

Combining Thermal Sensing And Facial Recognition For Efficient Prevention Of Covid Spread

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Abstract: In present prevailing covid-19 situation medical industry had prescribed mandatory precautionary measures to reduce the disease spread. Face mask wearing and temperature monitoring of people in public places is a mandatory practice done across the world in common. People were appointed for this purpose of temperature checking and monitoring the wearing of face mask by people at public places . The traditional process being practiced involves a human involvement which in turn is an alarming threat that the person involved in this monitoring process can be affected by the disease and might act as a carrier unless the person is diagnosed with symptoms at the earliest. The primary goal of the paper is to avoid the human to human interaction and automating the process of implementing covid prevention practice at public places. This can be achieved by implementing a face mask recognition system based on opency-python which detects the wearing of face mask of people in public places by using face recognition technology and temperature monitoring is done by an arduino controlled human body temperature sensors . The collected data is fed to the monitoring person who is in a remote place and human assistance can be provided if any abnormality is recorded. Thus the proposed system provides and autonomous approach to the purpose of face mask and temperature monitoring in a minimalistic and feasible approach

Keywords: Arduino; Facerecognition; Opency-Python;

INTRODUCTION

Corona virus disease covid 19 is the latest epidemic which originated from wuhan-china has spread across the world and affected millions of people. According to who(world health organization) the disease had affected more than one million people so far . The disease is spread primarily through the droplets of saliva or dis charge from the nose of an infected patient.

Governments across the world have implemented several lock down to control the disease spread which have helped to control the disease spread to an extent but making people to stay in home for longer period is not possible considering the dropping global economy. On the guidance of who(world health organization) people were allowed for commuting in public places with certain precautionary practices including mandatory wearing of face mask and monitoring temperature of people entering public places..

Human involvement in the process of disease prevention has risk of virus being spread by the monitoring person . Automating the process helps in improvising the prevention process and human resource utilized for the monitoring purpose can also be reduced. Thermal sensing using microcontrollers can be helpful for temperature monitoring purpose and monitoring of face mask wearing is achieved by face recognition ,combining these technologies helps to automate the process of disease prevention in public places.

EXISTING SYSTEM

In the existing system being practiced, health care workers are appointed on people commuting places to monitor the body temperature of the incoming people using infrared operated thermo gun and the temperature is displayed on the thermo gun display. If any abnormality is observed the health worker block the person from entering the public place, medical care is provided for the person found with abnormality. The health care worker also ensures that if the incoming person wears a face mask, if in case a person try to enter without face mask a warning is provided insisting the person to wear a face mask. Considering larger building with multiple entrance or a public place with multiple entry and exit points a person is appointed at all the entry and exit points for recording temperature of people and ensuring face mask wearing of the incoming people. This system requires a lot of human resource to ensure the prevention of disease spread of people in public place.

PROPOSED SYSTEM

The primary aim of the system is to automate the entire process of recording body temperature and ensuring face mask wearing of people with minimal human involvement. The body temperature of people is detected by an human body temperature sensor integrated with arduinoand a proximity sensor is attached such that if an object is detected in the proximity range the body temperature is recorded and displayed in an oled display for the purpose of entering person and the recorded data is



sent to the python script for the monitoring person. An alarm beep is generated if the temperature is greater than the recorded temperature. Face mask detection is done by training a machine learning model using mobile net. The data set for training the data is gathered from kaagle. Image augmentation is done on the image data set . Head model is generated first and base model is generated with the basis of head model. The trained model is saved. The trained model is imported to another python script where the input stream is taken from a web cam using python open-cv. Face detection is done by importing a pre trained model. The python script will be listening on usb port connected forarduino. An alarm sound is generated on system side when there is violation in wearing of face mask. This system helps a single person to monitor remotely for multiple places. An immediate human attention can be given if there is a need or any abnormality is recorded on the monitoring system.

ARCHITECTURE



SYSTEM REQUIREMENTS

Hardware requirements of the module includes arduino nano,mlx90614 sensor, mini oled display, piezo buzzer, web cam, bread board and jumper wires.

Software requirements of the module includes arduino integrated development environmentand python 3.8 with "opency" library and tensorflow.

Modules and its descriptions:

Arduino nano

Arduino nano is atmega328p based micro controller with a small form factor making it compact for deploying as prototype. The micro controller is equipped with 30 male header pins. The board is powered by a type-b micro-usb cable. It can be powered either by 9v battery or type-b usb cable. The micro-controller acts as a brain of the hardware module. The data of sensors are collected by the micro controller through i2c communication from the sensor and are redirected to the python script.



Temperature Sensor:

The human body temperature is recorded by mlx90614 temperature sensor. The mlx90614 is a non contact infrared temperature sensor. The accuracy of the sensor can be increased by placing the object closer to the sensor . The sensor can record temperature from the range of 70°c to 38.2°c. The sensor uses ir waves to record temperature without physical contact and the sensor communicates with the micro-controller with i2c protocol. The sensor records the surface body temperature of people entering.

Proximity Sensor:

The proximity sensor is used to check whether the person places his hand near to the temperature sensor in order to improve the accuracy of the temperature sensor . Apds9960 is the proximity sensor we use here . The sensor communicates with the micro controller with i2c protocol.

Mobile Net:

Mobilenet uses depth wise separable convolutions. It significantly reduces the number of parameters when compared to the traditional deep neural networks. This results in light weight deep neural networks which can be applied easily on many real world applications. We took a data set of masked and unmasked image from kaagle and performed image augmentation on data set, a base model is created and based on it a head model is generated. The model is saved and it is used along with a pre-trained face recognition model.

Training Graph:



Transfer Learning :

Transfer learning is a common technique used for computer vision for classification related tasks. It is the process of sharing weights or knowledge obtained while solving one problem to solve other related problems. Transfer learning reduces training



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time if the application domains are closely related. We use a pre-trained face mask detection model to reduce the training time.

Displaying Recorded Data In Remote System:

The trained mask detection model and pre-trained face detection model is combined and the input for the models are taken from web camera using python open-cv. On execution, the python script opens up an open-cv frame taking input from web camera . A rectangular box is drawn around if a human face is detected. The rectangular frame turns red if the person doesn't wear a face mask and alarm beep is produced else it is displayed in green. The temperature sensor data being recorded is displayed on the right corner of the open-cv frame window

Output:



Data Display In The Mobile Application Unit :

Implementation:

The system is implemented in government higher secondary school, Ayyampettai , Kanchipuram, Tamil Nadu, India. The data for temperature were collected using temperature gun as well as our proposed system for the 12thstandard students and the results are tabulated.

Temperature Recorded:

Temperature	Developed	Difference
Gun(°F)	Project	
	Module(°F)	
97.5	95.49	2.01
97.8	95.9	1.9
97.1	97.6	0.5
97.3	95.38	1.92
97.7	94.55	3.15
96.8	93.72	3.08
97.5	93.65	3.85

In Average We Got An Difference Of 2.3°F As An Error Rate.

Implementation Result:





CONCLUSION

The proposed system provides an autonomous approach for covid-19 prevention practice which can be effectively used in public places to monitor people and wearing of face mask and temperature detection. The system also helps in reducing the human resource required for the monitoring purpose.

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