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RESEARCH ARTICLE OPEN ACCESS

IoT Based Intelligent Face Mask and Body Temperature Detection for COVID-19 Monitoring

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ABSTRACT
In this paper, we have come up with an innovative IoT – based solution to maximize COVID-19 safety covering relevant aspects: Face Mask Detection, temperature checking at an affordable cost. The Demand of face mask and checking of body temperature in public areas, led us to bring this system into existence. This system guides the user to find the body temperature without any effort and also restricts the person without face mask to keep the COVID-19 protocols strictly. The laptop camera in front captures the image of a person and stores the in the database for security purposes, the system also consists of a display that guides a user to enter the premises. Arduino Uno based temperature sensing subsystem uses infrared sensor, on the other hand detection of mask is verified by computer vision techniques on camera equipped Raspberry pi.
Keywords *- Arduino Uno, keras , LM35, Open cv, Python, Tensor Flow.*

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I. INTRODUCTION

Since the last days of 2019, the diagnosis of a respiratory infection such as the COVID-19 virus caused by SARS-COV-2 also known as corona virus has impacted majority of the people's health all over worldwide. The footprints of COVID-19 were identified in china, later it was quickly spread to the other countries in a little span of days. According to, as of March 31, 2021, the number of reported cases were 138,865,554 from which 2,986,118 lives were taken worldwide. Major symptoms of COVID-19 includes fever, fatigue, sore throat, nasal congestion, loss of taste and smell. In many cases, it is transmitted directly (from one person to another) through the droplets of respiratory. If a person is affected with COVID-19 virus then the symptoms will be shown between 14 and 27 days in most cases. In addition, even asymptomatic individuals (about 45% cases) can spread the disease making the condition worse. Therefore, the use of face masks and sanitation has shown good results when talking about reducing the spread of infections. However, we do not have proper medication and reliable vaccines available in the market .Due to these facts, many safety and security measures were taken by government in order to reduce the spread of COVID-19, such as wearing mask, isolation, reducing citizen mobility within national and international travelers, often associated with preventing major public gathering events. Although the epidemic seemed to be weak in some areas, many safety rules are still in place due to the unstable situation. From work ethic to social relationships, sports and entertainment, corona virus is making many changes in our daily routine, habits and activities. In this project, we have designed a low cost IOT system to help organizations comply with the COVID -19 safety rules and instructions strictly to decrease the rate of spreading of COVID-19. Our main motto is to detect whether the person is wearing a mask and his body temperature is normal or not. No person will be allowed to enter without mask or with high body temperature. Only the person with both conditions passed will be sent inside the area. The system uses temperature sensor and a laptop connected to the raspberry pi system to control all operations. The laptop camera is used to detect the mask and sensor to check the body temperature. The raspberry analyzes the input sensor and determines whether the person should be allowed or not.

II. LITERATURE REVIEW

In the Era of 2020, the world has moved towards a great pandemic, in which every human was suffered due to pandemic situation and lockdown. After the lockdown as per the practical report[1], around 85% of respondents voted to resume their work places, but due to spread of COVID-19, this is practically impossible to unlock the lockdown without following proper guidelines

and safety precautions, in which wearing mask at public places was the major and primary safety precaution that everyone can follow.

In order to allow the opening of work places by following necessary precautionary measures we have developed an IOT system which allows the person to enter the public place if and only if he follows COVID-19 precautionary measure.

III. REQUIREMENTS

A. Arduino Uno

It is a microcontroller board based on ATmega328P. Arduino Uno has 14 pins which 6 of them are PWM output pins and 6 other are analog input pins.

It also has 16MHz ceramic resonator, ICSP header and reset button. It has to be connect to a computer with USB cable or power it with an AC to DC adapter or battery to get started.

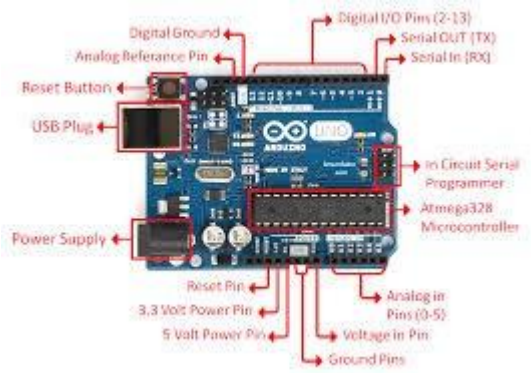
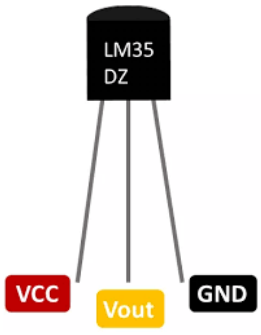


Figure 1 : Arduino Uno

A. LM35

The LM35 heat sensor emits an analog signal equal to the instant temperature. The output power can be easily translated to get a temperature reading in Celsius. The advantage of LM35 over thermistor is that LM35 does not require any other external requirement.



B. LCD Display

Liquid crystal display are the most popular displays in electronics world. LCD has a total of 16 pins. In these 16 pins, pin 1 is for ground and pin 2 is for power. Pin 3 is used for brightness and pins 4-6 is used to operate the LCD. Pins 7-14 are the data lines and pins 15,16 are used to power LCD's backlight.

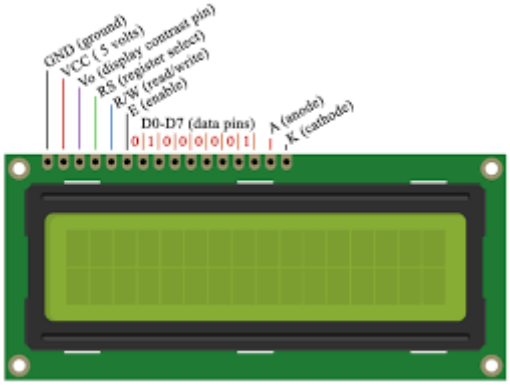


Figure 3 : LCD Display

IV. SOFTWARE REQUIREMENTS

A. NUMPY

Numpy is known as numerical Python. It has functions working on a straight algebra, matrices and fourier transform. Numpy was created in 2005 by Travis Oliphant. Numpy is a python library working with arrays. Numpy is 30 times faster than python as array size increases. It also frees the memory faster. So for its faster ability in python we used this software.

B. TENSOR FLOW

Tensor Flow is an open source end to end machine learning platform. It has a complete, flexible ecosystem of tools, libraries and community resources that allow researchers to compress machine learning technology and developers to easily create and use powerful ML applications. In this proposed model, the CNN architecture uses Tensor Flow at backend. It also reshapes the image in data processing [9].

C. OPEN CV

Open CV python is a library of python bonds designed to solve computer vision problems. Open CV python uses Numpy, which is a library optimized for mathematical performance with the matlab style syntax. All properties of the same OpenCv members are converted and removed from the same Numpy members. OpenCV is used for face recognition, visualization, group movement in recording [20]. This method uses these OpenCV features to resize and colour change of data images.

V. TRAINING SOFTWARE

To train a software we have been used two datasheets. Datasheet 1 [7] consists of 1376 images which 690 images are people wearing masks and remaining 686 images are people without wearing masks. In datasheet 1 the images are mainly front face pose with same type colour mask. Datasheet 2 from kaggle [8] contains 853 images having with and without masks. In this datasheet images are of different positions. Some are head turn, tilt and with multiple faces in the frame and different types of masks having different colours as well.

VI. WORKING

There are many algorithms designed for face recognition algorithms, including supported appearance, functional appearance [3], vector support Equipment(SVM)[4], Base model, in-depth neural learning network[5], and texture based. So we focused on facial expressions that include direct alignment, Eigen-Face [6], and fish-face. In contrast to a straightforward algorithm that aligns a face image with its original image size, the Eigen face and fisher face algorithms reduce the image to greater bias and find similarities between images with reduced image size. The fisher face algorithm uses the details of the internal division of the facial division and can use multiple human faces to establish class division to increase class division. In contrast, the eigen face algorithm uses one image per person using a single image variation in a complete viewing process. The Eigen face algorithm is vulnerable to variability in light or surface. However the computer requirement is small compared to the face algorithm.

VII. DIAGRAMS

A. FACE MASK DETECTOR

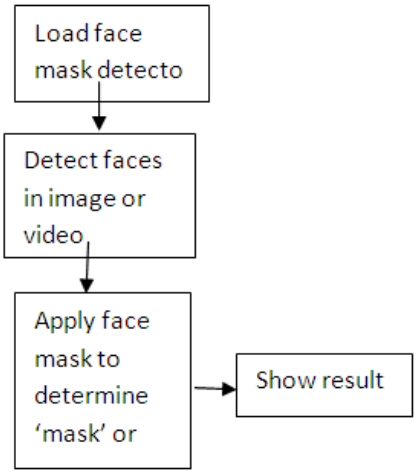


Figure 4: Flow chart of Face mask detection

B. Temperature Measurement

The Arduino is programmed using Arduino programming language. LM35 is used to sense the body temperature. Body temperature is a basic parameter for COVID-19. The recorded temperature is displayed on LCD display.

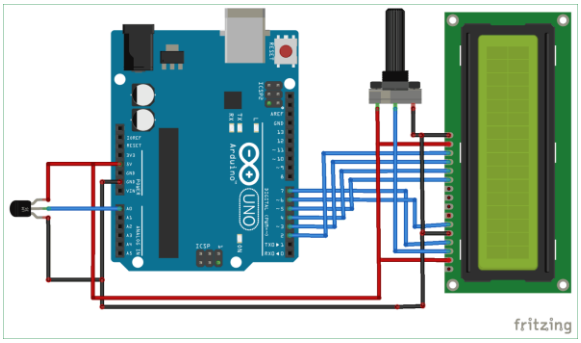


Figure 5 : Temperature Reading

VIII. RESULTS

For the detection of face mask, we had trained a software model to show the working process, for that we have choosen two classes of people, one with wearing mask and the other without mask.

We have properly configured MobileNetV2 for our storing the results in our database.

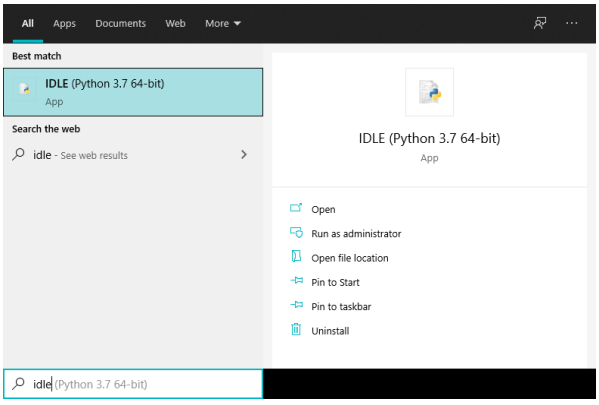


Figure 6

First open Python Idle from the search bar.

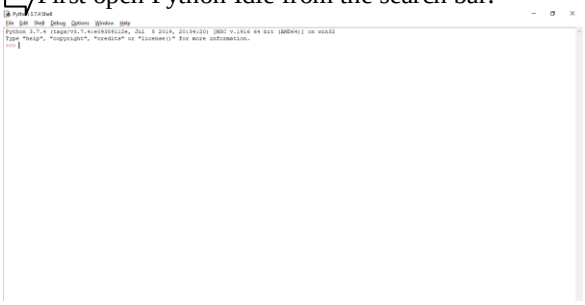


Figure 7

⇨ In python shell select the file.

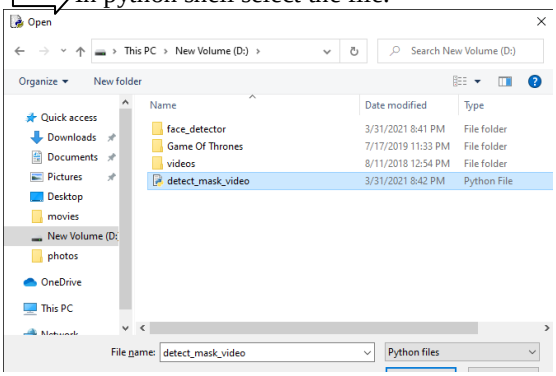


Figure 8

⇨ Selected detect mask video.

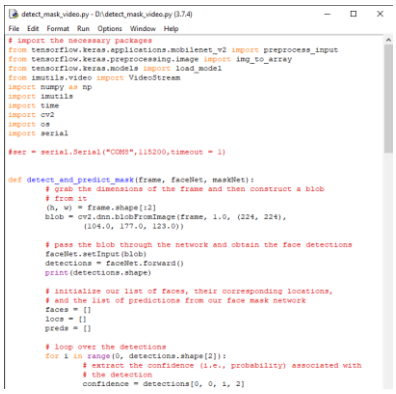


Figure 9

⇨ Then the code will run.

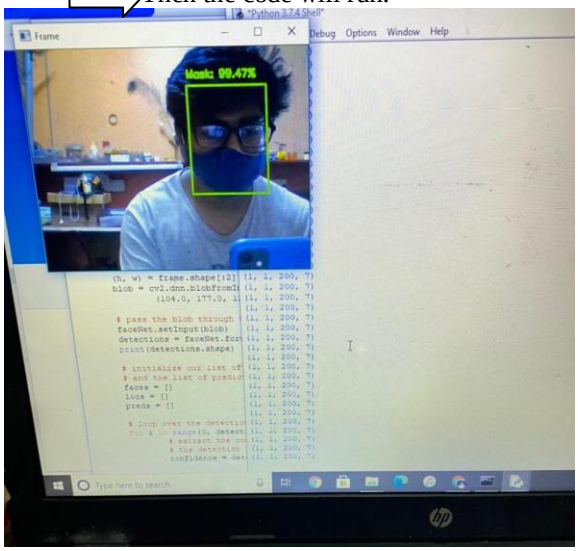


Figure 10: Person with Face mask.

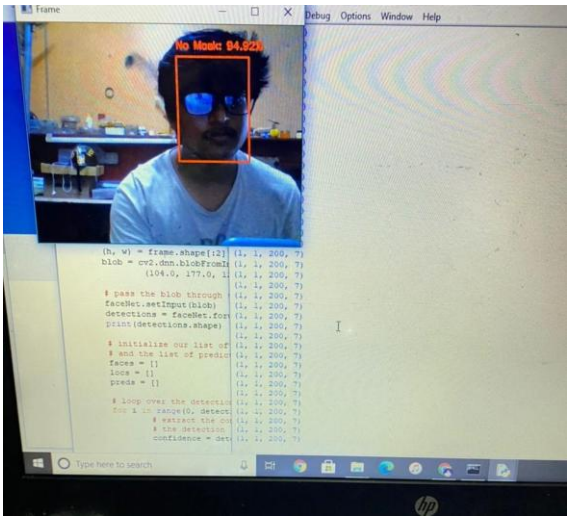


Figure 11: Person without Face mask.

IX. CONCLUSION

The sole purpose of this work was to take COVID-19 processes to another level by adding a face mask and gaining body temperature. Automatically, the complete process of checking the face mask and body temperature was replaced by the system. Depending on the results obtained, the designed system is very efficient in order to maintain the precautionary measures against COVID-19. The main advantage of our system is it depends on both open hardware and free software, to be a clear and desirable advantage of such program.

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