Computer Application** of **Visvesvaraya Technological University, Belgaum** during academic year 2023-24. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The mini project report has been approved as it satisfies the academic requirements in respect of project work for the said degree.

Signature of project guide
USHASREE R
Assistant Professor

Signature of HOD
Dr. Manjula Sanjay
HOD - MCA

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We would also take this opportunity to offer our sincere gratitude to our Project Guide Asst. Prof. USHASREE R for her excellent support throughout the development of this project and for providing the necessary information on our request at all times.

We also thank all Teaching and Non-Teaching staff of Master of Computer Application for helping us in all aspects. We thank our parents for providing all the facilities to complete and make this project successful.

DECLARATION

We, **Shobha D S** and **Venkatesh S D,** students of 3rd semester of department of Master of Computer Application, DSATM declare that the project entitled **"Automatic hand Sanitizer System"** has been submitted in partial fulfillment of the course requirement for the award of degree in Master of Computer Application**,** VTU during the academic year 2023-2024. We have not submitted the matter embodied to any other university or institution for the award of any other degree.

Date: **Shobha D S**

Place: Bangalore

Venkatesh S D

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“Automatic hand Sanitizer System”

1.Abstract:

In the wake of the COVID-19 pandemic, the necessity for efficient hand hygiene measures has become paramount. Automated hand sanitizer dispensers offer a solution to promote hygiene in public spaces, reducing the risk of disease transmission. This paper presents an Automatic Hand Sanitizer System utilizing the Node MCU(ESP8266) platform in the Internet of Things (IoT) framework. The system integrates a Node MCU microcontroller with a sensor suite, including proximity sensors and a flow sensor, to detect and facilitate hands-free sanitizer dispensing. Leveraging IoT capabilities, the Node MCU(ESP8266) connects to a centralized network, enabling remote monitoring and control of sanitizer levels and system functionality. Additionally, the system incorporates a data logging feature to track sanitizer usage trends for maintenance and restocking purposes. Experimental results demonstrate the effectiveness and reliability of the proposed system in providing a seamless and hygienic solution for hand sanitizer dispensation in various environments. This innovative approach to hand hygiene management holds significant promise for enhancing public health measures and reducing the spread of infectious disease

2.Introduction:

In the wake of the COVID-19 pandemic, maintaining hand hygiene has become more critical than ever. Automatic hand sanitizer dispensers provide a touch-free solution for individuals to sanitize their hands effectively. Combining IoT (Internet of Things) technology with a servo motor and Node MCU microcontroller enables the creation of a smart, automated hand sanitizer dispenser. This project aims to create an automatic hand sanitizer dispenser that dispenses sanitizer when a hand is detected underneath it, using an IR sensor to detect proximity. The Node MCU microcontroller is programmed to control the servo motor, which actuates the hand sanitizer pump. Additionally, the Node MCU can be connected to the internet to provide remote monitoring and control capabilities.

Automatic hand sanitizer dispensers offer a convenient and hygienic way to ensure that individuals can sanitize their hands without physical contact. In this project, we will create an IoT-based automatic hand sanitizer dispenser using a servo motor controlled by a Node MCU (ESP8266). The project involves building a system where an ultrasonic sensor detects the presence of a hand within a certain range, triggering the servo motor to dispense sanitizer automatically.

3.Objective:

The objectives of automatic hand sanitizer dispensers include:

1. Hygiene Promotion: Encouraging regular hand hygiene by making sanitizing easily accessible in public spaces, workplaces, and other high-traffic areas.

2. Disease Prevention: Minimizing the spread of infectious diseases, including but not limited to viruses, bacteria, and other pathogens, by promoting consistent hand sanitization.

3. Convenience: Providing a convenient and efficient method for individuals to sanitize their hands without the need for manual contact, reducing the risk of cross-contamination.

4. Compliance: Ensuring compliance with health and safety regulations and guidelines by providing readily available hand sanitization options in accordance with recommended protocols.

5. Environmental Sustainability: Reducing waste and promoting sustainability by using controlled dispensing mechanisms that minimize excessive use of sanitizer and packaging materials.

6. Public Safety: Contributing to public safety measures by promoting good hygiene practices, particularly in settings where individuals gather and interact closely.

7. User Experience: Enhancing the user experience by offering touchless or sensor-operated dispensers that are easy to use and maintain, thus encouraging regular hand sanitization habits.

8. Cost-Efficiency: Optimizing resources by efficiently dispensing the appropriate amount of sanitizer needed for effective hand hygiene, thus minimizing waste and associated costs.

4. Scope:

1.Touchless Sanitization: The primary function of the system is to provide touchless hand sanitization. The IR sensor detects the presence of hands within a certain range, triggering the system to dispense sanitizer automatically without the need for physical contact, thereby minimizing the risk of cross-contamination.

2. User Interface: The LCD screen provides a user-friendly interface for displaying system status, such as sanitizer levels, operational messages, and any error notifications. It can also be utilized to provide instructions for users on how to operate the system effectively.

3. Sanitizer Dispensing Mechanism: The servo motor controls the dispensing mechanism, which could be a pump or a valve to regulate the flow of sanitizer. The motor is activated upon detection of hands by the IR sensor, ensuring precise and controlled dispensing of sanitizer.

4. ESP8266 Connectivity: The ESP8266 module enables connectivity to the internet, allowing for remote monitoring and control of the system. It can be integrated with a web server or mobile application to provide real-time updates on sanitizer levels, usage statistics, and operational status. Additionally, it can send alerts or notifications in case of low sanitizer levels or any malfunction.

5. Data Logging and Analytics: The system can log usage data such as frequency of sanitization events, peak usage times, and sanitizer consumption rates. This data can be analyzed to optimize refill schedules, identify usage patterns, and improve the overall efficiency of the system.

6. Customization and Scalability: The system can be customized to accommodate different types of sanitizers and dispensing volumes based on specific requirements. Additionally, it can be scaled up or down to suit various environments such as offices, hospitals, schools, and public spaces.

5. Requirement Analysis and Specifications-

Hardware required for the project:

- ESP8266 Node MCU
- IR Sensor
- Jumper wires
- Breadboard
- USB Cable
- LCD Display (16x 2)
- Dispenser Bottle
- Servo motor

Software required for the project:

- Windows 10 or Above
- Arduino IDE
- Minimum RAM 4GB
- Minimum Disk Space 5GB

6.Data Flow –

The following diagram shows the data flow of the project:

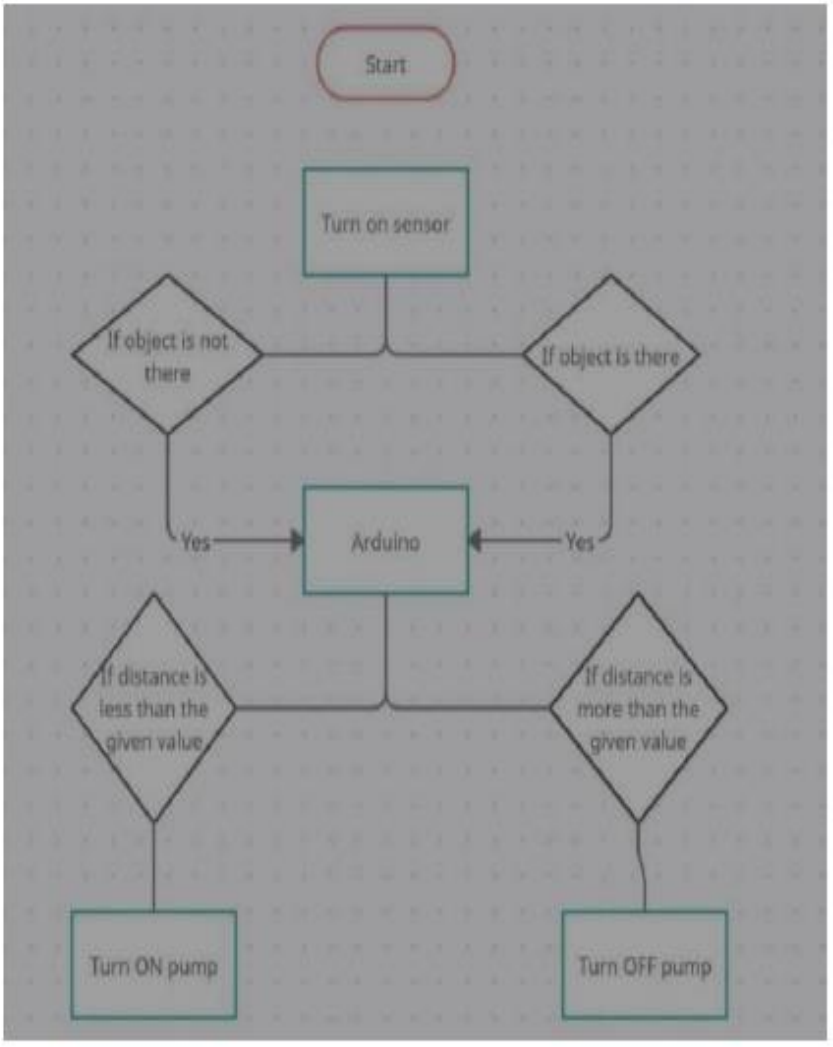


Fig 4.9 Block Diagram Automatic Hand Sanitizer

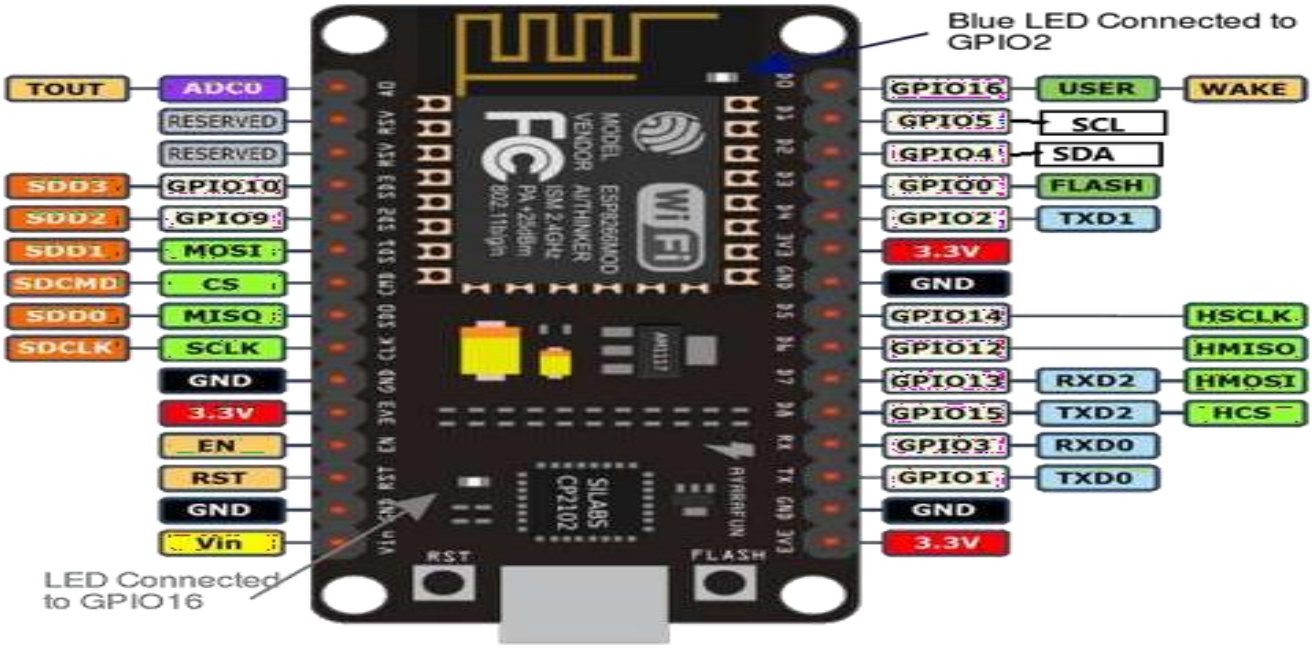
7. Components:

The components used in this project are:

- ESP8266 Node MCU
- IR Sensor
- Jumper wires
- Breadboard
- USB Cable
- LCD Display (16x 2)
- Dispenser Bottle
- Servo motor

1. ESP8266 Node MCU board:

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits.



2. Jumper Wires:

A jumper wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, orgroup of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Type of Jumper Wire

Jumper wire come in versions:

1. Female-to-female jumper wires
2. Male-to-male jumper wires

i. Female-to-female jumper:

They are simple wires that have not connector pins at each end allowing them to be used to connect two points to each other. These are typically used with breadboards and other prototyping toolsin order to make it easy to change a circuit as needed.

ii. Male-to-Male jumper:

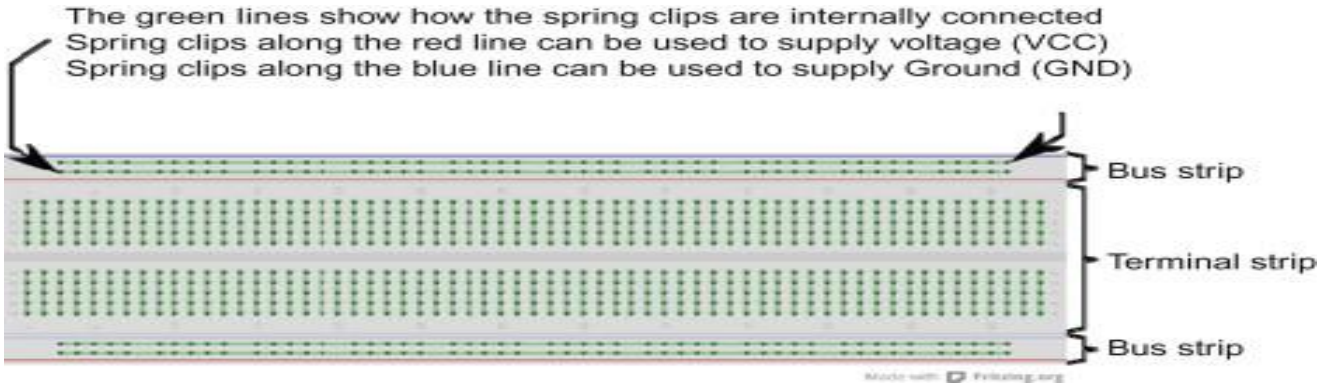
They are simple wires that have connector pins at each end allowing them to be used to connect two points to each other. These are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

3 .IR Sensors:

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests. In a defined angle range, the sensor elements detect the heat radiation (infrared radiation) that changes over time and space due to the movement of people. Such infrared sensors only have to meet relatively low requirements and are low-cost mass-produced items. Infratech does not supply such products, Infratech develops, produces and sells pyroelectric detectors.

4. Breadboard

A breadboard, solderless breadboard, or protoboard is a construction base used to build semi-permanent prototypes of electronic circuits. Unlike a perf board or stripboard, breadboards do not require soldering or destruction of tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education.

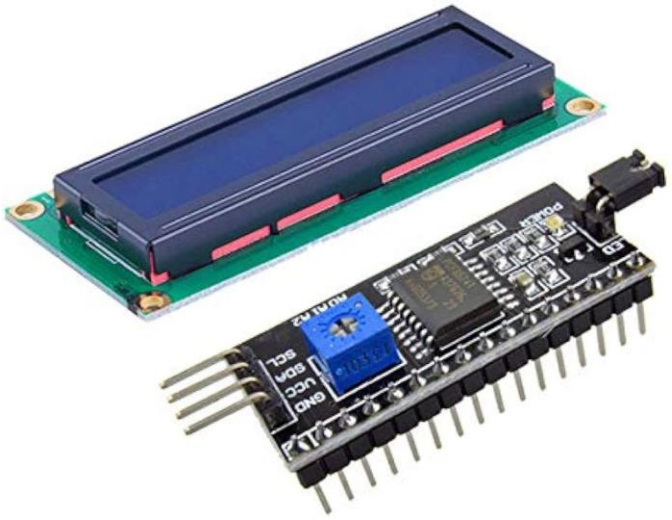


5. USB Cable

USB cable is a power connector to connect ESP32 Board to the Computer. Through thiscable the code is uploaded into the board.

6.LCD Display (16x 2)

This LCD screen is a 16x2 character LCD display with an I2C interface. It features two rows for displaying text, with each row capable of displaying up to 16 characters. The white characters will be displayed on a blue background, providing a clear and visually appealing display.



7.Dispenser Bottle

A dispenser bottle is a container designed specifically for dispensing liquids in a controlled manner. It is a common household, commercial, and industrial product used for dispensing a wide range of substances, including hand sanitizer, soap, shampoo, lotion, condiments, cleaning agents, and more.

8.Servo motor

A servo motor is a type of rotary actuator or motor that allows for precise control of angular position. It is commonly used in various applications where accurate control of the rotational motion is required. The key feature of a servo motor is its ability to maintain a set position or to move to a specific angle as commanded by an external signal.

8. Software Requirement Specification-

Introduction:

SRS is the official statement of what is required by the system developers; it includes both user requirements for the system and detailed specification of the system requirements. This document is used while designing the proposed system and can also be used in the future if theSystem is to be enhanced.

Purpose:

The purpose of this Requirements Elicitation document is to provide a clear understanding as to what actually the Industry Management System is and to identify the critical requirements essential for the project's successful completion.

Arduino IDE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - containsa text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Features:

Toolbar Button:

The icons displayed on the toolbar are **New, Open, Save, Upload,** and **Verify**.

Upload:

The Upload button compiles and runs our code written on the screen. It further uploads the code tothe connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected. We also need a USB connection to connect the board and the computer. Once allthe above measures are done, click on the Upload button present on the toolbar.

Open:

The Open button is used to open the already created file. The selected file will be opened in the current window.

Save:

The save button is used to save the current sketch or code.

New:

It is used to create a new sketch or opens a new window.

Verify:

The Verify button is used to check the compilation error of the sketch or the written code.

Serial Monitor:

The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor.

When we connect the serial monitor, the board will reset on the operating system Windows, Linux,and Mac OS X. If we want to process the control characters in our sketch, we need to use an external terminal program. The terminal program should be connected to the COM port, which will be assigned when we connect the board to the computer.

9. Applications:

The application of an automatic hand sanitizer system can be seen in various settings where maintaining hand hygiene is crucial. Here are some common applications:

1. Public Restrooms: Automatic hand sanitizer dispensers are commonly installed in public restrooms in places such as airports, malls, restaurants, and office buildings. They provide a convenient and hygienic way for people to sanitize their hands after using the facilities.

2. Healthcare Facilities: In hospitals, clinics, and other healthcare settings, hand hygiene is critical for preventing the spread of infections. Automatic hand sanitizer systems ensure that healthcare workers and visitors can easily access hand sanitizer to maintain cleanliness and reduce the risk of spreading germs.

3. Schools and Educational Institutions: Schools and universities often install automatic hand sanitizer dispensers in hallways, classrooms, and common areas to promote good hand hygiene among students, teachers, and staff. This helps reduce the transmission of illnesses and promotes a healthier learning environment.

4. Public Transportation Hubs: Places like bus stations, train stations, and airports see a high volume of people passing through each day. Installing automatic hand sanitizer systems in these locations encourages travelers to clean their hands frequently, reducing the risk of spreading illnesses in crowded environments.

5. Workplaces: Offices, factories, and other workplaces can benefit from automatic hand sanitizer dispensers placed in common areas such as entrances, break rooms, and meeting rooms. This promotes a culture of cleanliness and helps prevent the spread of illnesses among employees.

6. Retail Stores and Shopping Centers: Retail establishments often place automatic hand sanitizer dispensers near entrances, cash registers, and fitting rooms to encourage shoppers to sanitize their hands before and after handling merchandise. This helps protect both customers and employees from germs.

10. Implementation:

Hardware Setup:

Connect the IR sensor, servo motor, LCD, and ESP8266 module according to their pin configurations. Refer to the datasheets and pinout diagrams of each component for proper wiring.

Software Setup:

Install the necessary libraries for the components you're using. You'll likely need libraries for the LCD, servo motor, and ESP8266.
Set up your development environment (Arduino IDE, Platform IO, etc.) to program the ESP8266.

Code Implementation

- Write the code to read the IR sensor's input to detect when a hand is placed under the dispenser.
- When the IR sensor detects a hand, trigger the servo motor to dispense the sanitizer.
- Display appropriate messages or indications on the LCD to inform users about the dispensing process.
- Use the ESP8266 to connect to a Wi-Fi network and potentially send data or notifications about usage (optional).

Code Snippets

```
#include <ESP8266WiFi.h>
#include <ArduinoOTA.h>
#include <Servo.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd (0x27, 16, 2);
Servo servo;
int val = 0 ;
int ir = 14; //D5


// Wi-Fi connection parameters
const char * wifi_ssid = "SSID";
const char * wifi_password = "Password";

void setup() {
  lcd.init();                    // Initialize the LCD
  lcd.backlight();               // Turn on the backlight
  lcd.clear();
  Serial.begin(9600);
  Serial.println("Booting...");
  connectToWiFi();
  setUpOverTheAirProgramming();
  servo.attach(2); //D4
  servo.write(180);
}

void connectToWiFi() {
  Serial.printf("Connecting to '%s'\n", wifi_ssid);

  WiFi.mode(WIFI_STA);
```

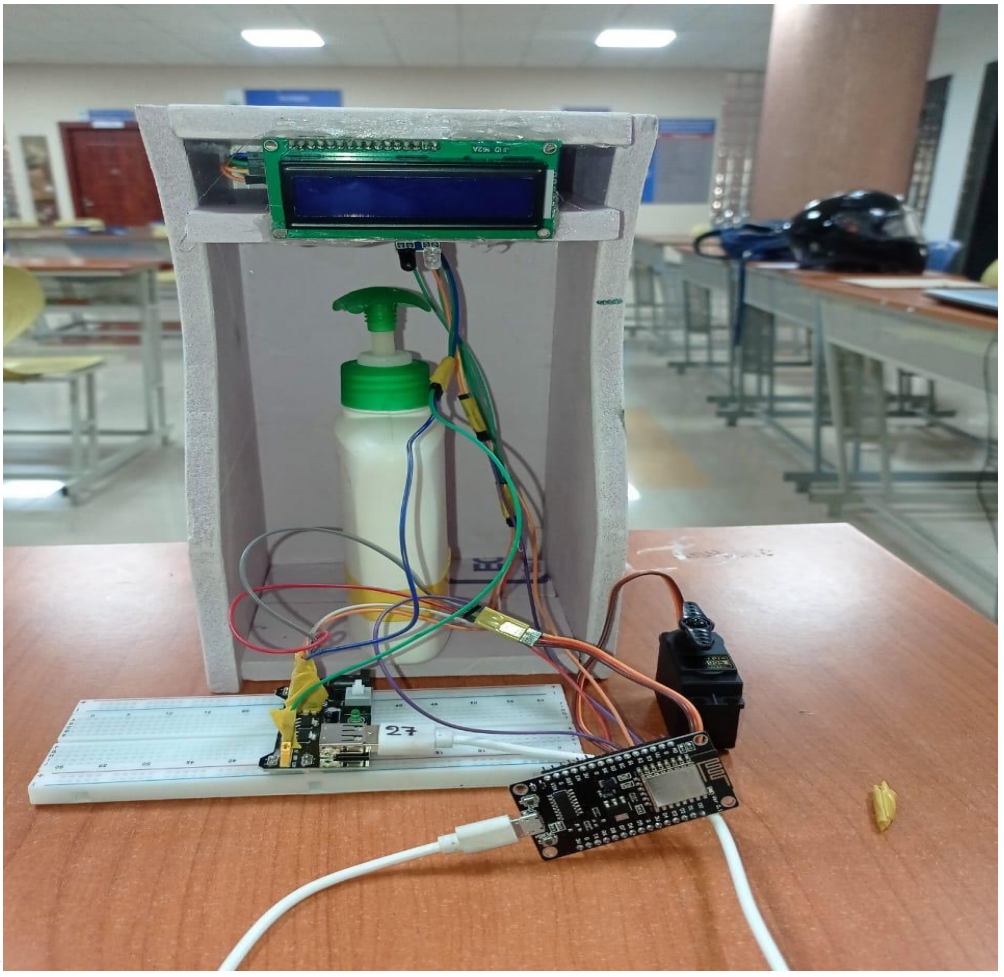
```
  WiFi.begin(wifi_ssid, wifi_password);
  if (WiFi.waitForConnectResult() == WL_CONNECTED) {
    Serial.print("Connected. IP: ");
    Serial.println(WiFi.localIP());
  } else {
    Serial.println("Connection Failed!");
  }
}

void setUpOverTheAirProgramming() {
  ArduinoOTA.setPassword("8660639268");
  ArduinoOTA.begin();
}



void loop() {
  ArduinoOTA.handle();
  val = digitalRead(ir);
  Serial.println(val);
  lcd.setCursor(0, 0);              // Set the cursor to the first column and first row
  lcd.print("Please Sanitize");     // Print some text
  if(val == 0)
  {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Remove your hand");
    delay(500);
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Thank you");
    servo.write(0);
    delay(500);
    servo.write(180);
  }
```

delay(1000);



}

Working Model

11. Conclusion:

The development of an automatic hand sanitizer dispenser utilizing IR sensor, servomotor, LCD, and ESP8266 offers a significant advancement in hygiene maintenance, especially in public places where hand hygiene is crucial for disease prevention. This system effectively detects the presence of hands through the IR sensor, triggers the dispensing of sanitizer using the servomotor, and provides real-time feedback through the LCD display. Additionally, the integration of the ESP8266 module enables remote monitoring and control, enhancing the system's accessibility and efficiency.

12. Future Enhancements:

1. Smart Data Analytics: Incorporating data analytics capabilities can provide insights into usage patterns, peak times, and refill requirements. This can optimize sanitizer usage and maintenance scheduling.

2. Enhanced Connectivity: Integrate additional communication protocols such as Bluetooth or RFID for more versatile connectivity options, allowing users to interact with the system using their smartphones or smart cards.

3. Advanced Sanitation Features: Implement features such as UV-C sterilization or antibacterial misting alongside hand sanitizer dispensing for enhanced sanitation.

4. User Authentication: Incorporate biometric or RFID-based user authentication to ensure that only authorized individuals can access the sanitizer dispenser, enhancing security and preventing misuse.

5. Energy Efficiency: Optimize power consumption to prolong battery life or utilize alternative energy sources such as solar panels to make the system more sustainable and environmentally friendly.

6. Customization Options: Provide options for users to select different sanitizer types or concentrations based on their preferences or specific needs.

7. Integration with Health Monitoring Systems: Integrate with health monitoring systems to provide alerts or notifications in case of outbreaks or when additional precautions are necessary.

8. Modular Design: Design the system with modular components to facilitate easy maintenance, upgrades, and scalability to accommodate varying usage demands in different environments.

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