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Automatic Door Knob Sanitizer Machine

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Abstract: *A rise in COVID-19 transmission risk led people, industries, and the government to adopt different approaches for controlling the spread rate of the virus. This project uses Arduino-Nano, Servo motor, and a servo motor. While each approach has its advantages, one approach in particular -- Arduino-based sanitizing systems -- has played a key role in preventing the spread of Coronavirus due to its cost-effectiveness and flexibility. According to our information, an automatic sanitizer for door handles and knobs that uses IR sensors and servo motors has not been reported so far. Therefore, we have demonstrated an automatic door handle sanitizer which is commonly used in hospitals, houses, and other places to sanitize the handles and knobs. Efforts have been made to prevent Coronavirus infection. A person who gets infected by touching a contaminated doorknob of any organization, house, hospital, etc., will suffer serious repercussions as well as the country in which he lives. By sanitizing the door handle, the said system removes the virus it contains from the door handle as the person touches it. An IR sensor is used to demonstrate the mechanism. To prevent the spread of COVID-19, it can be implemented in places such as hospitals and businesses where the doors are used frequently.*

Keywords: Disinfection, Door Knob/Handle, Automation, Arduino, Micro Controller, IR Sensor

I. INTRODUCTION

Since December, the coronavirus disease (COVID-19) caused by SARS-CoV-2 (the coronavirus that causes severe acute respiratory syndrome) has been identified in Wuhan, Hubei Province, China. Worldwide, people are getting infected with the Corona virus, and within half of the year, the death rate from COVID-19 is about 50 percent. 6 million, while about 12 million people are affected. A droplet can be suspended in the air as aerosols if droplets are coughed, sneezed, inhaled, or the surface of a contaminated object is contaminated. The transmission of viruses occurs most often through the hands, according to a number of researchers. The most important preventive measure during the COVID-19 pandemic is therefore regular hand washing.

In addition, it is important that proper hand hygiene is practiced within public healthcare systems such as hospitals and nursing homes to prevent the transmission of the COVID-19 infection. From the following example, it becomes clear why it is important to break the chain of COVID-19 infection. Consider a lady sitting behind her husband in a hospital who was being treated for Corona virus. Her hands become infected after touching her husband's hand, and at that time is she touching the door handle to open to leave the patient room. As a result, the virus gets attached to the hand. It is also possible that the hospital compounder gets infected if he touches the same handle, and if he delivers the file to a nurse, she will also become infected. As the aforementioned example shows, many people are infected by only one person without even knowing it.

In order to break the chain of COVID-19 infection, numerous Arduino-based projects have been created. Some of the projects are based on the system of closing the door, where the sanitizer sanitizes the handle or knob when the door closes, but, in any case, if the door did not close, the virus would spread. There is a way to overcome this limitation by implementing the given project. However, the engineers did not use an Infrared Sensor (IR) to detect a person's hand. In addition, we have developed an automatic door handle or knob sanitizer that sanitizes the door handle or knob when a person touches the doorknob or handle in order to improve sanitizing-based projects. Hospitals, schools, private companies, colleges, etc., might benefit from the reported project. This work is organized into three sections to stop the infection. A detailed methodology is presented in Section II, which discusses the key results of the designed product, i.e., Automatic Door Handle or Knob Sanitizer. The results are described in further detail.

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II. OBJECTIVE

There has been an increase in the risk of COVID-19 spreading, which has led governments, industries, and individuals to adopt various approaches to prevent COVID-19 viruses from spreading. Despite the advantages of each approach, Arduino-based sanitizing systems have played an important role in preventing Coronavirus spread due to their cost-effectiveness and flexibility. As far as this research field is concerned, a lot of researchers have worked diligently to stop COVID-19 outbreaks. As far as we know, there has not been any report of an automatic door handle and knob sanitizer based on an infrared sensor and servo motor. Our paper has demonstrated an automatic door handle sanitizer for sanitizing the handle or knob of a door that is commonly used in homes, hospitals, and industries. People are being prevented from becoming infected by the Coronavirus through the reported work. Anyone who touches a door knob that is contaminated will be severely affected by it, as well as his country if they become infected. As a result, the reported system eliminates virus from the door handle when someone touches it. It is comprised of Arduino-Nano, a Servo motor, breadboard, and an IR sensor. To stop COVID-19 infection from spreading to public places such as hospitals, companies where doors are frequently used, this system can be put into place.

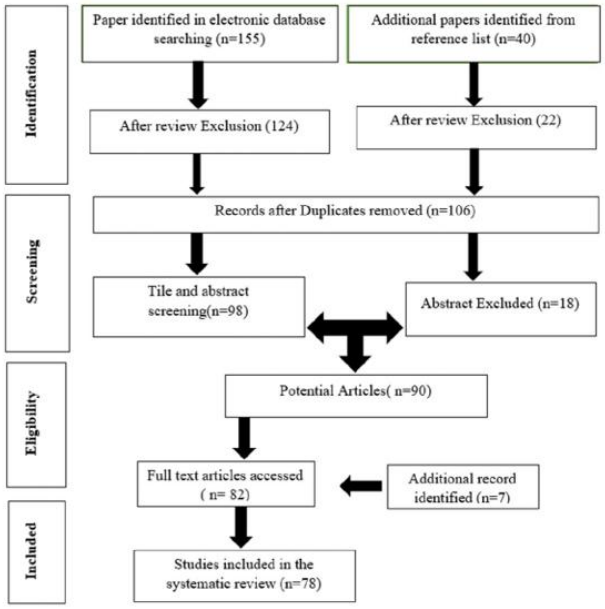

Figure 1: Flow chart for research paper identification and selection strategy

The search engines Google Scholar, Scopus, and Science Direct were used to identify the most important articles relevant to this review. The combination of keywords "disinfection", "door knob/handle", "micro-controller", "automation" and "automatic sanitizer spray" were used. The last search took place on May 5, 2022. Figure 1, illustrates the process of identifying and selecting relevant research articles.

The first stage involves searching for articles according to their titles and abstracts. Afterward, existing articles are sortedin order to select the appropriate ones that meet the following three basic criteria, namely: a) the subject should be related to an automatic door knob sanitizer machine, b) the working of a sanitizer machine, and c) the subject should be related to automation. References in the list also led to the identification of additional papers. The final number of papers left in the database is 106 after exclusion from the database. In the second stage, abstracts from these papers are screened, which resulted in 90 potential articles being shortlisted. Then, the articles are read through to determine if they are relevant or not. 78 articles were deemed relevant at the end of the process.

III. LITERATURE REVIEW

It includes, the data of the published journal papers related to our projects. It also contains descriptions of the work of the respective authorities in their books, papers, blogs, and videos. We have learned about various processes, methods, and design factors from these papers related to our project topic. By combining all the ideas and methods from journals, we were

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able to refine the data we needed for our project. In "How can airborne transmission of COVID-19 indoors be minimized?" by "firmament international, vol 142, discussed about various routes of transmission for this pandemic disease. As well as the more widely recognized transmission through larger respiratory droplets and direct contact with infected people or contaminated surfaces, small airborne droplets are likely to cause infection as a third route. As part of the Engineering Controls to reduce SARS-CoV-2 transmission via air, a focus is placed on surface cleaning and indoor environments, which are where most transmission occurs (Nishiura et al., 2020). Furthermore, the measures are mainly applied to public buildings. According to the research, normal indoor practices (e.g., segregating infected individuals, opening windows and doors, and using portable air-cleaning and surface-cleaning devices) should be maintained at any time to ensure healthy indoors.

University Hospitals Birmingham NHS Foundation Trust. Infection control: break the chain. 2010. [online]Cleaning & Hygiene Supplies. Handle Hygiene Door Handle Sanitiser. 2017 in this online video shows a concept of a similar device that was helpful for conceptualizing our device. It also emphasizes the importance of door knob hygiene and its effect on bacterial disease spreading. According to the report, door knob hygiene can reduce the spread of bacteria very effectively. It is proposed to incorporate the same kind of mechanism with Arduino automation as an advancement.

Aatik's lab DIY Door Handle Sanitizer || Corona Virus Precaution. 2020. [Online] Available: https://youtu.be/DP06k6w 2ILE (Accessed: Oct 2021) Here is the raw model we studied for this project, which was helpful to us. Data they used and a mechanism for the machine were taken into consideration for our research. Data on Arduino integration and power distribution and consumption for different components is used to conduct our research. There is still a lack of design in the product, which we hope to improve, along with improvements in safety measures.

Allegranzi, L. Conway, E. Larson, and D. Pittet. Status of the implementation of the World Health Organization multimodal hand hygiene strategy in United States of America health care facilities. American journal of Infection Control, vol. 42, pp. 224-230, 2014 In this research paper, the spread of infection through multiple surfaces is studied and the spread through hand and infected surfaces is studied, emphasizing the necessity of multimodal hand hygiene. A number of harmful bacteria, viruses and fungi can be found on door handles, and they are often the source of human-to-human germ transmission. By inadvertently touching un-sanitized door handles, people can contract the common cold, flu, and other diseases. A door handle, for example, can keep germs alive for hours, or even days, according to the Centre for Disease Control (CDC). Regardless of whether you keep your hands clean, it only takes one person to contaminate a door handle and put everyone else at risk.

IV. COMPONENTS USED

4.1 Infrared Sensor

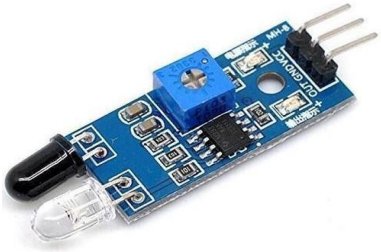

Figure 2: Infrared sensor [6]

In figure 2, Sensors that measure and detect infrared radiation are known as infrared (IR) sensors. Infrared radiation is emitted by anything that emits heat above five degrees Kelvin. Infrared sensors can be active or passive. Infrared radiation is emitted by active infrared sensors and detected by them.

In figure 3, Both emitting and detecting infrared radiation are done by active infrared sensors. Active infrared sensors consist of two parts: a light-emitting diode (LED) and a receiver. In Figure, infrared light from the LED reflects off of an object when it comes close to the sensor and is detected by the receiver. Active IR sensors are common in obstacle detection systems (such as those used in robots) and act as proximity sensors. An IR sensor is powered by its Vcc (5V) pin, which connects to the Arduino's 5V pin, and its ground (GND) pin is connected to the Arduino's ground point. As a next step, connection of Out pin of IR sensor to Pin2 (D2 pin of Arduino) is performed.

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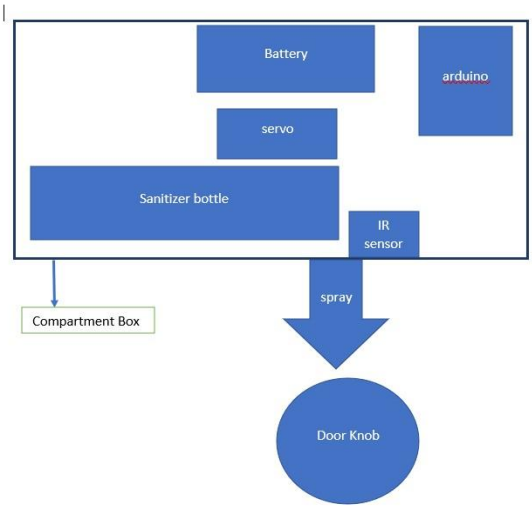

Figure 3: Working of IR sensor for automatic door knob sanitizer machine.

4.2 Servo Motor

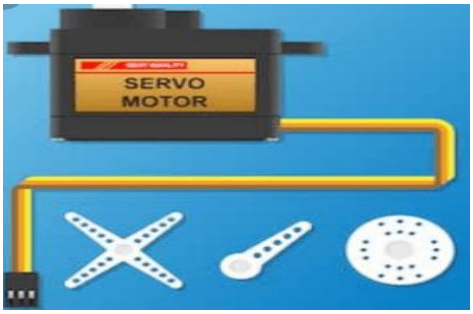

Figure 4: Servo Motor Design[8]

Servo motors are rotary actuators or motors that can be controlled precisely in terms of the angular position, acceleration, or velocity. Its basic capabilities differ from those of a standard motor. In this way, a regular motor is used in combination with a sensor that provides feedback on position. There are different types of servo motors depending on the application. AC servo motors, DC servo motors, brushless DC servo motors, positional rotation servo motors, continuous rotation servo motors, and linear servo motors are among the most valuable types of motors (see Fig. 4). This video shows how to connect the orange and brown wires of a servo motor to our Arduino board. The brown wire/ground wire is connected to the GND pin, the red wire is connected to the VCC (5V), and the orange wire/Out wire is connected to Pin3 (D3 pin of Arduino).

4.3 Arduino Nano Micro-Controller

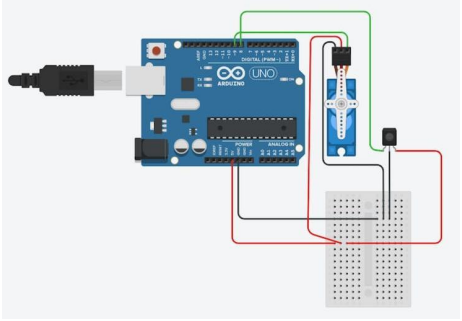

Figure 5: Arduino Nano Microcontroller board[13]

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In figure number 5, The Arduino Nano is a small, flexible, and breadboard-friendly Microcontroller board that has been developed by Arduino.cc in Italy based on the ATMega328P (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x). It is very similar to the Arduino UNO board except that it is quite a bit smaller. Using the Arduino Uno board, you can use PWM as well as digital inputs and outputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), USB connection, ICSP header, and reset button. This board contains everything needed to use the microcontroller; connect with a computer with a USB cable or power it with an AC-to-DC adapter or battery to get going... You can experiment with the Uno without worrying too much about making a mistake. In the worst case, you can replace the chip for a few dollars and try again. In Italian, "Uno" is used to denote the release of Arduino Software and IDE (Instrumentation Development Environment) 1.0. The Uno board and IDE (Instrumentation Development Environment) 1.0 served as the reference versions of Arduino, which have been replaced by subsequent releases. The Uno board is the first of a line of USB Arduino boards and the reference model for the Arduino platform; for a listing of current, past and outdated boards, please see the Arduino platform index.

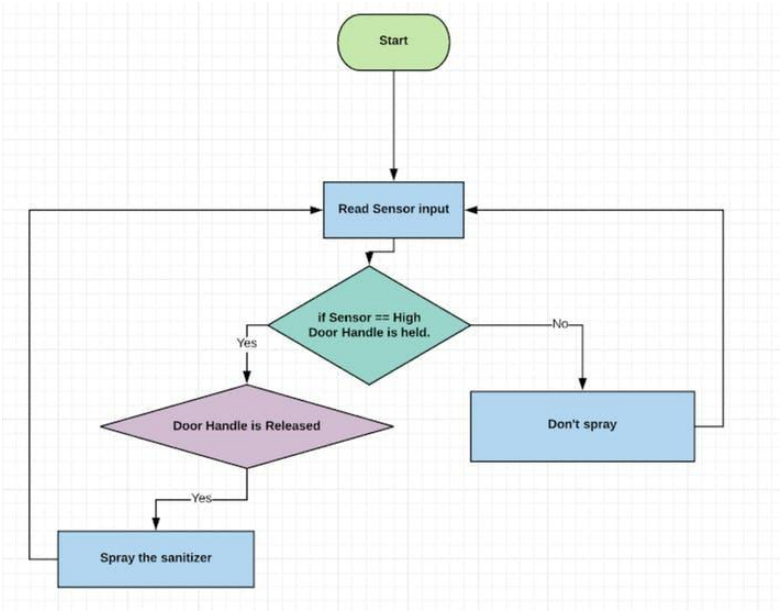

Figure 6: Flow chart for working of Automatic door knob sanitizer machine [10]

In figure 6, when the working gets start then it will read sensor input. When the sensor is high or the door handle is held then door handle will be released and then it will spray sanitizer. Simultaneously, if sensor is not high or door handle is not held then it will not spay sanitizer.

The specifications for the used Arduino Nano and Arduino Components:

1. EEPROM – 512 bytes or 1 KN
2. USART - Yes
3. Microcontroller – Atmega 328p / Atmega 168
4. Operating voltage – 5V
5. Input voltage - 7-12 V
6. Digital I/O pins – 14
7. PWM – 6 out of 14 digital pins.
8. Maximum current rating – 40mA
9. USB – Mini
10. Analog pins – 8
11. Flash memory – 16kb or 32 kb
12. SRAM – 1KB or 2KB
13. Crystal oscillator – 16 MHz

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V. CONCLUSION

Using our device, door knobs and handles can be disinfected more efficiently as well as reducing the number of bacteria that can spread. This device will reduce health care associated infection rates to a considerable extent. Therefore, this device is applicable to places like hospitals where surfaces need to be disinfected and in public places such as railway stations, airports, offices, etc. to eliminate surface bioburden, resulting in improved hygiene and fewer infections.

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