Review - COVID-19 Detection System Using Image Processing and Biomedical

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Abstract: *In this work the design of implementation of an image processing based physical safety and health monitoring system for covid-19 pandemic. Which can support to know the physical health in the time of coronavirus using an Arduino mega 2560 microcontroller board is based on the Atmel AT mega 2560 8-bit microcontroller by using RFID EM 18 and spo2 sensor. The sensors is sense the human body's vital signs. That is it measured the pulse oxygen level in your blood, body temperature and heart beat rate based on the way the light passes through your finger and delivers the data to the device screen attach and RFID it is one of the method of automatic identification and data capture. In this system we design this disinfection chamber known as personal sanitization enclosure is capable of the disinfecting person. Then face detection in image processing and computer vision. A binary phase classifier which can detect any face present in frame irrespective of its alignments. Represent this method to generate accurate face segmentation mask from any arbitrary size input image. The purpose of this model is to provide infection control through sanitizer. And facial mask detection by detecting body temperature and pulse oxygen level with the help of spo2 sensor MAX30100.*

Keywords: Open CV, Python, Face Segmentation and Detection, Embedded C, SP02MAX3010.

1. Introduction

Since the last days of the previous year, the occurrence of novel infectious flu-alike respiratory disease COVID-19 caused by SARS-Cov-2 virus (also known as coronavirus) has affected almost every aspect of people's lives globally. First, it was discovered in China, but spread quickly to other continents in just few weeks. July 11th, 2021, the total number of identified cases was 12,653,451, while taking 563,517 lives worldwide.

Common symptoms of coronavirus disease include fever, tiredness, sore throat, nasal congestion, loss of taste and smell. In most cases, it is transmitted directly (person to person) through respiratory droplets, but also indirectly via surfaces. Incubation period could be quite long and varies (between 14 and 27 days in extreme cases). Furthermore, even asymptomatic persons (almost 45% of cases) can spread the disease making the situation even worse. Therefore, the usage of face masks and sanitizers has shown positive results when it comes to disease spread reduction. However, the crucial problem is the lack of approved vaccine and medication.

Due to these facts, many protection and safety measures were taken by governments in order to reduce the disease spread, such as obligatory indoor mask wearing, social distancing, quarantine, self-isolation, limiting citizens' movement within country boarders and abroad, often together with prohibition and cancellation of huge public events and gatherings. Despite the fact that the pandemic seemed weaker at some points, most of safety regulations are still applied due to unstable situation. From workplace behavior to social relations, sport and entertainment, coronavirus disease poses many changes to our everyday routine, habits and activities.

In this paper, cost-effective Controller based-based system aiming to help organizations respect the COVID-19 safety rules and guidelines in order to reduce the disease spread is presented. We focus on most common indoor measures - people with high body temperature should stay at home, wearing mask is obligatory and distance between persons should be at least 1.5-2 meters. For the first scenario, Arduino Uno microcontroller1 board with contactless temperature sensor is used, while we rely on Raspberry Pi2 single-board computer equipped with camera making use of computer vision techniques for other two scenarios. We decided to use these devices due to their small size and affordability.

A coronavirus is a sort of virus that can make ailment in animals and individuals. The function of normal body is disturbed by the action of such virus which breaks into cells within their host and exploits them to replicate itself. The name of Coronaviruses was taken from Latin term 'corona', that means crown, since they are encompassed by what look like royal crown of a spiked shell shape. The World Health Organization (WHO) officially announced that a new virus had been identified which then is called by 2019-nCoV on January 2020. The virus was recognized as part of the coronavirus group, which involves SARS and the other known colds. The first reported case was from Wuhan, China and has infected 7,711 people and 170 reported deaths in China before coronavirus was declared as a global pandemic which produces a sickness authoritatively defined as COVID-19 that has diffused to a minimum 141 nations and regions, causing death over 5,700 individuals around the world. Someone who infected by coronavirus will show

common symptom such as fever, dry cough, and tiredness or some cases, infected person will feel pains &aches, runny nose sore throat, nasal congestion, or diarrhea. However, some people infected with the virus do not show any symptoms and do not feel uncomfortable. Around 80% of individuals infected by COVID-19 can get recovery without acquiring particular treatment, but it is so dangerous for older people or someone with develop serious illness which the probability for them to get serious illness and develops difficulty breathing are higher. Right now, no effective vaccine for COVID 19 was produced or particular medication for treatment such virus was developed. However, potential vaccines and some particular medicine treatments are still under investigation and now being subjected to comprehensive test by leading medical research centres. Further, extraordinary efforts are coordinated by WHO to develop and produce effective vaccines and drugs to avoid and treat COVID-19. As the reported case of death and infected people keep increasing, many nations have performed lockdown to minimize the spread impact of coronavirus. They also try to identify the infectee among crowd by screening the temperature in public places using infrared thermometer. But the usage of the infrared thermometer gun itself is still lacking because it might not cover all of people and time-consuming. That way also can lead to the spreading virus widely because the health officer has to do it one by one through a lot of people queuing when one of them has probability to infect people around. To prevent this flaw, an alternative technology is needed. The internet of things (Controller based) has been adopted in a smart city as infrastructure's key since the introducing the concept of a smart city. The big research efforts that are done presently are a confirmation on prosperity monitoring by remote sensing is based on Controller based. The internet of things (Controller based) is the interconnection between the physical objects or things that are attached with sensors and software to gather and deliver information among them and primary servers with least human mediation. Controller based healthcare is modern worldview that conveys the services and medical data associated indeed farther areas. The Controller based system in medical is now in an advance setup that contains so many varieties of mechanism like smart sensors, medical equipment, big data, cloud computing, telemedicine, clinical information system, and many more. Controller based technique is categorized into; remote monitoring of patients, remote tracking and monitoring of health, sensor based devices for hand wash monitoring, and monitoring of interactive RFID activities. It delivers best evaluation, better diagnosis, and maintains efficient treatment of patient.

The main applications of Controller based in the field of medical health care incorporate: Therapeutic data administration, Telemedicine and portable medical care and management of health. With the Controller based technology that has widely implemented in the health care sector, this study aims to design of system that has capability to detect the coronavirus automatically from the thermal image with less human interactions using Novel Covid-19 detection system with Mounted Thermal Imaging System. The thermal camera technology is integrated to the Novel Covid-19 detection system and combined with Controller

based technology for monitoring of the screening process to get the real time data.

2. Literature Review

[1] Di Gennaro, F.; Pizzol, D.; Marotta, C.; Antunes, M.; Racalbuto, V.; Veronese, N.; Smith, L. Coronavirus Diseases (COVID-19) Current Status and Future Perspectives: A Narrative Review. Int. J. Environ. Res. Public Health 2020, 17, 2690. [Google Scholar] [CrossRef] [PubMed].

The 2019 novel coronavirus disease (COVID-19), with a starting point in China, has spread rapidly among people living in other countries, and is approaching approximately 34,986,502 cases worldwide according to the statistics of European Centre for Disease Prevention and Control. There are a limited number of COVID-19 test kits available in hospitals due to the increasing cases daily. Therefore, it is necessary to implement an automatic detection system as a quick alternative diagnosis option to prevent COVID-19 spreading among people.

[2] Sajadi, M.M.; Habibzadeh, P.; Vintzileos, A.; Shokouhi, S.; Miralles-Wilhem, F.; Amoroso, A. Temperature, Humidity, and Latitude Analysis to Estimate Potential Spread and Seasonality of Coronavirus Disease 2019 (COVID-19). JAMA Netw. 2020, 3, 1–11. [Google Scholar] [CrossRef] [PubMed]

In this study, five pre-trained convolutional neural network based models (ResNet50, ResNet101, ResNet152, InceptionV3 and Inception-ResNetV2) have been proposed for the detection of coronavirus pneumonia infected patient using chest X-ray radiographs. We have implemented three different binary classifications with four classes (COVID-19, normal (healthy), viral pneumonia and bacterial pneumonia) by using 5-fold cross validation. Considering the performance results obtained, it has seen that the pre-trained ResNet50 model provides the highest classification performance (96.1% accuracy for Dataset-1, 99.5% accuracy for Dataset- 2 and 99.7% accuracy for Dataset-3) among other four used models.

[3] Usamentiaga, R.; Venegas, P.; Guerediaga, J.; Vega, L.; Molleda, L.; Bulnes, F.G. Infrared Thermography for Temperature Measurement and Non-Destructive Testing. Open Access Sens. 2014, 1, 12308–12310. [Google Scholar] [CrossRef] [PubMed].

The coronavirus disease (COVID-19) pandemic emerged in Wuhan, China in December 2019 and became a serious public health problem worldwide. Until now, no specific drug or vaccine has been found against COVID-19. The virus that causes COVID-19 epidemic disease is called severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Coronaviruses (CoV) is a large family of viruses that cause diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). COVID-19 is a new species discovered in 2019 and has not been previously identified in humans. COVID-19 causes lighter symptoms in about 99% of cases, according to early data, while the rest is severe or

critical. As of 4th October 2020, the total number of worldwide cases of Coronavirus is 35,248,330. Of these, 1,039,541 (4%) people were deaths and 26,225,235 (96%) were recovered. The number of active patients is 7,983,554. Of these, 7,917,287 (99%) had mild disease while 66,267 (1%) had more severe disease. Nowadays the world is struggling with the COVID-19 epidemic. Deaths from pneumonia developing due to the SARS-CoV-2 virus are increasing day by day.

Studies diagnosed with COVID-19 using chest X-rays have binary or multiple classifications. Some studies use raw data while others have feature extraction process. The number of data used in studies also varies. Among the studies, the most preferred method is convolutional neural network (CNN). Doctors can diagnose pneumonia from the chest X-ray more quickly and accurately thanks to computer-aided diagnosis (CAD). Use of artificial intelligence methods are increasing due to its ability to cope with enormous datasets exceeding human potential in the field of medical services. Integrating CAD methods into radiologist diagnostic systems greatly reduces the workload of doctors and increases reliability and quantitative analysis. CAD systems based on deep learning and medical imaging are becoming more and more research fields.

[5] Wang, D. FDC1004: Basics of Capacitive Sensing and Applications. Tex. Instrum. 2014, 1, 2. [Google Scholar]

Apostolopoulos and Bessiana used a common pneumonia, COVID-19-induced pneumonia, and an evolutionary neural network for healthy differentiation on automatic detection of COVID-19. In particular, the procedure called transfer learning has been adopted. With transfer learning, the detection of various abnormalities in small medical image datasets is an achievable goal, often with remarkable results. Based on chest X-ray images, Zhang et al. aimed to develop a deep learning-based model that can detect COVID-19 with high sensitivity, providing fast and reliable scanning. Singh et al. classified the chest computed tomography (CT) images from infected people with and without COVID-19 using multi¬objective differential evolution (MODE) based CNN. They proposed Residual Attention U-Net for automated multi class segmentation technique to prepare the ground for the quantitative diagnosis of lung infection on COVID-19 related pneumonia using CT images.

[6] Zdankiewicz, E.M.; A Comparison of Relative Humidity Sensing Technologies. HIGOMETRIX Applications Note 2004-2, Volume 1, p. 3. Available online: https://docplayer.net/22214027-A-comparison-of-relative-humidity-sensing-technologies.html (accessed on 5 September 2020).

"Auto Diagnostic Medical Analysis" trying to find infectious areas to help the doctor better identify the diseased part, if any. Both X-ray and CT images were used in the study. It has been recommended DenseNet network to remove and mark infected areas of the lung. Two different methods were used to diagnose COVID-19 using chest X-ray images. The first one used AOCTNet, MobileNet and ShuffleNet CNNs. Secondly, the features of their images

have been removed and they have been classified using softmax

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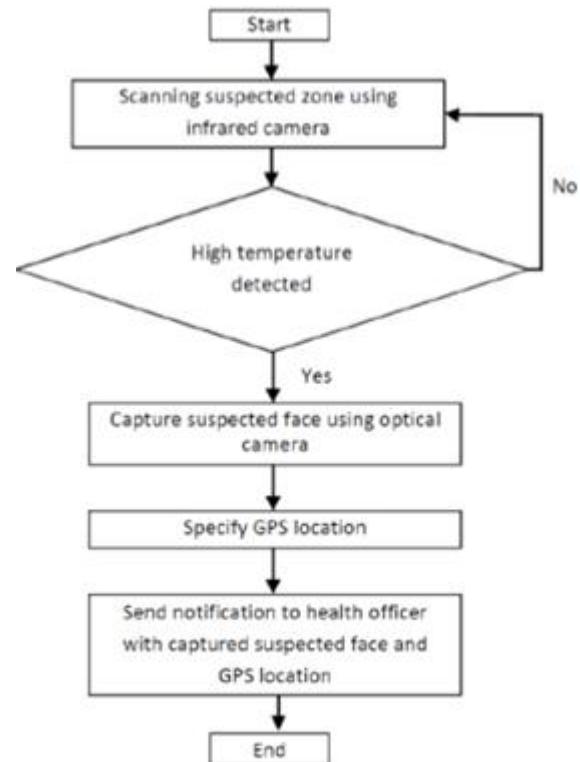
3. Approach of Proposed Methodology

Figure: Work Flow of System

The working flow of three subsystems due to the interrelationship between each other to perform the entire application. In addition, the necessary system's element, excluding module of decision making, are image processing module that is in charge of data processing of optical and thermal cameras. Furthermore, the task of the required data collection is assigned to the Novel Covid-19 detection system when needed. The interfacing of a modular system that is based on Controller based communication link and GSM is done. This system delivers a notification if detecting temperature higher than normal temperature. The GPS module determine the position coordinates after tagging it and a notification is sent to assigned smart mobile through a GSM. The officer will get the data of people's face and temperature to identify someone who is indicating as infected of COVID-19 as shown in figure 1. The proposed Novel Covid-19 detection system is integrated into three segments. The first segment of the system involves the input source of the mechanism that consists of the thermal camera, optical camera and mobile phone application. The processor development was the second segment of system development. In this segment, the microcontroller processor was integrated using the Arduino IDE software to perform coding of the source code. The software enables compilation of the necessary commands and source code into the

NODEMCU V2 processor. Meanwhile, the third segment of the system focused on the output source for the mechanism.

4. Conclusion

An innovative real-time early detection of coronavirus and monitoring system using Novel Covid-19 detection system which integrated with thermal imaging system has been developed. The Novel Covid-19 detection system can also detect high body's temperature in the crowds and send the measured data to be displayed on a phone application. As the latest big issue nowadays that happened across the world, the spreading of coronavirus give so much attention and awareness among people. Early detection of the coronavirus symptoms will be one of the suitable ways to prevent the spreading of coronavirus. As the high body temperature of people is one of the very common symptoms, a real time monitoring system of the screening process that automatically appearing the thermal image of temperature of people is needed. So the diagnosis of the screening process will be less time consuming and less human interactions that might cause the spreading of the coronavirus faster. It can be concluded that the remote sensing procedures, which provide an assortment of ways to identify, sense, and monitoring of coronavirus, give an awesome promise and potential in order to fulfil the demands from the healthcare system.

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