Research Article

Artificial Intelligence Based Mask Detection With Thermal Scanning and Hand Sanitization Based Entry System

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Abstract: According to the World Health Organization, the corona virus COVID-19 outbreak is causing a global health disaster, and the most successful safety measure is wearing a face mask in public places. As per reports, wearing a face mask while at work significantly decreases the risk of transmission. Hygiene refers to activities that support health and disease prevention, especially through tidiness such as hand washing. Hand washing will help prevent the spread of any illness that spreads through touch. A method of using artificial intelligence to build a healthy working environment in a manufacturing environment that is both reliable and cost-effective. A hybrid model combining deep and classical machine learning are going to be proposed for mask detection. Images with and without masks make up a face mask recognition dataset. We'll use a Raspberry Pi to detect faces in real time from a live flux from our webcam. Infrared thermography sensors are best used for temperature measurement and non-destructive tracking. Structural Changes Changed Words Thesaurus Create a low-cost smart hand sanitizer dispenser with a Raspberry Pi-based door controller and an ultrasonic sensor to help security guards overcome obstacles at various locations such as bank gates, school gates, and hospital gates.

Keywords: Hygiene, Hand sanitizer, Raspberry Pi, Thermopile sensor, Ultrasonic sensor, Machine Learning, python.

1. Introduction

Due to the worldwide COVID-19 corona virus outbreak, the wearing of face masks in public is becoming more common. Before Covid-19, people wore masks to protect their wellbeing from air pollution. Some people conceal their feelings from the public by covering their faces[1], while others are self-conscious about their appearance. The most recent influenza virus to strike human health in the last century is COVID-19 (also known as corona virus)[2]. Face masks have been shown to help inhibit COVID-19 transmission by scientists. COVID-19 has been declared a global epidemic by the World Health Organization (WHO) in 2020 due to its rapid spread.

In this paper, we present a mask face detection model that is focused on computer vision and deep learning[3]. Artificial Intelligence (AI) based on Machine Learning and Deep Learning will help to combat Covid-19 in several ways. The proposed model can be used in conjunction with observation cameras to prevent COVID-19 transmission by detecting people who aren't wearing face masks.

Our project's goal is to create an infrared thermometer, which is a device that measures the emitted energy from an object's surface. For a broad range of uses, infrared thermometers are used in medical, manufacturing, and home environments. We discovered that infrared thermometers have three essential stages[4]. A sensing stage that converts IR radiation to an electrical signal, a signal conditioning stage that filters, amplifies, and laniaries the analogue signal, and a digital output stage that converts the analogue signal to a digital signal[5].

Hand sanitizers are generally regarded as an appropriate hand hygiene regime for hospitals, health-care settings, and other settings[6]. The COVID-19 epidemic, as we all know, wreaked havoc on the planet and altered our way of life[7]. In this case, alcohol and hand sanitizers are essential fluids, but they must be used correctly. When infected hands touch alcohol containers or hand sanitizers, the virus will spread to the next person. We will develop and implement a smart hand sanitizer dispenser in this research paper that uses an ultrasonic sensor to detect the presence of a hand, activates the first servo motor to pour the liquid on the hand, de-energizes the electromagnetic lock, and sends a signal to the second servo motor to open the entrance door immediately[8].

2. Literature Review

In the literature, we found several face detection, hand sanitizer and thermal scanning system but with different approach and proposed solution.

A. Kumar, A. Kaur, and M. Kumar [5] introduced the artificial face mask detection technique in simple form and low cost device proposed in the paper. Deep learning introduced in this paper.

Hurriyatul Fitriyah [7] proposed automatic hand wash dispenser. So, everyone can wash their hands without touching machine and maintaining hygiene.

N. H. Leung [10] proposed a layered face mask that how virus cannot enter in mouth and also solving breathing problem after wearing face mask. Need of wearing face mask proposed in the paper.

Gade, R.; Moeslund [14] introduced thermal cameras for thermal screening and measuring temperature of body.

3 Hardware Implementation

3.1 Machine Learning

Machine learning (ML) is the study of computer algorithms that learn from their mistakes or evolve over time. A subset of this is artificial intelligence. Machine learning algorithms use training data to build a mathematical model that can make predictions or decisions without having to be programmed directly. Machine learning algorithms are utilized in good range of applications. Where designing different algorithms to perform the necessary tasks, such as email filtering and computer vision, is difficult or impossible. Machine learning is closely associated with computational statistics, which focuses on making predictions with computers.

The study of mathematical optimization benefits the field of machine learning because it provides techniques, theory, and application domains. Unsupervised learning for exploratory research data analysis is the focus of data mining, a related area of research. When used to solve business problems, machine learning is also known as predictive analytics.

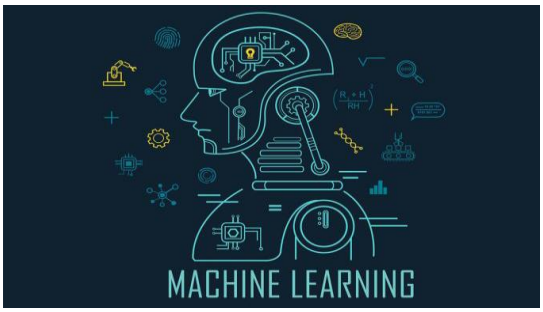

Fig.1: Machine learning outlook

3.2 Thermopile Sensor

Thermopiles convert thermal energy into electrical energy. Thermopiles are made up of several thermocouples which are connected in series or parallel. Thermopiles are used for contactless temperature sensing. A thermopile function is to transfer the heat radiation generated by an entity into a voltage output. The voltage output is in the tens or hundreds of millivolts range.

The thermopile is used as a sensor to calculate a low temperature (compared with normal thermocouple operations). Microwave ovens, clothes dryers, medical equipment, automotive (car climate control, seat occupancy, blind spot warning, black ice detection), electronic products (printers, copiers, cell phones), and many other applications use thermopile sensors.

Thermopiles are used as either sensors or generators. A thermopile generator converts heat into electricity. The failure of a flame is an example of a standard application. A thermopile generator generates voltage when a pilot light is lit in a gas water heater, gas fireplace, or gas stove. When the pilot light goes out, the voltage drops, causing a valve to close, cutting off the gas supply to the appliance.

3.3 Raspberry Pi

The Raspberry Pi is a credit badge computer that connects to a computer monitor or tv and uses a computer. It's a capable little computer that shows people of all ages about computers and programming languages like Scratch and Python It do everything you'd expect a device to do. There's plenty to do on a desktop computer, from surfing the internet and watching high-definition video to creating spreadsheets, word processing, and playing sports.

The Raspberry Pi has been used in a variety of digital creator ventures, including music machines and parent detectors, as well as weather stations and tweeting birdhouses with infrared cameras. We want to see kids all over the world learn to programme and understand how operations run using the Raspberry Pi.

3.4 Artificial Intelligence Camera

Artificial Intelligence (AI) is the term used in the AI Camera. An AI Camera, on the surface, performs automatic scene recognition. When you aim your camera in the right direction, the AI Camera takes over and adjusts the settings for you.Artificial intelligence is a computer system that can perform tasks that would normally require human intelligence (AI). Machine learning powers many of these artificial intelligence systems, while deep learning powers some.

In bright light, AI cameras can automatically combine HDR images, move to multi image capture mode in low light, and use computational imaging to create a stepless zoom effect as two or more camera modules can be used.

3.5 Ultrasonic Sensor

An ultrasonic sensor is an electronic system that measures the distance between a target object by using sound waves and transforms the reflected sound into an electrical signal. Ultrasonic waves move faster than sound waves which can be heard (i.e. the sound that humans can hear). Ultrasonic sensors has two main components: a transmitter (which emits sound using piezoelectric crystals) and a receiver (which encounters the sound after it has travelled to and from the target).

In order to determine the distance between the sensor and the object, the sensor calculates the time between the transmitter's sound emission and its interaction with the receiver.Ultrasonic Sensors for Human Presence Detection The ultrasonic sensors from MaxBotix address the issue of detecting human presence. Our ultrasonic sensors have a high read rate and excellent reading to reading stability, allowing them to detect people over a wide range of distances.

Ultrasonic transducers are commonly used in applications that include the measurement of level or distance. Ultrasonic sensors are commonly used in level measurement because they are fast and simple to implement.

4 Software Implementation

4.1 OpenCV

OpenCV (Open Source Computer Vision Library) is a free computer vision and machine learning software library. OpenCV was designed to provide a shared infrastructure for computer vision applications and to help accelerate the application for machine perception in commercial products. Since OpenCV is a BSD-licensed software, businesses can easily use and modify the code.

The library contains more than 2500 optimised algorithms, as well as a wide range of both classic and cutting-edge computer vision and machine learning algorithms. These algorithms can be used to detect and recognise faces, identify objects, classify human behaviour in videos, track moving objects, extract 3D models of objects, generate 3D point clouds from stereo cameras, stitch images together to create a high-resolution image of a scene, and more. find good images in a database, delete red eyes from flash images, monitor eye movements, identify scenery and position markers to overlay it with augmented reality, and so on

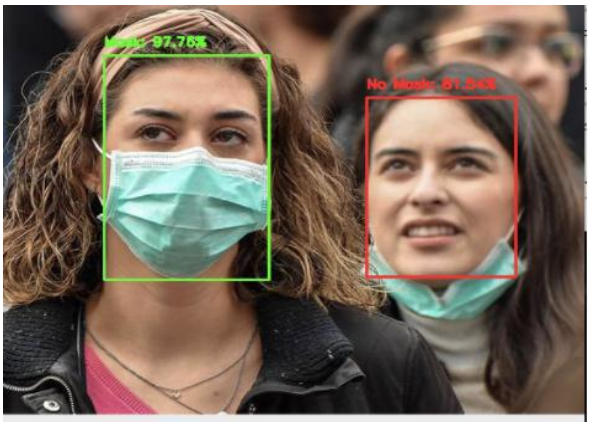

Fig.2: Detection of "Mask"and"No Mask

OpenCV has a user base of over 47 thousand people and has issued over 18 million downloads. Corporations, academic institutions, and government agencies frequently use the library. The library is used by many startups, including Applied Minds, Video Surf, and Zeitera, as well as well-known companies including Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, and Toyota. OpenCV is used in a wide range of applications in Israel, ranging from stitching together street view photos to detecting intrusions in surveillance footage, tracking mine

equipment in China, assisting Willow Garage robots in navigating and picking up items, detecting swimming pool drowning accidents in Europe, running immersive art in Spain and New York, and searching runways for debris in Turkey.From checking food labels in factories around the world to rapid face recognition in Japan, there's something for everyone.

It has interfaces of Windows, Linux, Android, and Mac OS, as well as C++, Python, Java, and MATLAB.When MMX and SSE instructions are available, OpenCV leans heavily toward real-time vision applications. CUDA and OpenCV interfaces with full functionality are currently being developed. There are about 500 algorithms and about ten times as many functions that make up or endorse it. OpenCV is written in C++ and has a template interface seamlessly with STL containers.

5.Proposed System

The proposed framework uses an OpenCV-based computer vision and machine learning algorithm to identify a person wearing a face mask in a picture or video stream. OpenCV was used to enhance the majority of the images. The photos had already been labelled mask and without mask. The images were of various sizes and resolutions, and were most likely taken from various sources or from devices (camera) of various resolutions.

This face mask detector uses the Caffe model. Deep learning based approaches for individual detection have sparked a lot of debate. This prompted us to devise our own algorithm for resolving the problem. Our work on face mask identification involves data collection in order to resolve the large variety of face masks worn by staff. The face mask detection model combines a face detection model that detects existing faces in camera feeds with a mask detection model that processes those faces.

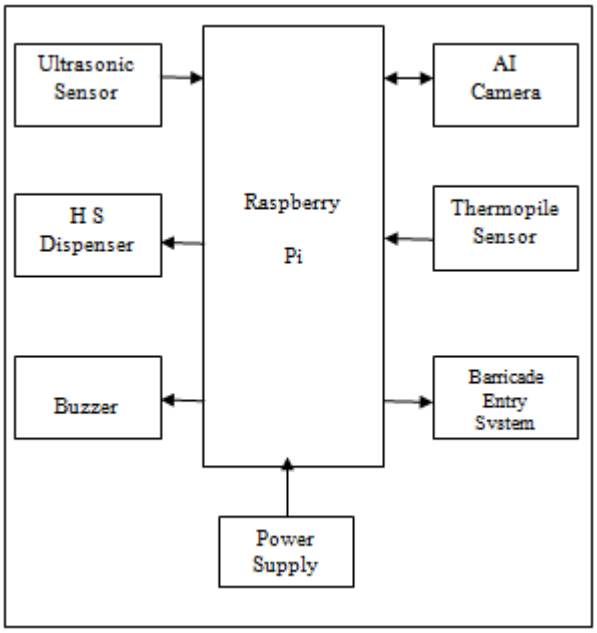

Fig.3: Block Diagram Of Module

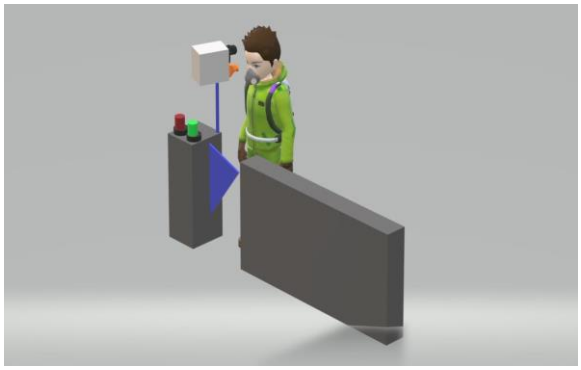

Fig.4: Imagination Of Module

A contactless temperature scanner and a mask display are used in the device. If a high temperature or the absence of a mask is observed, the scanner is linked directly to a human barrier, which prevents entry.Without a temperature and mask scan, no one will be allowed in. Only those who meet both requirements are automatically admitted. To monitor the entire process, the device uses a temperature sensor and camera connected to a Raspberry Pi system.

The camera is used to search for the mask, and the temperature sensor is used to determine the temperature of the forehead. The Raspberry Pi analyses the sensor data and determines whether or not the individual is permitted. In this case, the device activates a motor, which opens the barrier and allows the individual to enter. If a person is flagged by the system for having a high temperature or not wearing a mask, the system illuminates a red light and prevents them from entering.

The ultrasonic sensor is being used to detect the presence of a hand. When it senses a hand less than 10cm away, it activates the first servo motor, which moves from 0 to 180 degrees to spill the liquid onto the hand. It will then return to 0 degrees after a two (2) second delay. The electromagnetic lock will de-energize after returning to 0 degrees, and a green LED will light up immediately, followed by the words "The Entrance Door is Open" on the LCD panel, followed by the second servo motor opening the entrance door. We added a six-second delay to energise the electromagnetic lock, and a two-second delay to reset the device. The Raspberry Pi is used to monitor all of the connected devices around the external electronics equipment, including the ultrasonic sensor, servo motor, LCD display, and LEDs in this system. The power supply provides the voltage and current that the device needs to function properly.

6. Result

When anyone enters in the building, they have to pass our module. over module placed at the entrance of the building we used AI camera, open CV to detect whether people where wearing face mask or not the module where tested with image and real time video streams .

By using thermopile sensor connected to raspberry pi that convert the small temperature voltage reading from a thermopile sensor into temperature value in degree Celsius it measured temperature of body .

The ultrasonic sensor detect the presence of hand , it triggers the fist motor to pour the liquid sanitizer on the hand. the electromagnetic lock open immediately lighting of a green LED and display a word " the entrance door is open" on the LCD display , then the second motor opens the entrance door.

The system surely help in implementing the hygiene without any challenges to access any entry point. all the devices communicate well. the result achieve in this project are genuine .

7. Conclusion

To assess whether or not people were wearing face masks, we used OpenCV. The models were tested using images and real-time video streams. The model's accuracy has been achieved, and model optimization may be a continuous method during which We're fine-tuning the hyper parameters to make a highly accurate solution.

Face mask detection technology which will identify whether someone is wearing a mask and permit them entry would be highly beneficial to society. The primary step in detecting covid is to seem for signs of fever. We still go to keep an eye fixed on everyone for a mask. Every individual features a temperature monitor that detects if the temperature is too hot or too cold. If the temperature is just too hot or tool cold, the buzzer will sound and therefore the machine are going to be notified otherwise the gate will open.

The device would undoubtedly aid within the implementation of hand hygiene easily, as hand sanitizer is required for access to any entry point. Due to its touchless property, which removes any possibility of cross contamination, it is much safer and more recommended. This is a low-cost, easy-to-use device that everybody can use. Both of the machines are in good working order. It are often assumed that the tactic has been introduced effectively, and therefore the target has been met with none deviations. The outcomes of this project are real and therefore the product of diligence and honesty.

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