

# The Disinfectant Solution System Preventing SARS-COV-2 Epidemic

Trung Thien Pham <sup>\*1</sup>, Manh Ha Nguyen<sup>2</sup>, Ngoc Sang Nguyen<sup>2</sup>

<sup>1,2</sup>University of Economic and Technical Industries, Vietnam

\*Corresponding author email: pthtien.ck@uneti.edu.vn

**Abstract**— This paper researched about the solution of designing the public disinfection chamber which helps us prevent SARS-CoV-2 epidemic. The disinfection chamber can provide automatic hand sanitizer, body temperature measurement system, and display the result of body temperature on the screen. Moreover, it can warn with excessive body temperature, 360° automatic disinfection spraying system with silver nano antiseptic solution. The result of the study is acceptable and highly applicable in community, improving the capability of preventing SARS-CoV-2 epidemic.

**Keywords**— SARS-CoV-2, disinfection, body temperature, photoelectric sensor, infrared temperature sensors.

## I. INTRODUCTION

At the end of December 2019, some patients having unidentified viral pneumonia were in Wuhan (China). The gen sequencing has been temporarily identified as 2019-nCoV (novel coronavirus 2019). Until January 26, 2020, there were more than 2000 cases which show positive with 2019-nCoV. Until May 2020, according to the statistics of the WHO, there are 5.69 million infected people and 365,000 deaths in 215 countries and territories globally. Now, there is no available vaccine that can prevent the disease. Countries that deal with respiratory infections caused by the Coronavirus (SARS-CoV-2 virus) implement epidemic control measurement at the border, manage the immigration, and isolate people from epidemic zones. Moreover, the will control border, supervise, and detect patients in the community as well as encourage residents to wear masks. In particular, the will limit the concentration in crowded places and remind people to usually use the hand sanitizer. In this complicated epidemics, to help people use hand sanitizer without touching public equipment, it is suggested measuring and testing body temperature to monitor the situation of individual health and disinfect the whole body when people gather in public. The group of author has studied the solution to create an automatic disinfection chamber which can spray silver nano solution with many automatic functions. When people enter it, the system automatically measures and displays the body temperature on the screen and alert if the body temperature exceeds the allowed level. When we pass through the automatic body temperature, we will see the automatic hand sanitizer system. It will automatically provide a sufficient amount of antiseptic solution. Finally, it is the whole body disinfection chamber sprayed with 360°.

## II. THE PRINCIPLE OF THE SYSTEM

The system operates with 3 small system including the automatic hand sanitizer system, the body temperature measurement system, and the system of spraying automatically silver nano disinfectant solution for whole body. When someone go into the chamber, the body temperature and

warning system automatically works. The infrared temperature sensors measures the body temperature and the signal is sent to the center and displays on the LCD screen. If the body temperature exceeds 37 degree, the system will be automatically alerted. The automatic providing solution system works according to the following principle. When the hand is put into waiting position to take the sanitizer, the photoelectric sensor will recognize the signal and transmit it to the processor. After that, the processor will provide solenoid valve to provide solution.

The solution is provided with a sufficient amount according to the calculation to ensure that the disinfectant hand washing process is accurate. The system of spraying nano silver solution of the whole body including the photoelectric sensor can recognize when someone enters the disinfection chamber. The photoelectric sensor will send signals to the processor, the processing system will open high pressure pump and pump high-voltage to take the silver nano disinfection in the solution tank pumped to the spray pipe via safety valve, throttle valve, pressure reducing valve and 360-degree rotating nebulizer around people. The disinfectant solution is sprayed around the body to disinfect.

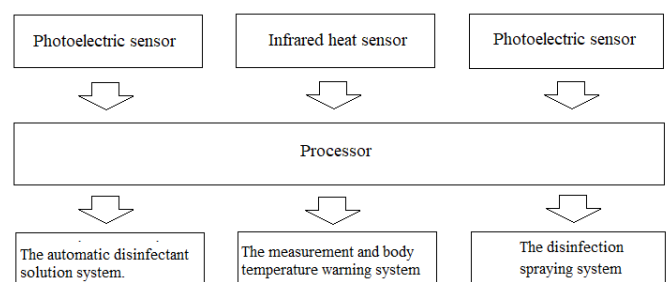


Fig. 1: The principle and diagram of system

## III. THE SOLUTION OF CONTROLLING

### A. The Automatic Disinfectant Solution System

The automatic solution supplying system works according to the following principle. When we put our hand into the waiting position to receive disinfectant solution, the

photoelectric sensor will recognize signal and transmit it to the processor. The processor will provide the solenoid valve to provide solution. The solution is supplied with a sufficient amount according to the calculation to ensure that the disinfectant hand washing process is accurate.

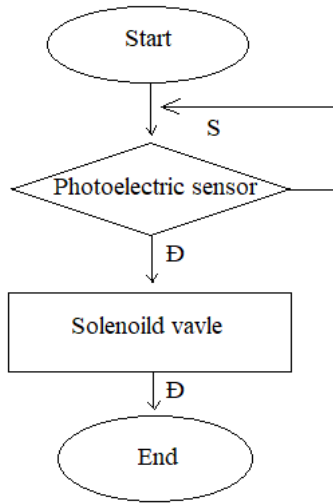


Fig. 2: Algorithm diagram the hand sanitizer supplying system

The automatic disinfectant solution system uses photoelectric sensor (BRQPS 10M-TDTA-C type NPN). The photoelectric sensor can change the distance of the object recognition which ranges from 10mm-300mm. When detecting that there is an object blocking light and wave, the photoelectric sensor will transmit signals to the processor and signals to the solenoid valve. The BRQ photoelectric sensor details in table 1.



Fig. 3: Photoelectric sensor

Table 1: Parameter of Photoelectric sensor

Attribute	Value
Sensing type	Through-beam type
Sensing distance	10 m
Sensing target	Opaque material of min. Ø7mm
Light source	Red LED(660nm)
Response time	Max 1ms
Power supply	24VDC
Operation mode	Light ON/Dark ON(set by control wire)
Control output :	NPN open collector



Fig. 4: Photoelectric sensor

The automatic disinfectant solution system uses the solenoid valve to open and close to provide antiseptic solution. Solenoid valve is electromagnetic control valve. When a current is applied to the suction coil, the suction valve opens and closes the valve doors to control the flow of fluid through the valve. The solenoid valve system has 24 VDC suction coil.

#### B. The Measurement and Body Temperature Warning System

The body temperature measurement system and body temperature warning system will automatically work. When someone enters the disinfectant chamber, the photoelectric sensor will activate the measuring system to work. Infrared temperature sensor measures the body's temperature and the signal will be sent to the processor. The processor will process the signal and display it on the LCD screen, if the body temperature reaches above the allowed level(37 degree), the system will be alerted. The measurement algorithm and body temperature warning is in figure 5

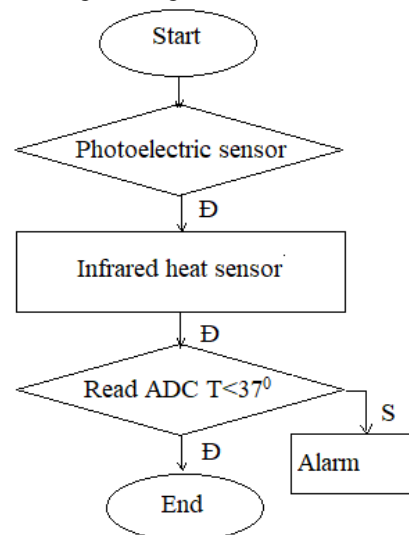


Fig. 5: Algorithm diagram the measurement and body temperature warning system

Infrared temperature sensors are used in the measurement and body temperature warning system to identify people and measure human body temperature. The sensor does not measure the temperature of a non-human source to avoid mistakes. The range of the sensor is from 0.7mm to 700mm. Infrared spectrum of the sensor maybe up to 1000mm. The sensor works on the principle of focusing infrared energy

emanating from human. These photodetectors convert that energy into an electrical signal, which is proportional to the infrared energy emitted by the object. The infrared energy emitted by any object is directly proportional to its temperature. Specifications of infrared heat sensor in table 2.



Fig. 6: Infrared temperature sensors

Table 2: Parameter of Infrared temperature sensors

Attribute	Value
Sensing type	MA Output Signal
Accuracy	1%
Cable Length	1m
Light source	Red LED(660nm)
Response time	240ms
Power supply	24VDC ±10%(ripple P-P: max. 10%)
Maximum Temperature Sensed	+250°C
Control output :	Analoge

### C. The Disinfection Spraying System

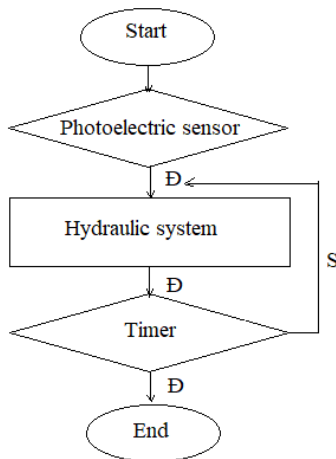


Fig. 7: Algorithm diagram the disinfection spraying system

The spraying nano silver mist system including the photoelectric sensor will recognize someone entering the disinfectant chamber. The photoelectric sensor will send signals to the processor. The processor will send signals to high pressure pumps and pump high voltage to take the silver nano in the solution tank via safety valve, throttle valve, and pressure reducing valve with 360-degree rotation nebulizer around people. The disinfectant solution is sprayed all over the body to disinfect. The algorithm diagram of the disinfection spraying system is in figure 7. Figure 8 is a schematic diagram of hydraulic system that provide silver nano solution.

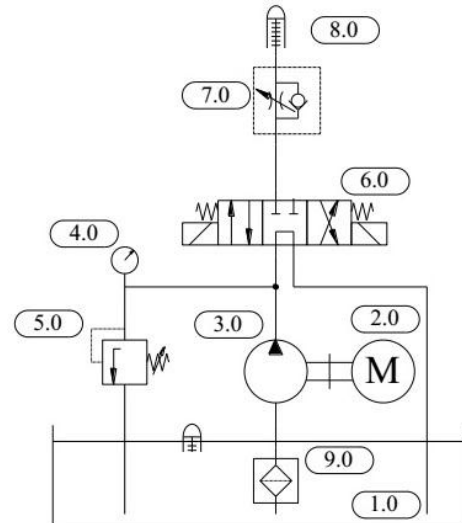


Fig. 8: Hydraulic system.

Table 3: The hydraulic system

1.0	The silver nano solution tank
2.0	Pump motor
3.0	Pump
4.0	Pressure clock
5.0	Safety valve
6.0	Distribution valve
7.0	Throttle valve
8.0	Mist nozzle

Table 4: Properties of silver nano solution

Effective	Within 1 min For H1N1,H3N2 Flu virus.Antivirus rate up to 99.99%
96 hours of protection	within 1 min. for E. coli, Staphylococcus aureus, Candida albicans, sterilization rate up to 99.99%
Safe	After Kill 99.99% bacteria and virus with 96H protection
Care	Physical sterilization mechanism,no drug resistance. No chemical added, gentle repairs the skin.
	300ML large-capacity package, save costs, meet the needs of the whole family, protect the health of the whole family .Electrolytic preparation, stable quality.
	50ML package, small and exquisite, easy to carry, always take care of your health. Electrolytic preparation, stable quality.
Use	Spray to your hand, your pet, door handles, cloth, shoes or surface you need to antibacterail. No need to wipe with cloth or paper.

JMNano Sliver is a solution which is used to spray and disinfect whole body. JMNano silver solution has a bactericidal effect on the H1N1, H3N2, and SARS virus. Because of being in the SARS virus group, Nano silver solution is preferred for antibacterial, disinfection to avoid the invasion and spread of SARS-Covid-2

### D. Processor

The system processor is Arduino Uno R3. The processor is applied with ATmega328P chip. With 14 digital input and output ports, 6 analog input ports, 6 PWM pulse signal ports, and 16 Mhz processing speed to meet the requirement and processing speed of the system. The entire control program is

connected from Arduino Uno R3 to laptop via USB. Arduino Uno r3 Kit specifications in table 5.

Table 5: Parameter of Arduino Uno R3

Attribute	Value
Processor	ATmega328- 8bit
Voltage	5VDC
Frequency	16Mhz
Curent	30mA
Voltage input	6-12V DC
Voltage limit	6-20V DC
Digital I/O	14 (6 hardware PWM)
I/O Analog	6 (10bit)
Curent limit I/O	30 mA
Current max (5V)	500 mA
Current output max (3.3V)	50 mA
Memory flash	32 KB (ATmega328)
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)

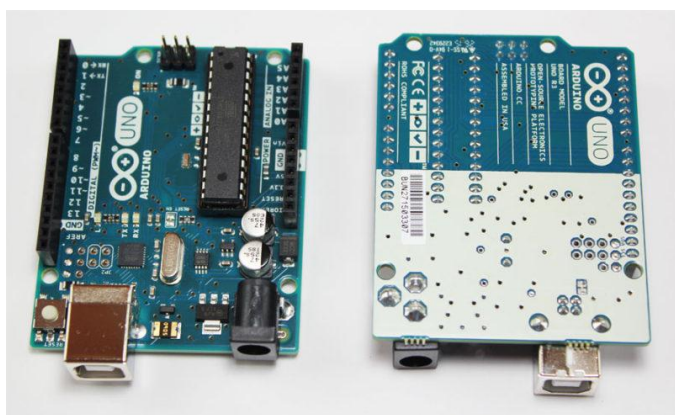


Fig. 9: Arduino

#### IV. CONCLUSION

This research presents disinfection system with automatic functions providing supplying disinfectant solution, automatically measuring and warning people with high body temperature and spraying mist-type solution around whole body with silver nano antiseptic solution which was tested and certificated by health organization. The system will be located in public and prevents people from touching surface of public places, helping people monitor their body temperature. Therefore, people will be protected from disease.

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