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Development of Robot for Healthcare Problems

[1] Prof. Sagar Changdev Wangdare, [2] Omkar Rajendra Suryawanshi,
[2] Tejas Uttamgir Gosavi, [2] Shubham Rajendra Bagul,
[2] Atharva Dinesh Dhariya
1 – Guide, 2 – Student
Department of Mechanical Engineering
D. Y. Patil College of Engineering, Akurdi, Pune

Abstract
This research describes the creation of an affordable automatic sanitizer dispenser that prioritizes cost reduction without compromising on quality. Typically, automatic sanitizers employ infrared sensors to detect the presence of hands in the dispenser. However, a drawback of infrared sensors is their sensitivity, which varies with temperature and sunlight exposure. To overcome this issue, an ultrasonic sensor is utilized as a solution. The ultrasonic sensor provides accurate and reliable output. The development of this dispenser also includes the incorporation of contactless sensing for gases and obstacles using a gas sensor. Additionally, a water pump is employed to spray the sanitizer. Given the current COVID-19 situation, frequent hand cleaning with alcohol-based sanitizers or soap and water is crucial for preventing infection. While washing hands with soap and water can be inconvenient in various locations, the use of alcohol-based sanitizers offers greater convenience.

Keywords
Low-cost automatic sanitizer dispenser, Ultrasonic sensor, Contactless sanitizer, Gas sensor, Water pump, COVID-19 infection, Alcohol-based hand sanitizer

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I. Introduction

The ongoing COVID-19 situation necessitates regular hand hygiene through the use of soap, water, or alcohol-based hand sanitizers to prevent the spread of the infection. SARS-CoV-2, a member of the virus family, is protected by a lipid and protein envelope. This envelope can be disrupted by the use of soaps and alcohol-based sanitizers, rendering the viruses inactive. However, frequent handwashing with soap and water can be inconvenient in various locations. In contrast, utilizing alcohol-based hand sanitizers offers a more practical solution. Traditional sanitizer dispensers with hand pumps and pedals are not user-friendly. Automatic sanitizer dispensers, on the other hand, provide a touchless and secure operation. The urgent need for affordable automatic sanitizer dispensers has arisen in bus stops, train stations, workplaces, and institutions. Since the onset of the global pandemic, there has been a surge in demand for hand sanitizers. Conventional hand pumps often spray sanitizer onto hands when pressed, increasing the risk of viral transmission. Moreover, customers are limited to specific brands as sanitizer containers and pump devices are designed to be compatible only with products from the same manufacturer. To address these issues, this study proposes the development of an automatic hand sanitizer system that can accommodate different sanitizer containers.

II. Problem Statement

Develop a model such that we can achieve the autonomous control, so that direct contact of patient can be avoided which are having the contagious diseases and detect the various parameters like obstacles ahead, various gases, etc. in hazardous conditions.

III. Objectives

1. To achieve the control on vehicle with the help of programming in Arduino UNO Micro-controller.
2. To detect the various parameters in working space such as temperature, etc.
3. To install camera system & Bluetooth control.

IV. Methodology

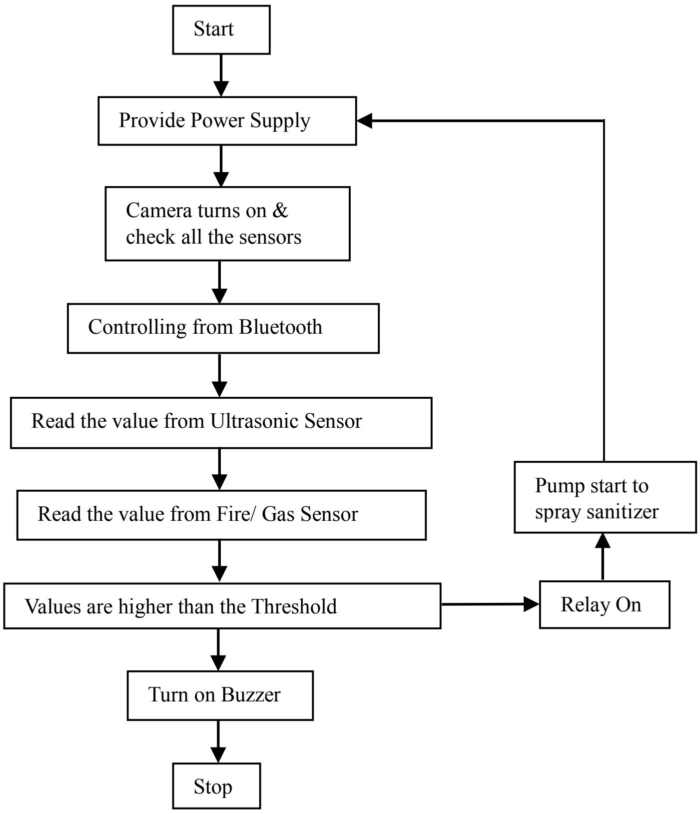

Figure 1. Flowchart of the system

The above Fig. shows the flow chart of the system. Where the sensors sense the input parameters & accordingly gives the data to the Arduino UNO. Arduino UNO processes the data & accordingly gives the notification.

System Architecture

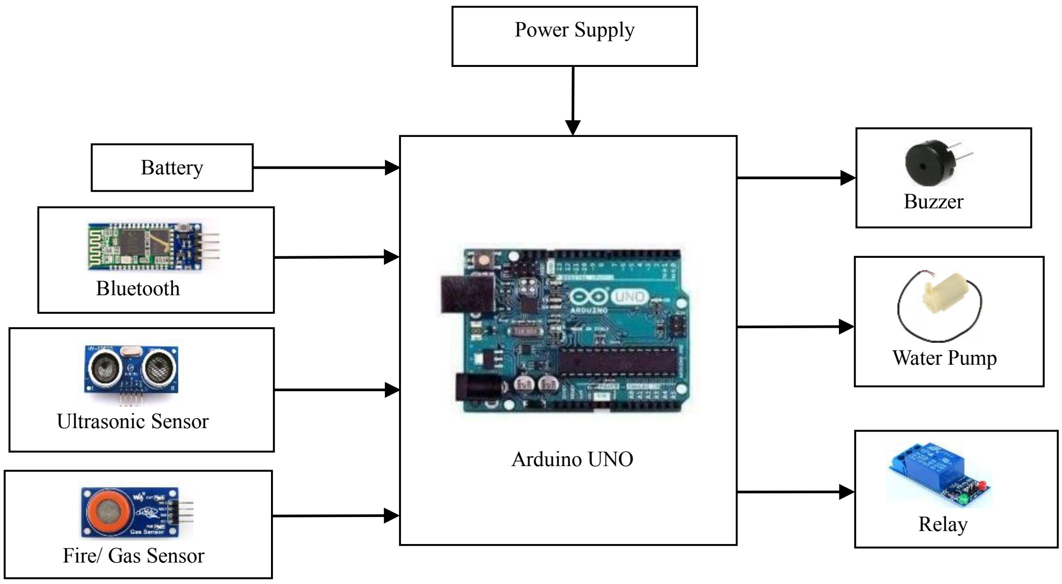

Figure 2. Block diagram of the system architecture

Block Diagram Explanation

The Arduino Uno serves as the primary controller for the system, with the input provided by an ultrasonic sensor. The ultrasonic sensor operates by emitting sound waves at a frequency beyond human hearing range, using its transducer as a microphone to transmit and receive ultrasonic sound. Our sensor, like others of its kind, utilizes a single transducer to send out a pulse and receive its echo. By measuring the time elapsed between sending and receiving the ultrasonic pulse, the sensor can determine the distance to a target object. It can also detect any obstacles or objects in its vicinity. The gas sensor, on the other hand, is designed to detect the presence or absence of gas in a stationary environment. It finds applications in various settings such as coal mines, petroleum refineries, chemical plants, municipal buildings, hospitals, and transportation systems. Gas sensors are capable of detecting combustible, flammable, poisonous, or oxygen-utilizing gases. If any gas is detected, a high sound alert is activated, producing an audible alert through a buzzer. Relays, which function like electromagnets, are switches that establish connections between two points. In this case, the relay has three points: Common (COM), Normally Open (NO), and Normally Closed (NC). In its default state, COM is connected to NC. When an input is applied to the relay, an electromagnet (relay coil) is activated, causing a switching of the connection between the COM and NC terminals to the COM and NO terminals.

Actual Working Model

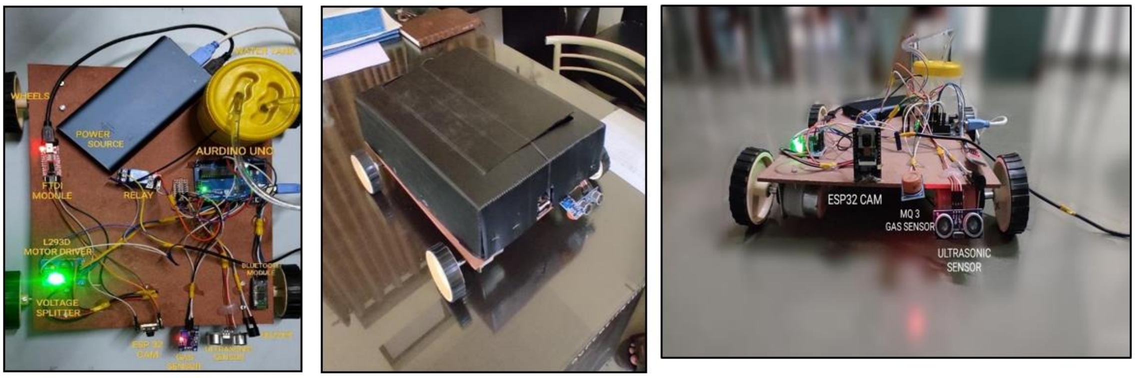

Figure 4. Actual working model

V. Results & Calculations

Motor:-

DC Motor:

Specifications of the motor are as follows:

The motor type is a standard 130 Type DC motor.

It operates within a voltage range of 4.5V to 9V.

The recommended or rated voltage for optimal performance is 6V.

At no load, the current drawn by the motor is a maximum of 70mA.

The motor's speed at no load ranges from 300 to 450 revolutions per minute (rpm).

When loaded, the motor draws approximately 250mA of current.

The rated load for the motor is 10g*cm (gram-centimeters).

The physical dimensions of the motor are 27.5mm x 20mm x 15mm.

The weight of each motor is 16 grams, making a total of 32 grams for two motors.

Wheel:-

Material = Thermoset plastic Diameter = 65 mm

= 15 gm x 4 nos

= 60 gm.

Tank (With water) :-

Water-filled tank:- Plastic as a material

Water tank's diameter is 80 mm. Water tank height is 110 mm. Hence, Volume of water tank = π/4 x (0.08)2 x 0.11 = 5.529 x 10-4 m3 = 0.55 lit.

Weight of water = 0.55 kg.

Total weight of tank = Weight of water + Weight of tank

= 0.55 + 0.05 = 0.6 kg.

Body (Chassis) :-
Material = Steel
Dimensions = 0.190 m x 0.105 m. Wight of body = 500 gm.

Weight of PVC Sheet, Pump & Other electronic equipment :-
= 100 gm.
Dimension of PVC Sheet = 0.260m x 0.130 m

Weight of Micro-controller (Arduino UNO) :-
= 50 gm.

Arduino Uno specifications:
The suggested input voltage range for optimal performance is 7-12V, while the acceptable input voltage limits fall within 6-20V. The microcontroller has 6 analog input pins labeled A0-A5. Additionally, there are 14 digital input/output pins available, out of which 6 can generate PWM (Pulse Width Modulation) output.
Total weight = 32 + 60 + 600 + 500 + 100 + 50 = 1342 gm = 1.342 kg.
Weight act on wheels = 1.342 - 0.6 = 0.742 kg.
Weight act on each wheel = 0.742/4 = 0.1855 kg.
Weight act on Front wheels = 0.1855 x 9.81 = 1.819 N.
Weight act on Rear wheels = 0.1855 + 0.6/2 = 0.4855 kg
= 0.4855 x 9.81 = 4.762 N.

Torque Calculation :-
For Rear Wheel, F = 4.762 N
T = F x wheel radius
= 4.762 x 0.065/2 T = 0.15 Nm

Speed of motor at no load condition =
N = 450 max
N = 300 min

Pmax = (2π x 450 x 0.15) / 60 = 7.068 W.
Pmin = (2π x 300 x 0.15) / 60 = 4.712 W.

VI. Conclusion

According to the paper, non-contact dispensing is crucial to prevent the spread of pathogens, and maintaining hand hygiene is of utmost importance as a part of our daily lives. This study presents a novel design for an automated sanitizer robot and provides detailed information about the required components for its development. The system architecture was carefully considered to ensure smooth connectivity between the components and the microcontroller circuit. Sequential diagrams and descriptions of the key components in the original model were provided for better understanding. The Arduino Uno was utilized to program the microcontroller effectively. Based on the research results, it can be concluded that the sanitizer robot performs well.

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