

Design and Implementation of a Smart Hand Sanitizer Dispenser with Door Controller using ATMEGA328P

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Abstract: 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, one needs 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 research paper aim to design and implement a low cost smart hand sanitizer dispenser with door controller based on ATMEGA328P (Microcontroller), electromagnetic lock and Ultrasonic sensor that can help to solve the challenges faced by security guards at different stations such as bank doors, school gates, hospital gates etc. in enforcing this hand sanitizing action before letting people in to where ever they intend to enter as some people are not willing to collaborate, some look at it as a wastage of their time and also sometimes these security guards can let some people in without sanitizing just because they are their friends or family relatives which is very risky. Therefore, the smart hand sanitizer is stationed at the entrance door and it is connected to the door in such a way that it controls it. That is to say, when a person(s) wants to access the entrance door, they must first sanitizer their hands or else the door will remain locked. With this smart hand sanitizer dispenser, an ultrasonic sensor is used to check the presence of hands below the outlet of the sanitizer machine. It will continuously calculate the distance between the sanitizer outlet and itself and tells the microcontroller to turn on the servo motor whenever the distance is less than 10cm to push the sanitizer out and immediately after the sanitizer outlet dropping some amount into your hands, the electromagnetic lock will de-energize (unlock the door) lighting up a green LED and display a word "The Entrance Door is Open" on the LCD display, then the second servo motor will open the entrance door. Otherwise, the door will neither unlock nor open but a red LED will continuously be on with the "Please Sanitize Here" words displayed on the LCD display.

Keywords: Hygiene, Hand sanitizer, Microcontroller, Ultrasonic sensor, Servo motor, LCD, Electromagnetic Lock.

1.0 Introduction

Hands are considered to be the primary mode of infectious diseases, especially for those living in close proximity such as college residence halls, shopping malls, bank halls, market areas etc. Because of the frequent contact with hands and multiple surfaces, the incidence of cross-contamination is significantly increased. Hand hygiene is a major requirement for human health and many infectious diseases can be emerged if proper hand hygiene procedures are not implemented. Hand washing is the simplest, important and cost effective way to improve hand hygiene in health care and support the prevention of infectious disease.

Over recent years, there has been increasing availability and usage of hand sanitizing products. The main advantage of these products seems to be that they are more trusted, quicker and easier to use. They may also provide another way to clean the hands when water and soap are not available. Using hand sanitizers is usually considered to be an effective hand hygiene regime for hospital, health-care settings and others. As we all know, the COVID-19 outbreak hit the world and changed our lifestyle. In this condition, Alcohol and hand sanitizers are vital fluids, however, they must be used properly. Touching alcohol containers or hand sanitizers with infected hands can spread the virus to the next person. In this research paper, we will design and implement a smart hand sanitizer dispenser that uses ultrasonic sensor to detect the presence of a hand, activates the first servo motor to pour the liquid on the hand, de-energizes the electromagnetic lock and immediately sends a signal to the second servo motor to open the entrance door.

1.1 Objectives

The main objective of this research paper is to design and implement a low cost touch free smart hand sanitizer dispenser with door controller that includes features such as ultrasonic sensor, LCD display and servo motor, based on Microcontroller.

- ✓ To design a touch less hand sanitizer dispenser.
- ✓ To design and implement a low power consumption system

1.2 System Description

In this research paper, we are using the ultrasonic sensor (HC-SR04) to detect the presence of a hand. When it detects presence of hand below 10cm, it will trigger the first servo motor to move from 0 degrees to 180 degrees in order to pour the liquid on the hand. It will delay for two (2) seconds before returning back to 0 degrees. After returning to 0 degrees, the electromagnetic lock will de-energize and a green LED will light up immediately, a word “The Entrance Door is Open” will appear on the LCD display then the second servo motor will open the entrance door. We added a delay of six (6) seconds to energize the electromagnetic lock and a delay of two seconds to reset the system. In this system, microcontroller is used to control all the attached devices across the external electronics equipment which are: ultrasonic sensor, servo motor, electromagnetic lock, LCD display and LEDs. The power supply provides the voltage and current required for effective performance of the system. The electromagnetic lock taps directly from the 12V DC power source and then Microcontroller and servo motor are fed with regulated DC power supply, which is 5V and 9V respectively.

This system consists of two parts, Hardware and Software.

The Hardware parts include:

- ATMEGA328P
- Ultrasonic sensor
- Electromagnetic lock
- 12V DC Power Supply, 9V and 5V DC Regulator
- LCD display
- Relay
- Servo motor
- Saleae Logic 16 (Logic Analyzer)
- LEDs
- Resistors, Capacitors and Diodes.

Software parts include:

- Arduino IDE
- Saleae Logic 1.2.18

1.3 Flow Chart

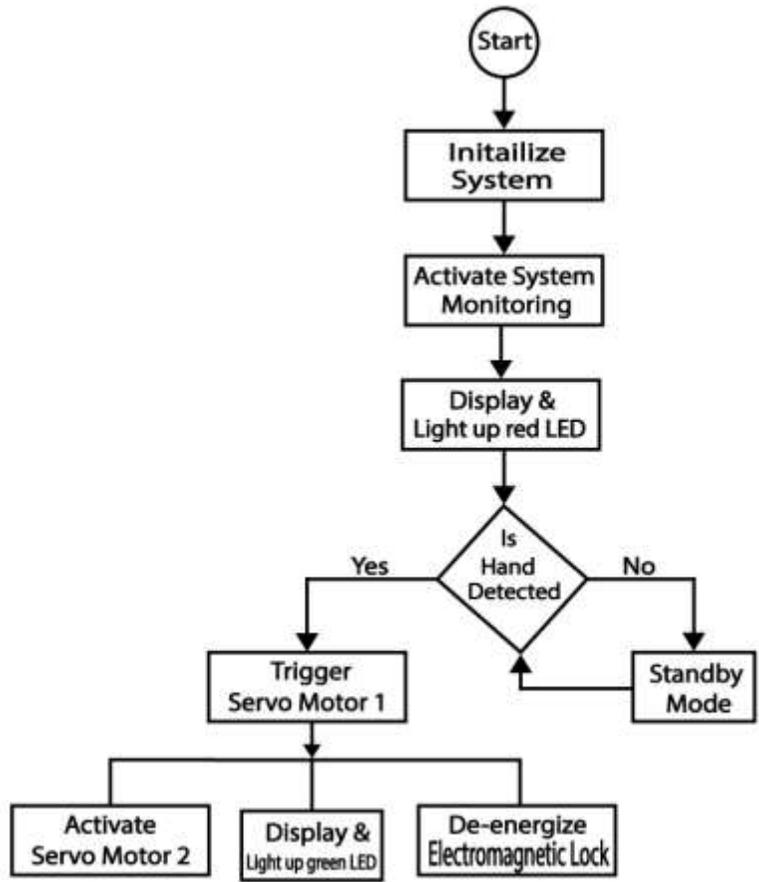


Fig1. The flow chart of the system

1.4 Block Diagram

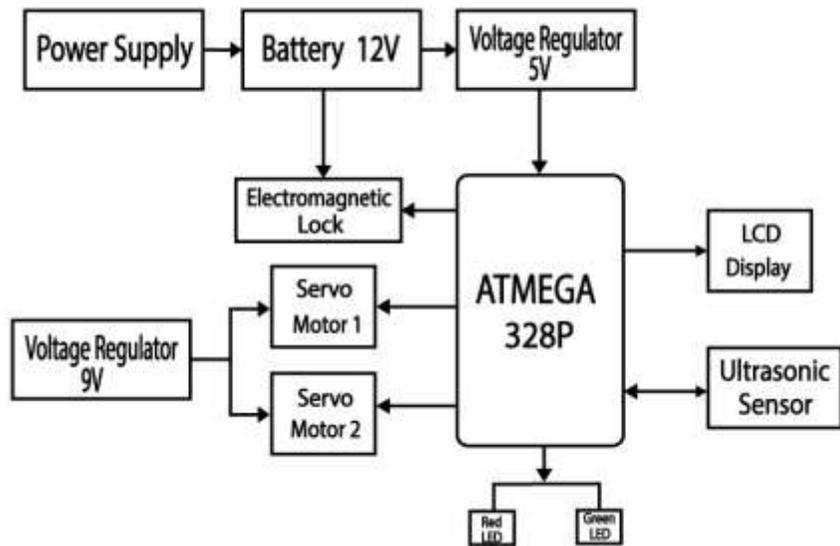


Fig2. The block diagram of the system

1.5 Circuit Diagram

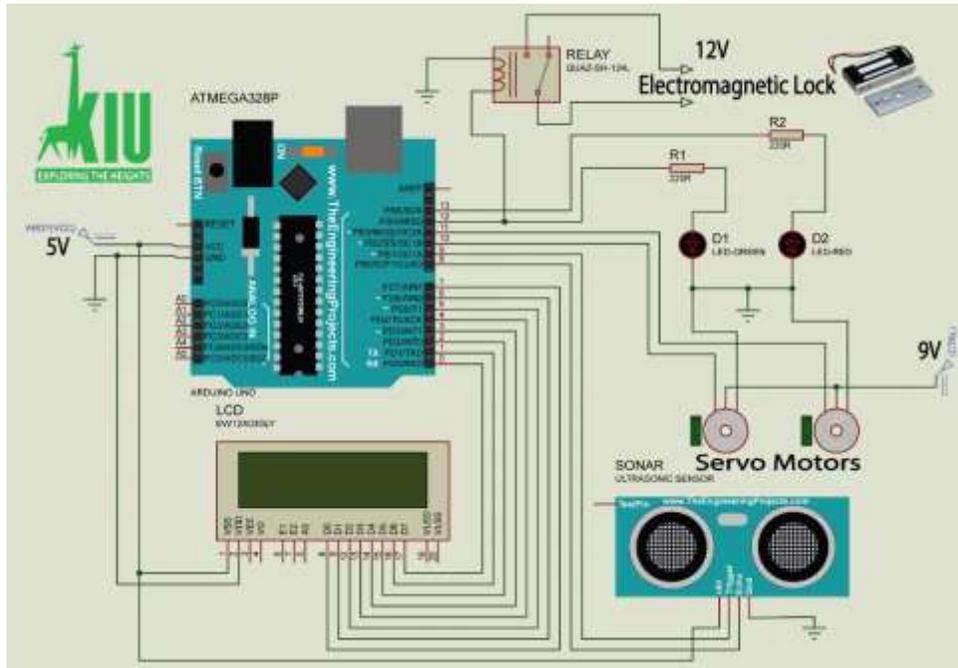


Fig3. The circuit diagram of the system

1.6 Applications

This system can be applied in hospital, banks, offices, home, shopping malls etc.

1.7 Result

The following are the results achieved from this work:

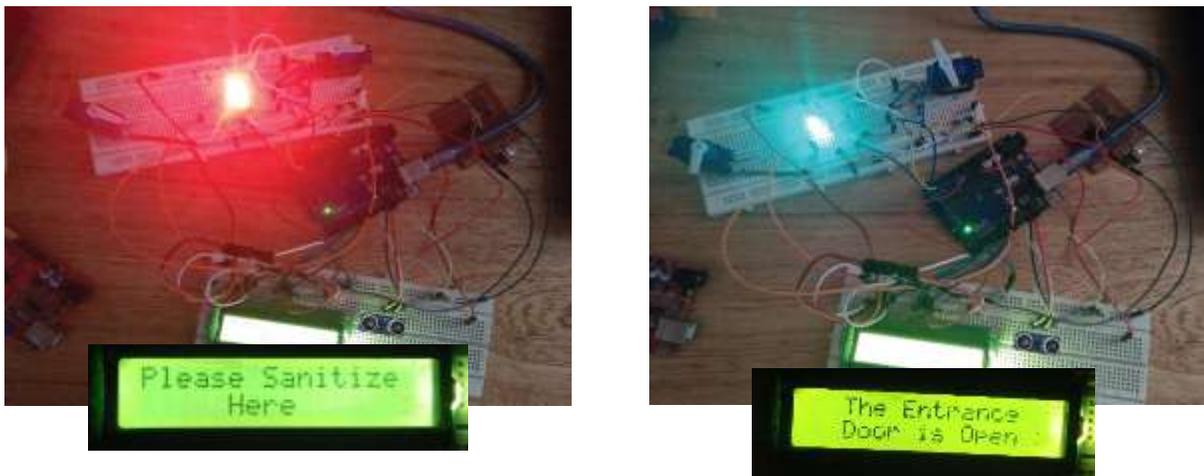


Fig5. The IP Spy camera result pictures

The ultrasonic sensor (HC-SR04) detect the presence of a hand. When it detects presence of hand, it triggers the first servo motor to pour the liquid (sanitizer) on the hand. The electromagnetic lock de-energizes immediately lighting up a green LED and display a word “The Entrance Door is Open” on the LCD display, then the second servo motor opens the entrance door.

1.8 Conclusion

The system surely help in implementing the hand hygiene without any challenges as it is a must to sanitizer if you are to access any entry point. It is much safer and more recommended due to its touch less property which zeros down any chances for cross-contamination. This is a low cost user friendly system that anyone can make use of. All the devices communicate well. It can be concluded here that the system has been successfully implemented and the aim is achieved without any deviations. The results achieved in this project are genuine and are a product of sincerity and hard work.

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