Implementation of a Room Temperature Control System in Patient Rooms with Positive COVID-19 Patients

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Abstract

Technology development triggers the development of human thought to be able to create innovations to improve performance. The increasing cases of COVID-19 infection mean that you should seek to break the chain of this virus by self-isolation. However, the purpose of self-isolation rooms should be considered especially at rooms without air conditioning. These technological innovations are needed to provide comfort for patients and families. The goal of this study is to give families of COVID-19 positive patients easy access to their loved ones' rooms without having to physically enter the room. The procedure is artificial intelligence with Arduino programming using Arduino IDE that is part of the micro controller board. Micro-controlled systems can be thought of as being like an integrated computer system packaged in a single chip. The result showed the temperature control system tool was able to work well with a temperature error rate of 1.13%. It is known that in COVID-19-positive patients it is very helpful for families to monitor room temperature and for patients to rest comfortably.

Keywords: *Temperature,COVID-19, Self-Isolation, Mobile Apps, Android.*

Introduction

The public is developing expectations for convenience in various aspects of life. Research into Artificial Intelligence is growing, with advances in technology future health practitioners will surely incorporate AI into clinical care. Artificial Intelligence could help early diagnosis and treatment. For example, deep learning diagnoses COVID-19[(1)]. other research that includes human health monitoring and environmental temperature monitoring[(2,3)].

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In the year 2020, coronavirus spread throughout the world after first appearing in Wuhan City in September 2019[(4)]. Who declared SARS-CoV-2, transmitted through sneezing, coughing and saliva with symptoms of fever, tired body, dry cough. The increasing cases of COVID-19 require that all cases are taken out of hospitals and isolated from other patients. The use of the temperature-control rooms should be especially considered for those with no air conditioning. Innovations are needed to facilitate family engagement to provide comfort for patients[(5)].

A human would be interacting with a machine using the Programing Board Arduino Nano through the Arduino Software IDE. Micro-controllers can be likened to one chip system integrated with android-based applications in its monitoring. There is AI technology with micro control machines to help with air conditioning controls. Simultaneously, those who are not comfortable living in a shared living room environment might consider artificial

intelligence technology machines to control room temperature. The temperature and humidity monitoring system for COVID-19 patients is coupled with the LINE App and IoT. The system is connected to several end devices that collect temperature and humidity data. Our designs can be used in the IoMT group of patients[6].

Method

Methods on the technology used: Designing general, the room temperature monitoring system consists of several integrated systems. Arduino, Relay Drivers mobile apps. Designing software to regulate the performance of Arduino nano. Where the Arduino Nano is the brain's controlling subsystem. The Arduino software to perform commands disconnect / auto-charge the flow of electric current and send a command to display the temperature value on the LCD. The Relay Driver receives an Arduino command to automatically turn on the light when the indoor temperature starts to cool and turn on the fan when the indoor temperature value rises. The detected temperature value will be controlled on the smartphone using a Bluetooth connection connected to the Bluetooth Module HC-05 on the Arduino.

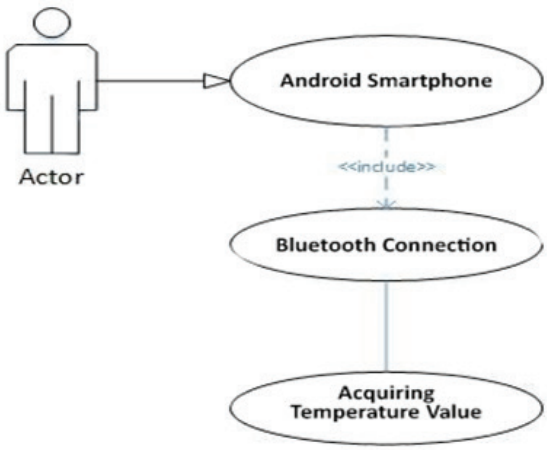

Figure 1: Design Flow

Literature review

COVID-19

In December 2019, pneumonia caused by an unidentified viral agent was first reported in Wuhan city, China. Coronavirus is a collection of viruses that can infect the respiratory system. Furthermore, healthcare institutions named the agency "2019 novel coronavirus (2019-nCOV)" or COVID-19[7]. In the months that followed, the world had witnessed the rapid spread of the disease, which has now infected nearly 16 million people worldwide and caused an estimated 640,000 deaths. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), better known by the name of Coronavirus, is a new type of coronavirus that is transmitted to humans[8]. This virus can affect anyone, such as the elderly (elderly), adults, children, and babies, including pregnant women and nursing mothers. In addition to the SARS-CoV-2 virus or Coronavirus, viruses that are also included in this group are the virus that causes Severe Acute Respiratory Syndrome (SARS) and the virus that causes Middle-East Respiratory Syndrome (MERS). Although caused by viruses from the same group, namely coronavirus, COVID-19 has several differences with SARS and MERS, among others in terms of the speed of spread and severity of symptoms. Besides, COVID-19 may also jeopardize the implementation process of SDGs [9].

Self-Isolation

Self-isolation is done to patients who meet the required elements, namely without mild symptoms, and the house used as a place of isolation is eligible. Isolation of COVID-19 patients is carried out to help control the epidemic[10]. A World Health Organization report on contact tracking reveals that the use of digital tools in contact tracking is important for public health and controlling the spread of the virus. Contact tracking breaks down traces of transmission from human to human by identifying those exposed to confirmed cases, quarantine, and follow-up to achieve rapid isolation [11].

Temperature

Covid-19 patients should have their own room and bathroom to minimize contact with others[12]. Hal this needs to be applied to more at-risk people, such as the elderly or people with weaker immune systems[13]. Besides, the better the ventilation of the room, the lower the risk of transmission. If the weather permits, open the window for air exchange. Preferably, close the door of the infected person's room to minimize the movement of contaminated air in the house. Comfortable room conditions are needed so that COVID 19 patients can be

more passionate about undergoing self-isolation[14].

Recent studies and previous research on SARS-CoV, influenza, and MERS-CoV show that high temperatures and high humidity decrease the virus's spread and transmission. For example, SARS tends to persist on the surface longer when the temperature is below 38◦C, and the humidity is below 95%. In contrast, influenza lasts longer when temperatures are below 30◦C and humidity is below 35%. This data shows that COVID-19 is most likely to occur during winters, such as autumn and winter, and last longer in colder climates. This study only shows a correlation between temperature and humidity as a function of the average level of viral replication. Optimal temperature and humidity conditions for SARS-CoV-2 survival need to be validated over time in 2020 and beyond [15].

Technology

With the presence of appropriate technology devices and appropriate internet connections, checks were successfully carried out for all patients [14]. There are many smartphone applications developed and distributed worldwide[16], with some of them supported by official governments in countries such as China, Singapore, and India. Different countries have taken different approaches. For example, many countries require their citizens to enter their personal information and allow location tracking. In contrast, other countries use law enforcement monitoring authorities to track citizens' movements [15] automatically.

Reins of Arduino dan Android-based app that can help COVID-19 patients and their families make it easier for them to control room temperature. It uses Arduino as the main controller and uses an android-based application with a Bluetooth connection to display room temperature data directly to the patient or family's smartphone without the need to approach the isolation place to check the temperature value directly.

Result and Discussion

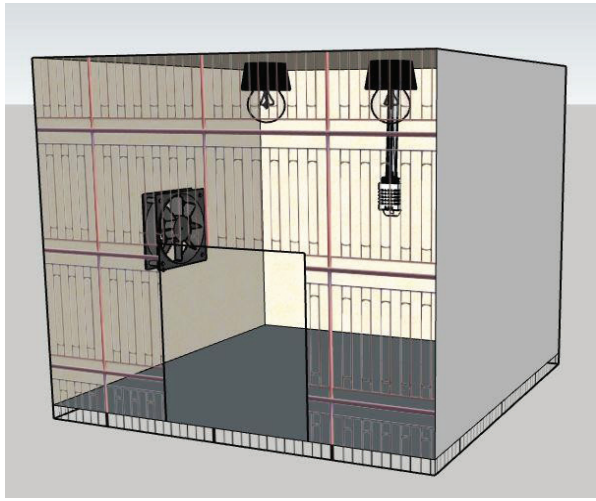

Figure 2: prototype room situation

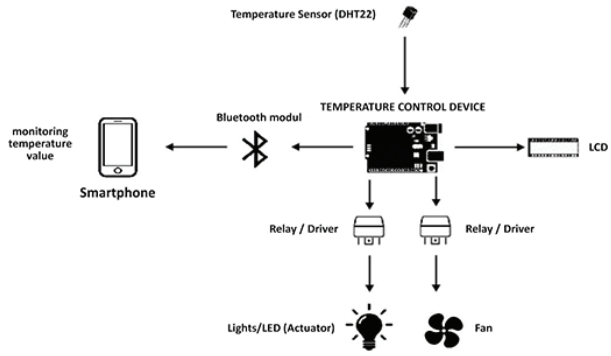

Figure 3: Working system architecture tool

System test results using DHT22 sensor Based on the measurement table obtained, that calibration error rate in the DHT22 temperature sensor with temperature thermometer ratio is 1.13%. The temperature control system tool works fine, as all important components such as DHT22sensor, LCD, Relay Driver and Bluetooth Module can run properly. System input using the DHT22 sensor displayed on 16x2 LCD will be displayed on a smartphone using the android-based application as isolation room temperature monitoring.

Seeing the design of this simple tool can work and make it easier for the patient's family to monitor the patient's room temperature so that the patient recovery process is faster.

Figure 4: display on smartphone room temperature results

As stated, the importance of digital devices to fight coronavirus in controlling and eradicating coronavirus is utilised. Thanks to recent advances in molecular engineering and calculations as well as information and communication technology (ICT), artificial intelligence (AI) and Big Data can help handle data, epidemic outbreak monitoring times, current forecast trends/ forecasts, regular situation briefings and updates from government agencies and information on the utilization of health facilities[11]. It can also analyze big data on the information network that can effectively make accurate predictions about the spread of COVID-19 to formulate appropriate policy measures. Artificial Intelligence (AI) can play a key role in complementing mitigation efforts. Another studyexplaining AI taxonomy is used to identify and recognize the medical picture of COVID-19[17].

Smartphones today are powerful and contain an awful lot of sensors[18], including temperature sensors, inertia sensors, colour sensors, and humidity sensors. A framework designed to support AI can read signal sizes from smartphone sensors that will help predict the severity of pneumonia and the effects of the disease. Implementation of the IoT system for COVID-19 infection detection. The device used is equipped with temperature sensors, heart rate, and GPS to determine whether the virus is in the person. The data is then retrieved and sent to Oracle Cloud and then processed according to Machine Learning algorithms. Its predictions are sent to family doctors and the national health system. If the patient is suspected of being infected with the virus, they should be contacted immediately for an examination[19].

The contact tracking application is based on digital contact tracking by relying on Bluetooth wireless technology, specifically its Low Energy (BLE). When two users are physically adjacent, the smartphone will send their identity in the form of temporary IDs or pseudonyms to each other. Each smartphone records all encounters within the time period, for example, in the last 14 days. If a user is infected with COVID-19, all users they meet will be alerted to the situation through the server and asked for self-isolation[20].

This research is also based on utilizing technology from several previous studies, such as the Large-Scale Covid-19 CT Scan Analysis. From a clinical perspective, machine learning (ML) can detect COVID-19 and predict patient outcomes. Pathogen laboratory testing is the standard for screening suspected cases, but this process is time-consuming, with significant false-negative results[15]. ML methodology with chest CT scans to diagnose Covid-19 disease, COVID-19-related pneumonia, or aid in image segmentation of the lungs. Pulmonary ultrasound can be used to triage patients who may have pneumonitis[21]. The results show a high to nearly perfect ability to identify covid-19, although this model and its evaluation also carry a high risk of bias, mainly due to poorly reported reporting [13]. Dress-COV was designed and developed to help people reduce uncertainty about unknown illnesses and enable healthcare providers to collect critical data to understand better the diffusion and characteristics of COVID 19 using Telegram. Besides, the Dress-COV system aims to be a long-time usable tool[7]. The investigative method is based on a systems engineering approach using system dynamics modelling. First, a causal model for smartphone-based monitoring of respiratory function is introduced. The systems thinking approach is then applied to direct the system dynamics model of a smartphone-based respiratory function monitoring system[10]. Decreased lymphocyte count usually indicates the decreased immune function, and multiple organ dysfunction can lead to increased lactate dehydrogenase[22].

In line with the stated[23], the use of this innovative technology using a low-cost system, and ensuring the privacy of its users, therefore the implementation of this

innovative technology is beneficial for patients confirmed positive for COVID-19 who must be self-isolated with a residential situation whose comfort is limited, such as without air conditioning. This innovative technology will help users, in this case, patients and families, to stay calm and be comfortable through situations of self-isolation. The increase inaccessibility of health content to highly vulnerable groups is needed in this pandemic[24].

Conclusion

Based on the data above, that artificial intelligence technology becomes a new convenience for all sectors, including the health sector, the current COVID-19 situation can be applied, the results of device testing at 1.13% error calibration temperature check, temperature control system tools are also functioning properly, and system integration in mobile apps is also running well, the results of user satisfaction in the utilization of this innovative technology are delighted both isolation patients and their families.

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Declarations

Ethical Clearance: Taken from the Investment Service and One Stop Integrated Service, South Sulawesi Province, Indonesia.

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Conflict of Interest: The authors declare no conflict of interest

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