A new method for the design and development of smart kit for early stage detection and prevention from covid 19 using IoT connected devices

Senthil Kumar Ramu
Sri Krishna College of Technology
Suresh Kalichikadu Paramasivam
Sri Krishna College of Technology
Leninpugalhanthi Ponnuswamy
Sri Krishna College of Technology
Ashok Kumar Loganathan
PSG College of Technology
Ravita Lamba
MNIT: Malaviya National Institute of Technology
Hitesh Panchal
Government Engineering College
Kokilavani Thangaraj
Sri Krishna College of Engineering and Technology
Maheswaran Shanmugam
Kongu Engineering College
Suresh Muthusamy (infostosuresh@gmail.com)
Kongu Engineering College

Research Article

Keywords: Automation, Contactless Sanitization, Internet of things, Smart Healthcare, Smart Sensors

Posted Date: July 28th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1870049/v1

Abstract

As World Health Organization (WHO) recommends to prevent infection spread includes regular hand washing, wearing a mask in public places, covering mouth and nose when coughing and sneezing, avoid close contact with anyone showing symptoms of respiratory illness. According to a study, people touch their faces more than 20 times an hour on average, which involves contact with the eyes, nose, or mouth. In India people often wear the same mask repeatedly without disinfecting them and a majority of the population do not wear a mask or follow social distancing protocols, which leads to further spread of the virus. This paper discusses a cost effective and smart solution for citizen in the form of a smart kit which contains multiple Internet of Things (IoT) devices with shared connectivity, each addressing a particular problem, which makes following the pandemic protocols easier and effective for the average citizen and the frontline workers.

1. Introduction

Corona virus disease (COVID-19) is an infectious disease caused by a newly discovered corona virus. The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in the air and quickly fall on floors or surfaces. But in certain cases, airborne transmission of the virus is also possible. Airborne transmission is different from droplet transmission as it is categorized by the presence of microbes within droplet nuclei, which are generally considered to be particles <5μm in diameter, can remain in the air for long periods of time and be transmitted to others over distances greater than 1 metre. You can be infected by breathing in the virus if you are within proximity of someone who has COVID-19, or by touching a contaminated surface and then your eyes, nose, or mouth. The prevention of this virus requires simple measures, like following social distancing protocols, wearing a mask in public places, proper sanitization and other personal safety measures [1]. But a majority of the population do not follow these measures properly. They are simple yet difficult for the average citizen to adhere to with seriousness.

The Centre for Disease Control and Prevention (CDC) recently updated its guidance to state that face masks provide some personal protection against the virus for those who wear them, not just for those around them. New data from a randomized controlled study published in Annals of Internal Medicine showed that wearing a mask was slightly more effective in preventing the virus than not wearing a mask in situations where other preventive measures like physical distancing are recommended [2]. In India, the Indian Council of Medical Research (ICMR) has issued a statement saying many irresponsible people not wearing masks and not maintaining social distancing is the major reason for the rise of the corona virus pandemic in India. A survey spread over 18 cities in India, initiated by Apna Mask, an NGO has shown that, only 44% of the people wear a face mask, although 90% of the people have the awareness. The data for social distancing and sanitization is even worse. The percentage of people in different sectors of the country following the pandemic safety measures have been represented in Table 1[3].

Table 1

People following the pandemic protocols in different sectors of the country

Criteria	Rural Area	Urban Area	Public Places
Face Mask	24%	44%	30%
Social Distancing	28%	46%	12%
Sanitization	26%	50%	24%
Awareness	60%	90%	56%

Since India is a major smart phone hub, connected technology is preferred even in many rural parts of the country. With the emergence of cheap internet facilities, many major applications such as education and jobs have taken the online route. Over the recent years smart devices with connected technology have had a predominant market in all the sectors of the country [4]. This paper explains about a smart kit which houses several smart devices interconnected with each other and to the user's smart phone, which provide efficient solutions in early detection and prevention of the virus. Since smart technology is preferred by a majority of the population, this kit makes following the pandemic protocols smarter, easier, hassle free and efficient. It is a cost effective solution prevalent on internet and a smart phone, which is already a basic household entity in the country. About 88% of households in India own a smart phone and almost more than half of them have access to the internet [5]

Internet of Things (IoT) is a rapidly growing technology that includes sensors and cloud computing. IoT has become one of the most significant technologies in this connected world, and in recent years a lot of electronic devices have started adopting the IoT standard. IoT applications have been developed and deployed in several domains such as transportation and logistics, healthcare, retail and supply chain, industry, and environment [6]. IoT in healthcare has been an emerging field in recent years and connected cities and devices have been very helpful in tracking and monitoring user data. The wider aspects include increased sanitation, which requires smart monitoring and control. In the case of health tracking, monitoring of people for high temperatures or other potential indicators might be used as parameters for evaluation [7]. Smart technology can help to manage people like a gathering of people, crowd management, quarantine people, follow the government guidelines properly, smart distribution of sanitization supplies and medicine, implementation social distancing protocols [8]. IoT integrated with sensor networks and robotics is highly effective in establishing a non-contact ecosystem and result in simpler monitoring and control systems.

A few of the major applications of the above-mentioned architecture include ensuring social distancing, provide smart, and effective sanitization, implement smart monitoring protocols and faster evaluation of determination parameters[9]. With the emergence of smart Automation, IoT and Artificial Intelligence of Things (AIoT), devices and smart sensors, which come with nice comfort, ease of use, and painless detection of parameters, patients prefer using non-invasive sensor devices to help them manage their health. As a result, devices such as smart bracelets and smart phones, are becoming increasingly popular in the field of personal health care.

The future of healthcare and sanitization and safety protocols have been rewritten with the emergence of the pandemic and the new normal has to emerge with smarter and affordable devices and solutions [7].The rapid growth of data transmission and communication protocols with the increased demand for smart solutions have resulted in the growth of a connected world, and this has been made the best use of in the healthcare segment.

The integration of different sources of data can be one of the greatest transformations in our way of living in this century, along with the processing possibilities provided by data science, which can be used in efficient ways to handle the pandemic. The initial analysis of the pandemic has demonstrated the rapid spread and propagation of the virus when initial measures were not properly adopted and implemented. Such a lack of quick response is even more critical for highly populated areas, as could be seen in the original epicentre of this pandemic. After the surveys and case studies from the initial report of the pandemic, a new and smarter solution can be structured in a way that the initial errors are resolved and the future can be safeguarded with certainty [10]. The system proposed in this paper is a smart essentials kit, which can be used in a variety of sectors including domestic households, industries, institutions, offices and other public places which involve huge gatherings or crowd. Each product in the kit is designed to address a particular problem in a particular situation and make use of smart connected technology and IoT standards to control, operate and manage different parameters. The block diagram representing the communication, hardware and interfacing protocols are shown in Figure 1.

This paper is organized as follows: Section 2 discusses the medical parameters for evaluation of the virus in the patient. Section 3 deals with smart and effective sanitization methods for the prevention of the virus. The smart patient monitoring and tracking system is discussed in Section 4. A smart personal hygiene maintenance, screening and prevention system is discussed in Section 5. The CPU, Hardware and Software Interface details are illustrated in Section 6. The real-world analysis and comparison with traditional methods is discussed in Section and appropriate conclusions from the study are discussed in Section 7.

2. General Medical Parameters For Evaluation

2.1 Temperature

The proposed system is a smart essentials kit, which houses a number of smart devices, which help in tackling the Covid situation in a smart and effective way. For a smart healthcare device, monitoring the parameters of a patient is an important criterion. There are many ways to measure the temperature of objects. The temperature measurement can be mainly divided into contact measurement and non-contact measurement. The temperature sensor is interfaced with a Nodemcu ESP8266 module, via which temperature is continuously monitored and stored on a web server. The patient’s temperature is continuously monitored and the data is stored in a cloud server, which can be accessed in real time via a mobile application. For the purpose of monitoring the patient’s temperature, standard temperature

sensors are used. Based on the convenience of the user, the temperature can be calibrated and stored, monitored and accessed.

2.1.1 Contact Measurement

LM35 is a temperature sensor that outputs an Analog signal which is proportional to the instantaneous temperature. The output voltage can easily be interpreted to obtain a temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration. The coating also protects it from self-heating [11]. The mentioned system is a continuous monitoring setup, which is plugged onto the user.

2.1.2 Non-Contact Measurement

MLX90614 is an optical infra-red temperature sensor[12]. It has Infra-Red radiation receptive thermopile and Acoustics Speech and Signal Processing (ASSP) on same TO-39 cascading. This temperature measuring device is surfaced with the digital Pulse width Modulation and System Managing Bus. The temperature of the user can be measured from a distance of 2 feet. This eliminates the need for unnecessary contact. The mentioned system is a continuous setup, which can be accessed according to the convenience of the user.

2.2 Heart rate

Pulse measurement is an important criteria in health monitoring. A standard pulse sensor SEN-11574 is used to monitor the patient’s vitals. The sensor measures the pulse using optical measurement system in the form of vibrations. This provides accurate results and provides a better health tracking system.

2.3 Oxygen saturation

Oxygen saturation levels play an important role in determining the presence of the virus. A standard oximeter sensor MAX30102 is used to measure the level of oxygen. It uses light absorption technique to measure the oxygen levels. Light beams pass through the blood to determine the amount of oxygen present in the blood.

3. Smart And Effective Sanitization Methods

Since Covid is a contagious disease, proper monitoring, screening and most importantly effective sanitization is required. The current technology predominantly uses liquid sanitization and in rare cases gaseous sanitization is involved. There exists another smart sanitization method which is UV light sanitization. This is a non-contact method and the end results are comparable with the traditional sanitization methods.UVC radiation is a subtype of radiation that is used for killing bacteria and viruses. It has a high intensity and hence kills virus and bacteria due to the shorter wavelengths. UVC radiation is not able to reach the earth’s atmosphere due to the ozone layer.

This radiation technology is beneficial for reducing the effect of the virus by integrating it with smart control measures. Another source of domestic sanitization has become essential in places were large gatherings of people can be seen. The traditional sanitizer dispensing mechanisms are tedious and in most cases, they are self-contaminated. To avoid such circumstances a smart non-contact dispensing mechanism has been employed for clean, hassle-free sanitizer dispensing with the facilities to monitor and clean the mechanical parts. In addition to sanitizer dispensing a vending mechanism has been made use to provide clean masks to the public. All the mentioned systems can be used independently or can be used as a connected system depending upon the place of use.

3.1 Portable Covid Clinic (Smart UV Disinfection Box, Smart Sanitizer and Mask Dispenser)

In this proposed system, the first product in the smart sanitization kit is a smart Portable Covid Clinic which houses a UV Disinfection Box, Smart Sanitizer and Mask Dispenser. The UV disinfection box has a non-contact opening mechanism powered using a SG-100 servo motor equipped with robotic arms. It is designed with an inbuilt 360o cleaning system. Masks can be reused after sanitization using the smart UV disinfection box. The box is also capable of sanitizing other medical or domestic equipment. The block diagram for the smart UV sanitization box is shown in Figure 2.

The system is capable of monitoring the light intensity using the GYML8511-UV Light sensor and the intensity of the light can be adjusted based on the product to be sanitized. The block diagram of smart sanitizer and mask dispenser block is shown in Fig. 3.

An inbuilt 555 timer makes sure that the contents are properly sanitized and the box opens and closes automatically or can be opened or closed manually via an ultrasonic sensor HC-005 which acts as a non-contact switch in the manual mode. The TUV11W-UV light is activated only when the box is closed, ensuring the safety of the user, preventing them from looking directly onto the light source and avoiding any other source of harmful contact. The box can be operated in two modes, manual mode and automatic mode based on the place of use. The mechanism is connected via a mobile app or a web application and the different aspects of the system can be controlled and monitored remotely via a local network. The operating standards and the communication protocols are designed to be accordance with the latest industry 4.0 standards. The internal mechanism of the UV Sanitization box is shown in Figure 4.

The Smart Sanitizer and Mask Dispenser is shown in Figure 5.EC-0141 IR sensors are used as a non-contact switch for triggering the sanitizer and mask dispensing mechanisms. The IR sensor is calibrated in a manner such that when the user places their hand at a particular distance in front of the sensor, the switch is triggered for the respective mechanisms. A DC6-12V submersible water pump is used to dispense the liquid sanitizer.

A SPG30E-30K geared motor is used to operate the vending mechanism to dispense the masks. The sanitizer container is equipped with a DC3-5V water level sensor, via which the user can monitor the level of sanitizer in through a mobile app or a web server. The Mask dispensing unit can also be altered to house medicines and other medical units required by the general public [13].

The system is designed with the vison for a post covid smart disfenction solution in public places, where frequent sanitization is needed. The system is designed with the vison for a post covid smart disfenction solution in public places, where frequent sanitization is needed. The block diagram of smart portable covid clinic circuit configuration is represented in Figure 6. The hardware prototype of Smart portable covid clinic equipped with contactless sanitizer, mask and UV disinfection box are shown in

3.2 Smart Disinfectant Rover

A movable rover bot is equipped with TUV11W-UV light to sanitize areas where human interference is not possible or not safe. The rover is built with a strong shock absorbent multi frame chassis with four-wheel drive via enhanced SPG30E-30K geared motors. The bot is controlled using a mobile app or a web application via a local network. The UV light is placed at an angle where maximum sanitization efficiency is achieved.

The block diagram for the proposed system is shown in Fig. 8. The rover is capable of sanitizing rough areas and can climb onto high altitudes, with the help of the high duty precision geared and servo motors combination. The smart disinfectant rover circuit configuration is shown in Fig. 9 and its hardware prototype is illustrated in Fig. 10.

The ultra- durable chassis ensures effective sanitization and the process is quick and efficient due to the high intensity UV light placed under the rover. The control and transmission is designed based on the latest Industry 4.0 protocols and the transmission is smooth, fast and lag free due the advanced connectivity protocols.

4. Smart Patient Monitoring And Tracking

GPS technology is one of the most sought-after technologies to track, analyze and monitor an individual or a group. During times of crisis like the Covid pandemic, GPS technology has played a valuable role in ensuring all safety protocols [14].

The next product in the smart essentials kit is a smart patient monitoring and tracking system, that can be employed onto an individual or a group to monitor, administrate and ensure safety and prevent protocol breach. The proposed is in the form of a band, housing a temperature sensor and a NEO-6M GPS module. The temperature of the user is monitored continuously using a LM-35 temperature sensor and the data is stored in a server. The data can be monitored via a mobile app or a web application.

Real time data is processed and the readings are used as an evaluation parameter to screen patients[10]. The inbuilt GPS module is used to ensure the location of the patient, to maintain proper quarantine protocols. The user's location data is also continuously monitored, and a quarantine perimeter is enabled. When the perimeter is breached, an alert is sent to a mobile app, and thus hospitals and other places were isolation, quarantine or tracking is required, ensure proper protocols. The block diagram for the proposed system is shown in Figure 11. The patient monitoring interface can be connected to a common server or database where several number of recipients can be monitored at a time.

The Covid patient monitoring system circuit configuration is shown in Fig. 12 and its hardware prototype is illustrated in Fig. 13. The smart band is designed with light weight plastic material to ensure proper comfort for the user for 24 hours continuous use. The device is also capable of additional enhancements like heart rate measurement and blood oxygen level measurement. Based on the preference of the user the add-ons can be modified. The data can be fed to neural networks or advanced Machine learning algorithms for smart screening.

The system can also be linked with other vitals of the patient and a personalized health report can be generated and the datasets can be manipulated using smart algorithms and can be used as a reference data for AIoT devices.

5. Smart Personal Hygiene, Screening And Prevention

Personal hygiene has been an important factor for the spread of the virus, lack of personal hygiene, poor screening and not following safety protocols has led to the tremendous rise of the virus. The traditional safety techniques are not happily welcomed by the common people [15]. On the other hand, healthcare workers also face difficulties with the existing solutions. The next product in the smart kit is an affordable solution for both the common public and healthcare workers. The proposed system is based on non-contact techniques for daily scenarios. The products use a simple and affordable electronic smart mechanism to provide a smarter, easier and hassle-free solution to follow protocols and make personal hygiene and social distancing more effective.

5.1 Smart Mask and Face Shield

It is a light weight non-contact smart mask with a face shield, which can be operated via gestures or through a mobile app or web application. The device is equipped with two high precision light weight servo motors which serve as the opening and closing mechanisms for the mask and face shield respectively. A smarter mechanical arm mechanism has been designed to limit the number of components and the overall weight and to ensure hassle free operation. Two EC-0141 IR sensors are placed on each side and act as non-contact switches. The top part of the device has a LM-35 temperature sensor equipped and it monitors the temperature of the user continuously. The mask and shield are connected to a SG-100 servo motor via a lever mechanism. The masks and shields are replaceable after

use. The device is mainly aimed at healthcare workers and it can also benefit the common people. The block diagram for the proposed system is shown in Fig. 14.

The device has two-way communication protocols and can be controlled via a software and also through the on-board hardware. The Smart mask and face shield circuit configuration is shown in Figure 15 and its hardware prototype is illustrate in Figure 16. A smart battery management system has been implemented to distribute adequate power among the micro components.

5.2 Smart Doorbell / Screening system

It is a smart anti touch doorbell equipped with an inbuilt optical non-contact temperature sensor. The doorbell is triggered via an HC-005 ultrasonic sensor as the switch. When the user places their hand in front of the ultrasonic sensor, the bell circuit is activated and the MLX-90614 optical temperature sensor is ready to measure the visitor's temperature[16]. The temperature data is transmitted to the inmate's mobile phone, and the person can be screened based on their temperature.

This system is mainly designed for domestic households to operate as a doorbell. The other use cases are in public places such as schools, colleges, movie theatres. This ensures early screening of patients and faster prevention of the virus. The block diagram of the proposed system is shown in Figure. 17. Thee smart contactless covid 19 doorbell circuit configuration is shown in Figure 18 and its prototype is illustrated in Figure 19.

All the temperature data are stored in cloud servers and the device can also be interfaced with a camera or an RFID (Radio Frequency Identification) sensor to be used in mask detection and student or employee screening respectively in the places of requirement.

6 Cpu, Hardware And Software Interface

The entire system is based on the ESP8266 architecture for integration with the various sensors and the transfer of data via a local area network. The software is based on static and dynamic webpages and mobile applications. Other supporting hardware like Arduino and motor shields have been interfaced for additional sensor operation and control. Nodemcu ESP8266 is the primary hardware of the system with the ESP architecture serving as the brain of the system.

Portable and efficient power supplies have been used and lithium polymer batteries have been employed to power most of the hardware. Standard sensors have been interfaced via software and calibrated to provide accuracy and precision over the monitor and control operations[10]. The hardware and the software architecture are shown in Figure 20. The software setup is represented in Figure 21. Based on the main configurations, the devices are designed to be part of a unified control system. Blynk IoT architecture has been used for the mobile app interface.

The IoT standard and AIoT standards have been followed in the interconnection of all the systems. The proposed system is also compatible with the emerging IoT 5G standards in the faster data transmission,

control and monitor over various fields, with healthcare being the main focus. Html, PHP and Google web services have been used in processing data.

7. Proposed Syestem Comparison With Existing System

Based on the analysis in the practical world and the comparison with traditional methods, the smart alternatives have increased efficiency and based on the results the outcomes have been tabulated as follows:

Table 2
Comparison between existing and proposed systems

Ref.	Existing Smart System	Proposed Smart System	Efficient Outcome of Proposed System
[10]	Mask and face shield with manual operation, integrated with voice speakers	Non-contact mask and face shield	The smart alternative is much cleaner, hygienic and hassle free
[13]	Manual Sanitizer dispenser	Contactless sanitizer dispenser	Hygienic, safe and easy to use
[14]	Individual manual patient monitoring with temperature and oxygen monitoring	Smart patient monitoring system	Convenient, risk free and can monitor many patients at once
[15]	One time use masks, 7 day use clinical masks	UV box, allows mark reuse	Cost effective, disinfects deadly virus, enables reuse
[16]	Manual Liquid based cleaning, robot based liquid sanitization	Rover with UV based cleaning	Hassle free, non-contact and efficient cleaning
[17]	Switch based doorbell with camera monitoring	Non-contact doorbell with temperature monitor	Helps maintain hygiene and provides early screening and prevention

8 Conclusion

Until a proper vaccine is introduced, Covid-19 prevention and the implementation of safety protocols is a tedious process with the existing manual technology, and the mindset of today's digital and connected generation. Smart alternatives are the need of the hour. With the rapid growth of the internet and the different generations of bandwidth, smart devices with connected technology with the latest IoT standards are the perfect solutions to tackle a pandemic of this scale. With the help of connected technology, there are a lot of opportunities to make the lives of healthcare workers and the general public easier, simpler and hassle free. With big cities under lockdown and most of the public places remaining closed, the new normal is a difficult situation to adhere to, hence a smart alternative would be the apt solution to bring back the normal scenario with a safer environment. Smart technology, smart healthcare

and smart delivery systems are the future for the implementation of smart cities for reducing the COVID-19 risk. It has been observed that these technologies are very useful to maintain the different protocols such as social distancing, isolation, and tackle the lockdown situation, as a result, reduce the spread of the virus.

Declarations

Conflict of interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability:

The data used to support the findings of this study are available from the corresponding author upon request

Funding information

There was no financial support received from any organization for carrying out this work

Ethical Approval

This material is the authors' own original work, which has not been previously published elsewhere. The paper is not currently being considered for publication elsewhere. The paper reflects the authors' own research and analysis in a truthful and complete manner.

Consent to Participate

I have been informed of the risks and benefits involved, and all my questions have been answered to my satisfaction. Furthermore, I have been assured that any future questions I may have will also be answered by a member of the research team. I voluntarily agree to take part in this study

Consent to Publish

Individuals may consent to participate in a study, but object to having their data published in a journal article

Competing Interests

To the best of my knowledge and belief any actual, perceived or potential conflicts between my duties as an employee and my private and/or business interests have been fully disclosed in this form in accordance with the requirements of the journal

Author contribution

Senthil Kumar Ramu, Suresh Paramasivam- Drafting the manuscript

Ashok Kumar Loganathan- Supervision

Ravita Lamba, Hitesh Panchal, Kokilavani Thangaraj- Assisting in drafting the manuscript

Maheswaran Shanmugam, Suresh Muthusamy- project administration

References

1. https://www.who.int/health-topics/coronavirus#tab=tab_1
2. a href="https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html">https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html
3. a href="https://www.hindustantimes.com/india-news/why-is-covid-19-spreading-rapidly-in-india-experts-identify-4-reasons-101618285916036.html">https://www.hindustantimes.com/india-news/why-is-covid-19-spreading-rapidly-in-india-experts-identify-4-reasons-101618285916036.html
4. a href="https://www.news18.com/news/tech/india-aims-to-surpass-china-to-become-worlds-largest-smartphone-manufacturing-hub-govt-3176126.html">https://www.news18.com/news/tech/india-aims-to-surpass-china-to-become-worlds-largest-smartphone-manufacturing-hub-govt-3176126.html
5. https://www.livemint.com/Politics/kZ7j1NQf5614UvO6WURXfO/88-of-households-in-India-have-a-mobile-phone.html
6. Udoh, I. S., & Kotonya, G. (2018). Developing IoT applications: challenges and frameworks. IET Cyber-Physical Systems: Theory & Applications, 3(2), 65-72.
7. Lin, Y., Ye, J., Jin, M., & Zheng, Y. (2020). Applications of non-invasive sensor devices to personalised health care. The Journal of Engineering, 2020(11), 1139-1147.
8. Alreshidi, E., & Alyami, S. H. (2020). End-users' requirements underpinned by IoT layered architecture to the development of smart sustainable cities. The Journal of Engineering, 2020(11), 1065-1073
9. Jaiswal, R., Agarwal, A., & Negi, R. (2020). Smart solution for reducing the COVID-19 risk using smart city technology. IET Smart Cities, 2(2), 82-88.
10. Chen, X., Wang, T., Zhao, Y., Wu, Y., Qie, R., Han, M., ... & Hu, D. (2020). Notes from the Field: Effectiveness of Prevention and Control Measures for Imported COVID-19 in Guangming District of Shenzhen. Evaluation & the Health Professions, 0163278720971833.
11. Oyebola, B., & Toluwani, O. (2017). LM35 Based Digital Room Temperature Meter: A Simple Demonstration. Equatorial Journal of Computational and Theoretical Science, 2(1).
12. Jin, G., Zhang, X., Fan, W., Liu, Y., & He, P. (2015). Design of non-contact infra-red thermometer based on the sensor of MLX90614. The Open Automation and Control Systems Journal, 7(1).

13. Samal, P., Roy, S., Chauhan, A., Chauhan, V., Malhotra, V., Pundir, S., ... & Kanojia, J. (2020). Automated Sanitization Device–Hand Sanitization, Thermal Screening and IoT-based Web-database. Journal on Today's Ideas-Tomorrow's Technologies, 8(1), 27-33.
14. Krishnan, D. S. R., Gupta, S. C., & Choudhury, T. (2018). An IoT based patient health monitoring system. In 2018 International Conference on Advances in Computing and Communication Engineering (ICACCE) (pp. 01-07). IEEE.
15. Gabriel, M. M., & Kuria, K. P. (2020). Arduino Uno, Ultrasonic Sensor HC-SR04 Motion Detector with Display of Distance in the LCD. International Journal of Engineering Research And, V9, 5.
16. Dignan, J. (2020). Smart cities in the time of climate change and Covid-19 need digital twins. IET Smart Cities, 2(3), 109-110.
17. Costa, D. G., & Peixoto, J. P. J. (2020). COVID-19 pandemic: a review of smart cities initiatives to face new outbreaks. IET Smart Cities, 2(2), 64-73.

Figures

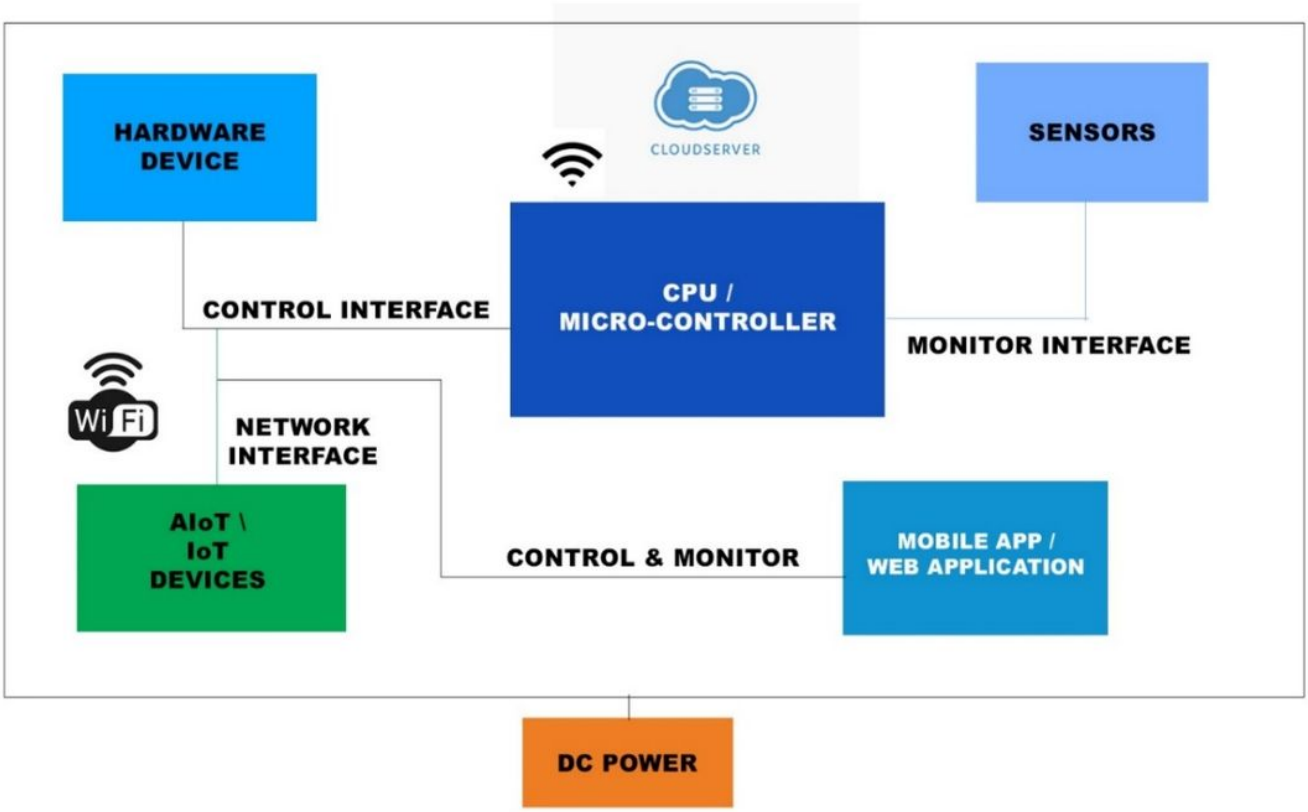

Figure 1

Proposed block diagram of IoT connected Covid Smart Devices

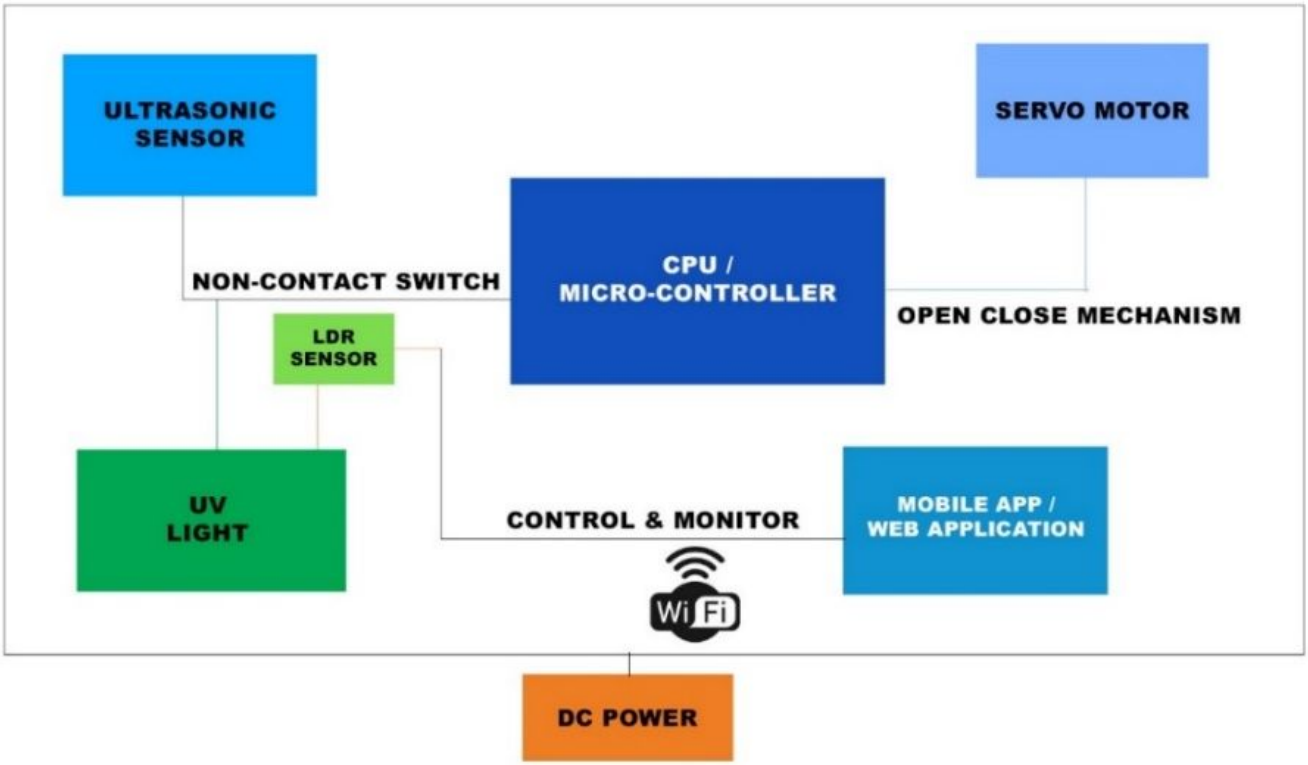

Figure 2

Smart UV Box Block

Figure 3

Smart Sanitizer and Mask Dispenser

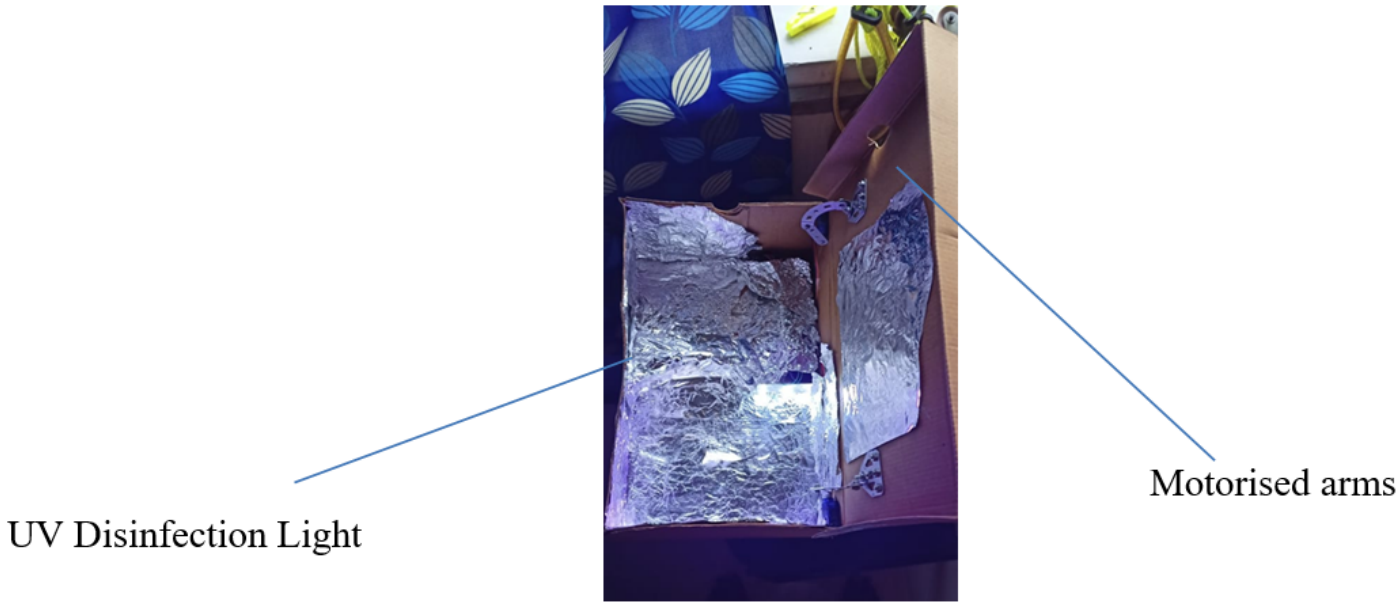

Figure 4

Hardware prototype of UV disinfection box

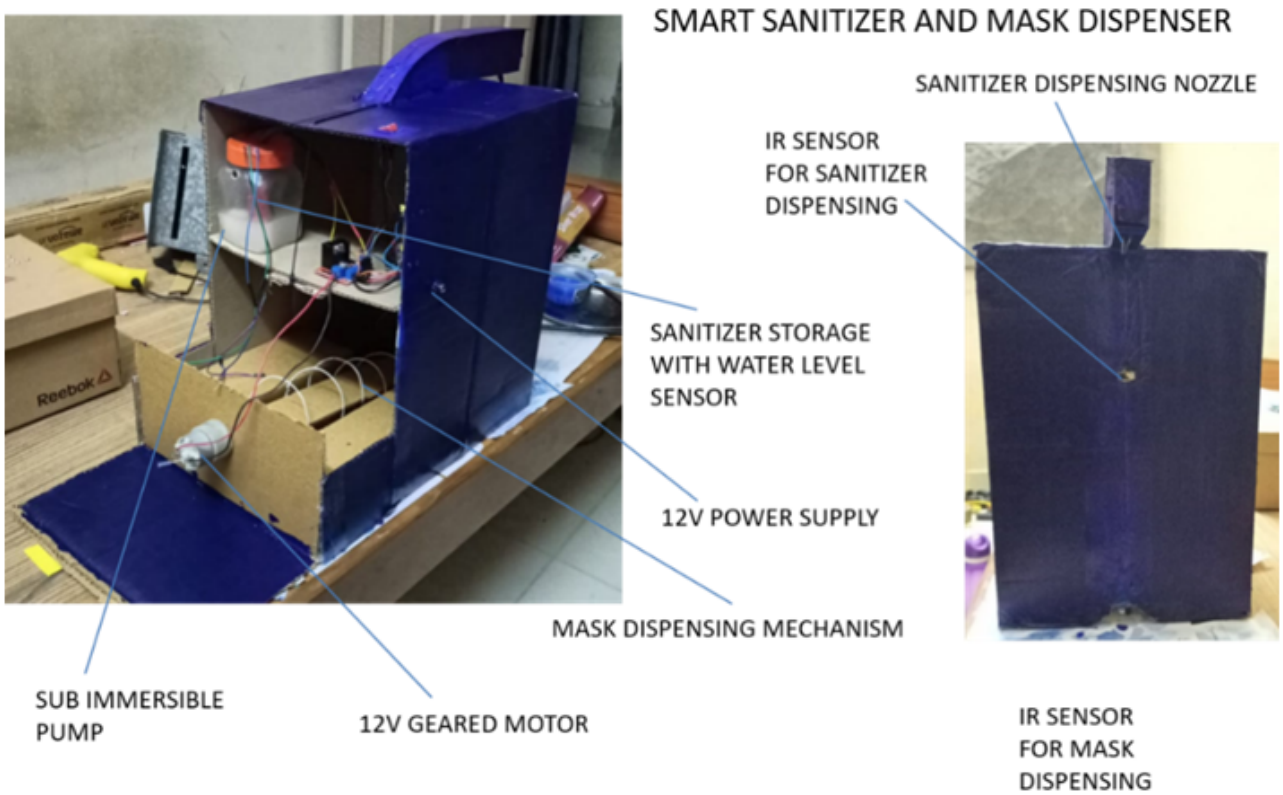

Figure 5

Hardware prototype of Smart sanitizer and Mask dispenser

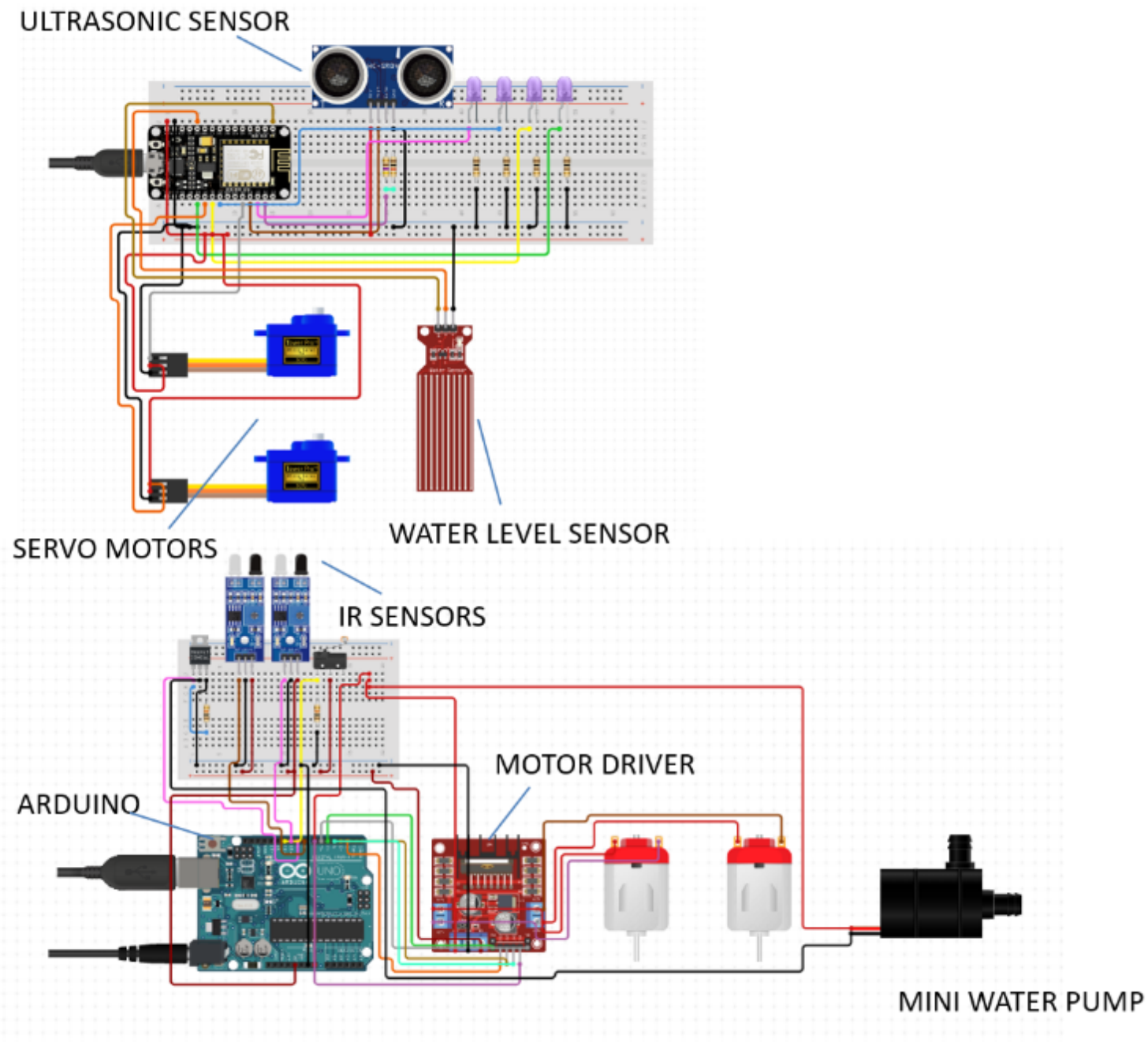

Figure 6

Smart Portable Covid Clinic Circuit Configuration

Figure 7

Hardware prototype of Smart portable covid clinic equipped with contactless sanitizer, mask and UV disinfection box

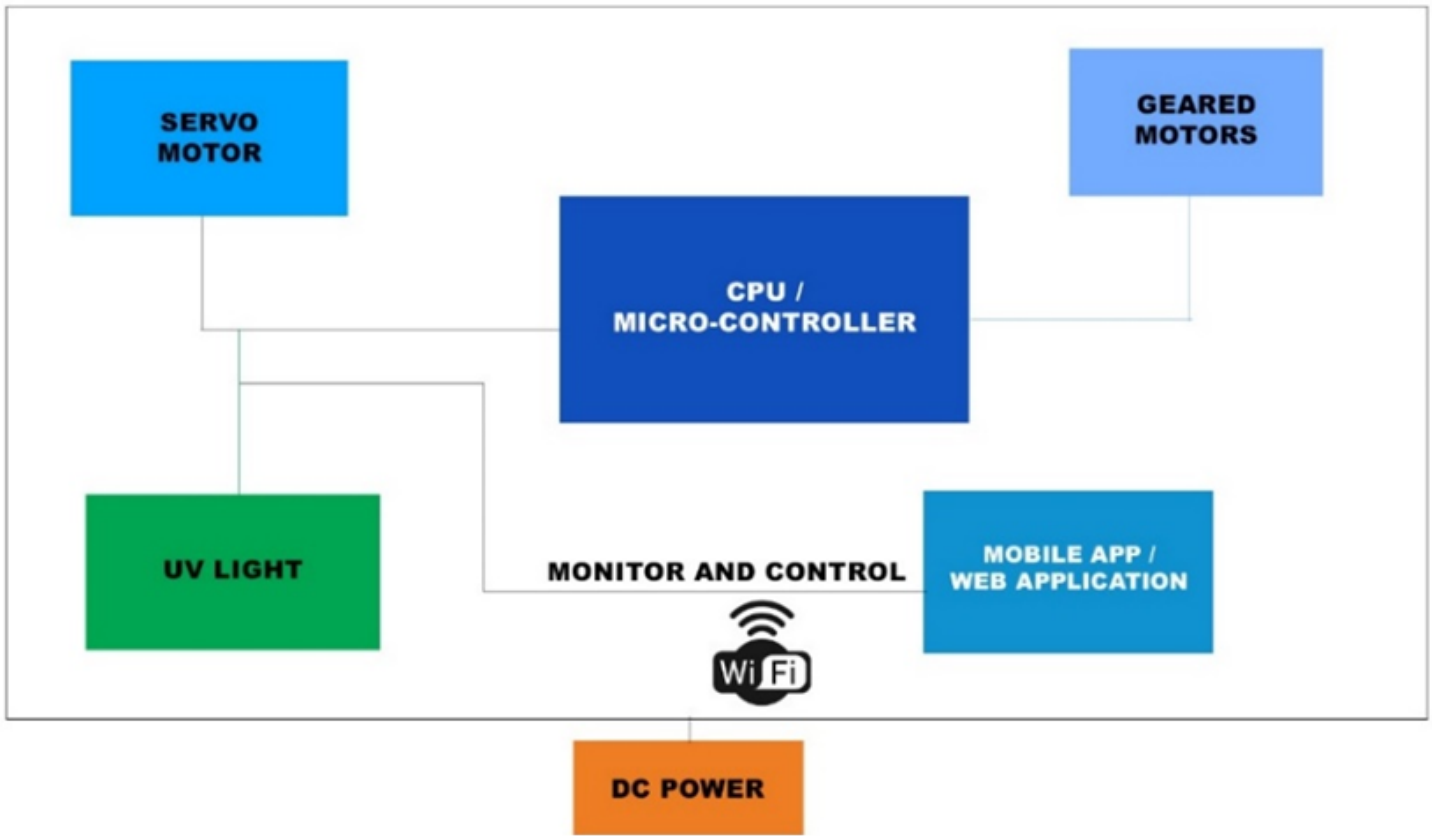

Figure 8

Smart Disinfectant Rover Block Diagram

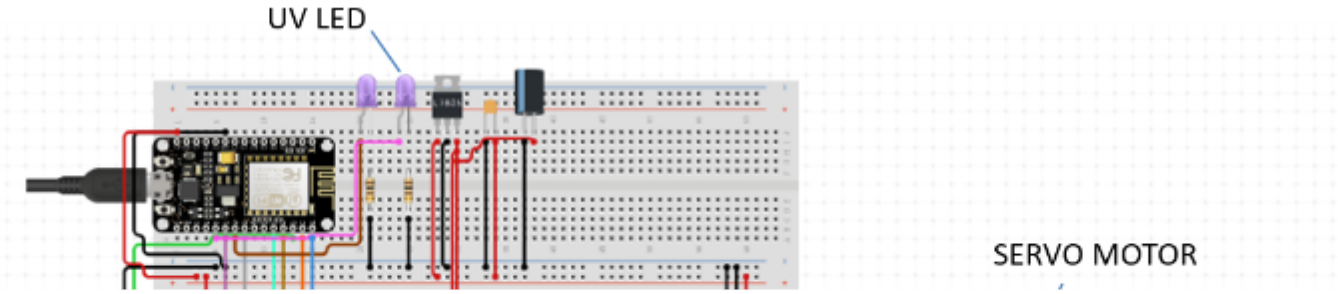

Figure 9

Smart disinfectant rover circuit configuration

Figure 10

Hardware Prototype of Smart disinfectant rover

Figure 11

Smart Patient monitoring and tracking system block diagram

Figure 12

Covid Patient Monitoring System Circuit Configuration

Figure 13

Hardware prototype of Smart Patient Monitoring and Tracking system

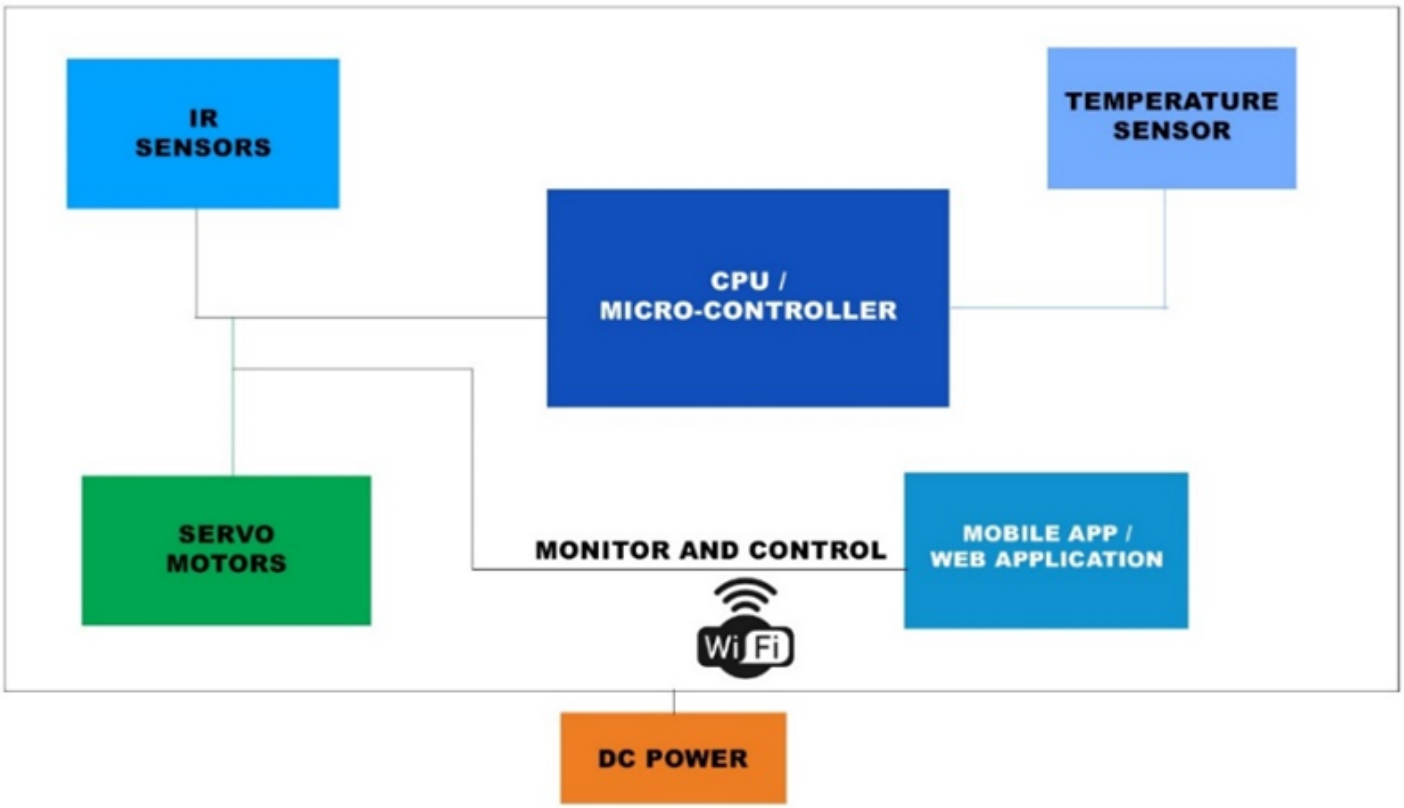

Figure 14

Smart Mask and face shield block diagram

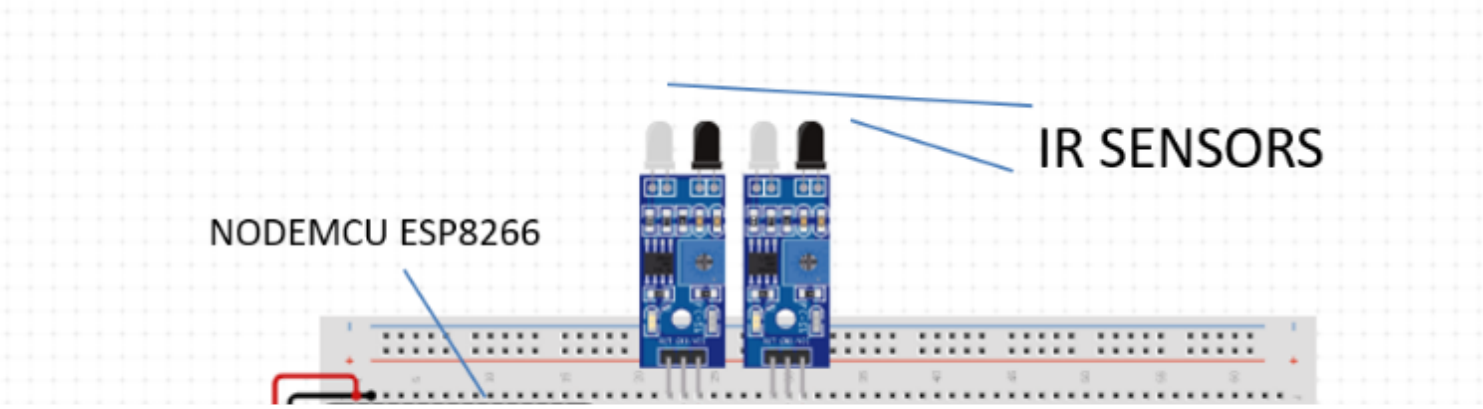

Figure 15

Smart mask and face shield circuit configuration

Figure 16

Hardware Prototype of Smart Mask and face shield

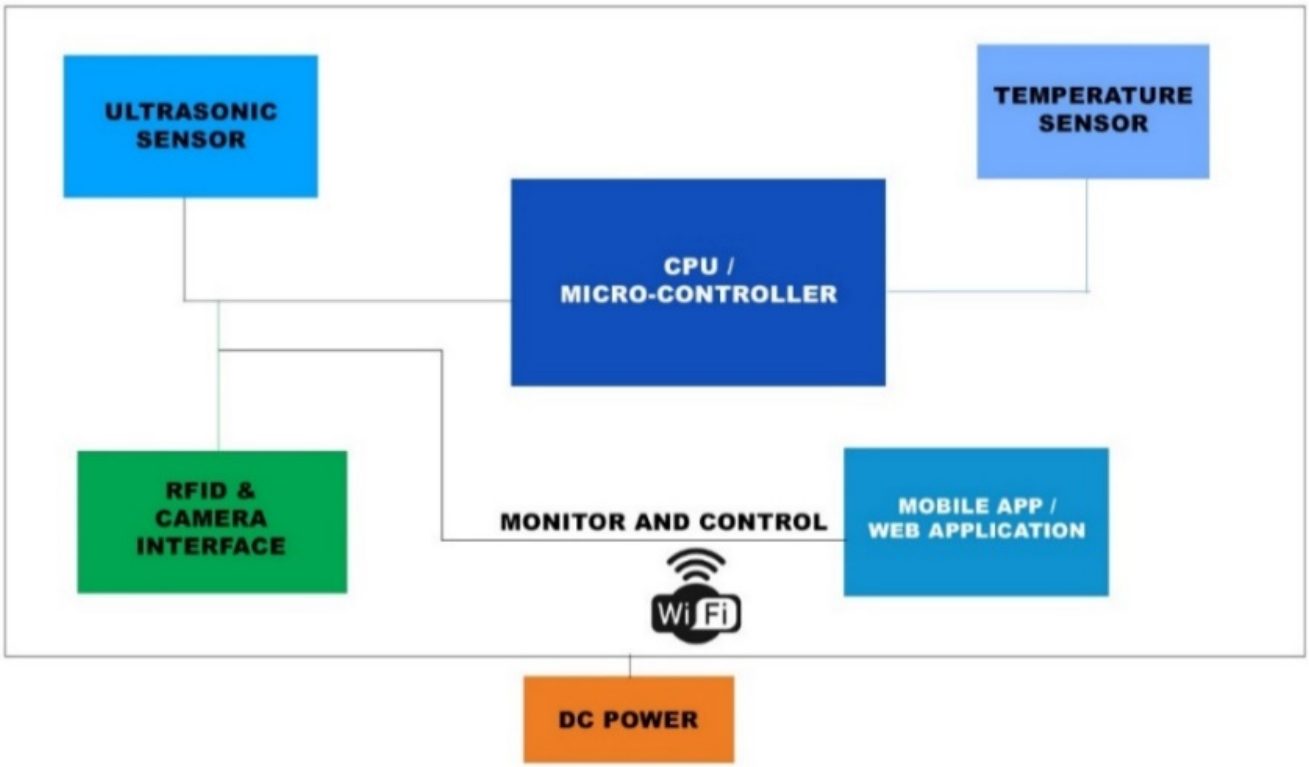

Figure 17

Smart Doorbell / Screening system Block

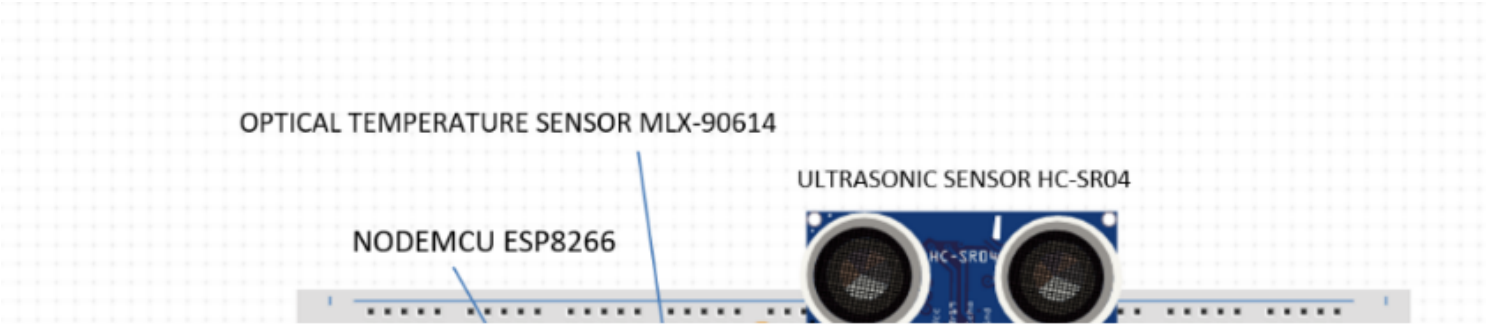

Figure 18

Smart Contactless COVID 19 Doorbell Circuit Configuration

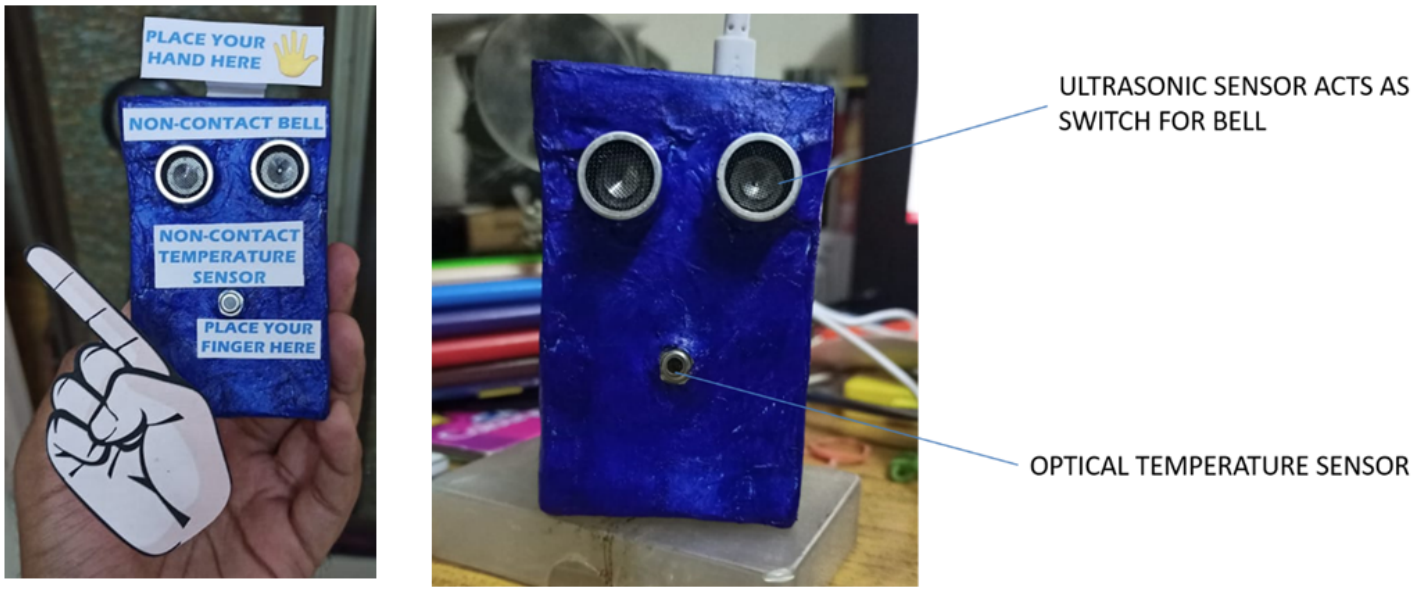

Figure 19

Hardware prototype of Smart doorbell / Screening system

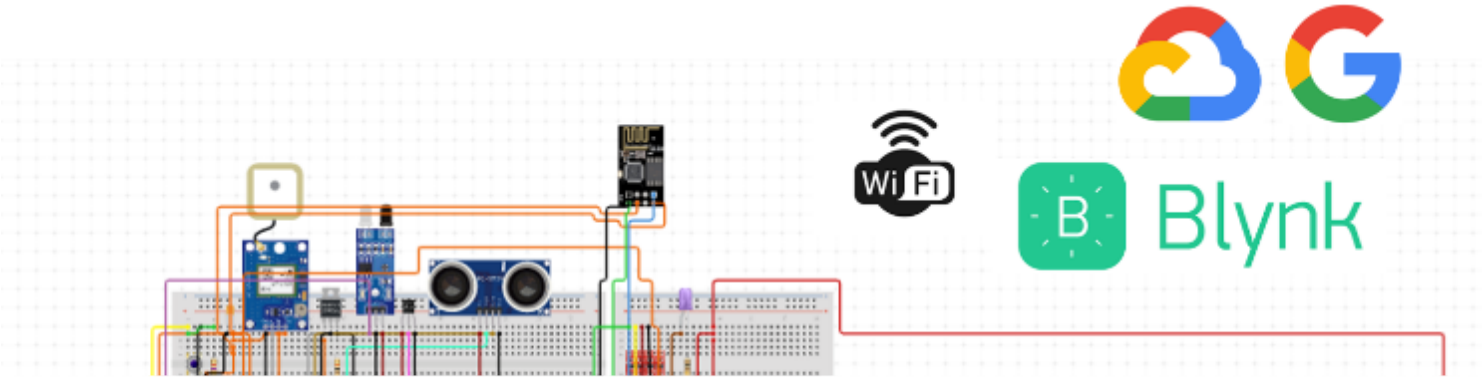

Figure 20

Software Interface with Hardware

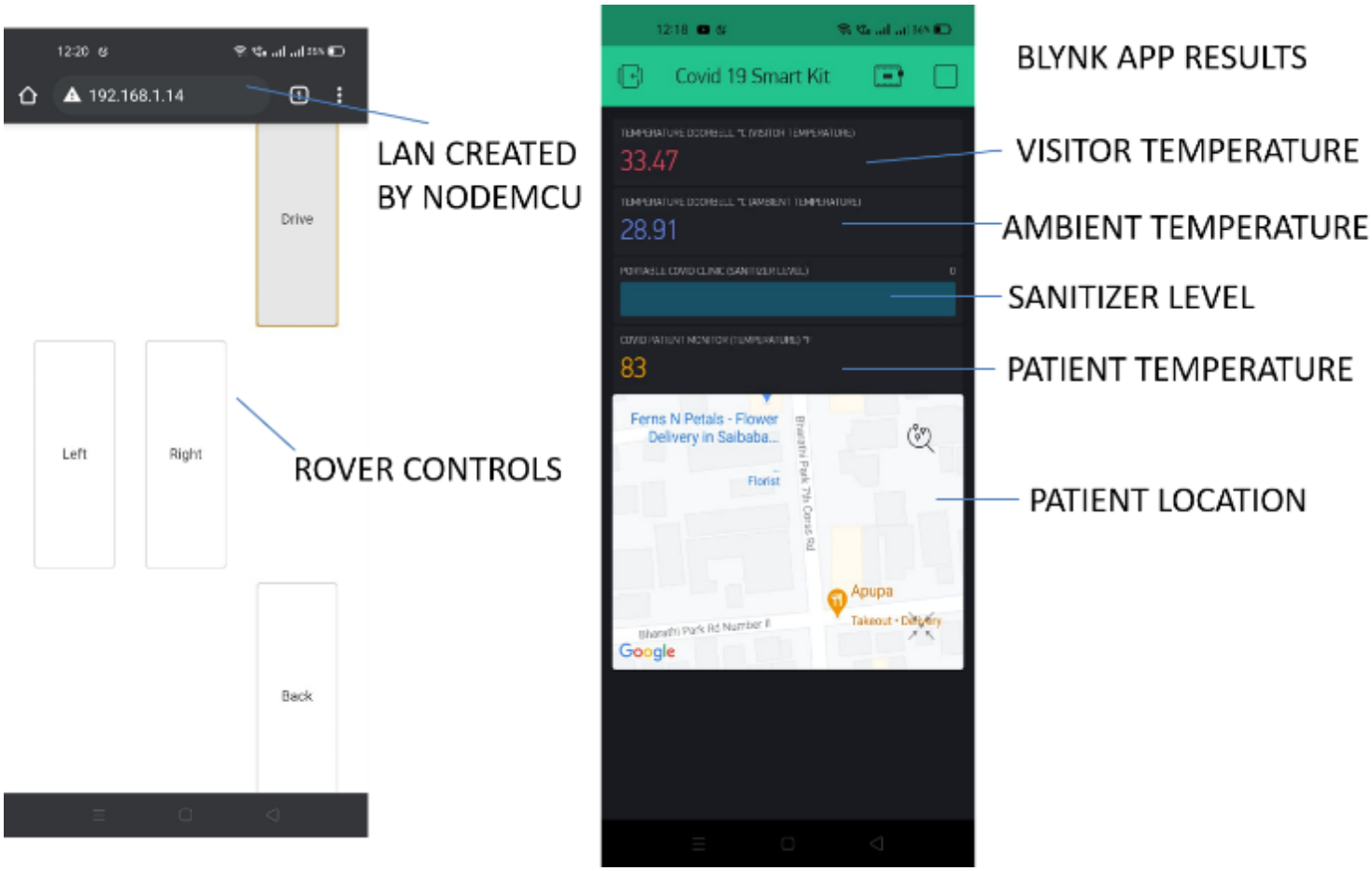

Figure 21

Hardware and Software architecture