HUMAN BODY TEMPERATURE SCREENING AND MASK DETECTION - COVID 19 MONITORING SOLUTIONS USING TENSORFLOW

PRESENTATION BY
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ABSTRACT

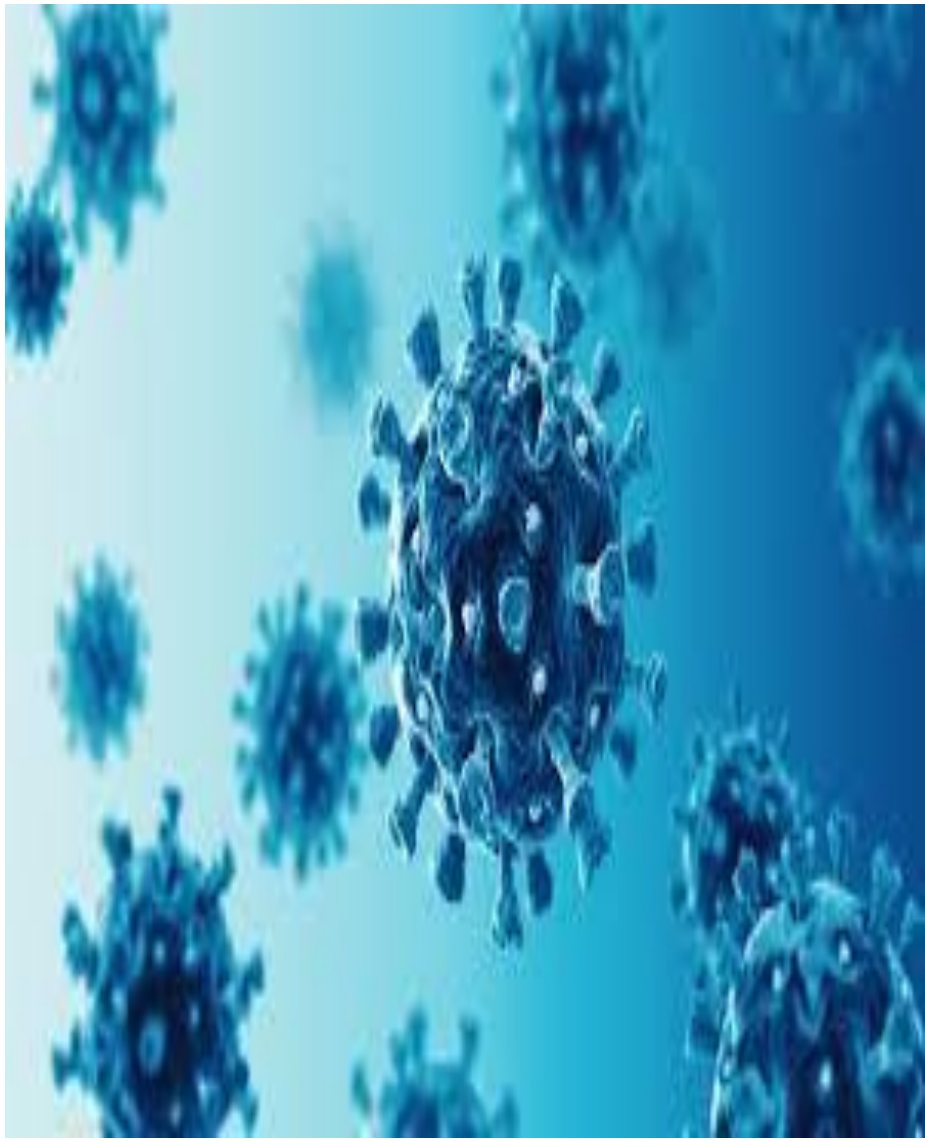
- Covid-19 has upended societies and dramatically altered everyday life across the globe.
- Many constraints have been set on the people on maintaining social distancing, wearing a mask along with periodical temperature check at the entrance of malls, offices, super markets.
- This project proposes a model which detects whether a person wears a mask or not by training a Covid-19 face mask detector with tensor flow, Deep learning.
- This model also performs thermal scanning of a person and compares his/her body temperature with normal body temperature.
- If the measured temperature is comparable with the pre-defined value and the mask is detected, the person is allowed to enter otherwise the entry is denied with an alarm.
- The proposed model also finds the count of the total number of people who entered, got rejected.

AGENDA

- Introduction
- Literature Survey
- Problem Identification
- Proposed Model
- Detailed Description of Proposed model (including Flow Chart)
- Tools and Components used
- Results with Justification
- Conclusion
- Future Scope
- References

INTRODUCTION

- As Countries around the Globe are reopening, living with the Novel Coronavirus is becoming the new way of life. But to Stop the Spread of the Virus, we need to separate people having the Coronavirus from the Rest.
- Currently, Temperature Checkups are done manually using Contactless Thermometer.
- To solve these problems, we have designed a Kiosk that automates the process of Temperature Checkup by using Facial landmark and Contactless IR Temperature Sensor and Mask Detection using Deep Learning Neural Network.



LITERATURE SURVEY

Year	Author	Description	Publication
2010	S. S. Mohamed, N. M. Tahir, R. Adnan	• Background subtraction is a widely used approach for detecting moving objects in videos from static cameras • Describes an efficient background subtraction technique for extracting the moving objects from a scene. Gaussian mixture models (GMM) gives best results than other segmentation methods.	Background modelling and background subtraction performance for object detection **https://www.researchgate.net/publication/224166004_Background_modelling_and_background_subtraction_performance_for_object_detection**
2015	R Girshick	• State of the art object detection networks depend on region proposal algorithms to hypothesize object locations • Fast R-CNN have reduced the running time of these detection networks, exposing region proposal computation as a bottleneck	Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks **https://arxiv.org/abs/1506.01497**

LITERATURE SURVEY

Year	Author	Description	Publication
2017	Shiming Ge, Jia Li, Qiting Ye, ZhaoLuo	• Introduces a dataset, denoted as MAFA and LLE-CNNs for masked face detection • This model contains three modules • two pre-trained CNNs, Incorporation of Embedding module (using locally linear embedding (LLE) algorithm) and Verification module	Detecting Masked Faces in the Wild with LLE-CNNs https://ieeexplore.ieee.org/document/8099536
2019	Selahattin, Sahaj Singh, Judy Qiu	• Cars are equipped with multiple cameras which captures video streams that can be used for detection and predictive tasks to increase race safety • New dataset is created and compared it with three different Single Shot Multibox Detector models from TensorFlow Detection Model Zoo.	A Fast Video Image Detection using TensorFlow Mobile Networks for Racing Cars https://ieeexplore.ieee.org/abstract/document/9005689

LITERATURE SURVEY

Year	Author	Description	Publication
2020	Adrian Rosebrock	• Includes two phase mask detector • Training the model using Keras/TensorFlow on datasets • Implemeting face mask detector in real-time video streams with OpenCV	COVID-19: Face Mask Detector with OpenCV, Keras/TensorFlow, and Deep Learning https://www.pyimagesearch.com/2020/05/04/covid-19-face-mask-detector-with-opencv-keras-tensorflow-and-deep-learning/
2020	Isack Farady, Chih-Yang-Lin, Amornthep Rojanasarit, Kanatip, Fityanul	• Deep learning object detection network to detect and capture the temperature of a specific point inside a predicted bounding box • Includes two modules for the RetinaNet model to detect three categories of mask-wearing positions and the temperature of the head	Mask Classification and Head Temperature Detection Combined with Deep Learning Networks https://ieeexplore.ieee.org/document/9249454

PROBLEM IDENTIFICATION

- As COVID-19 is spreading in our community, masks should be used as part of a comprehensive strategy of measures to suppress transmission and save lives
- It is easy to identify the masks on people and their body temperatures if the number of people are less in number.
- But the case is different with large number of people.
- As it is pandemic , we shouldn't risk the lives of workers who are closely exposed to everyone
- For the security, it becomes very difficult to detect the temperature of the person and identify whether he is wearing mask or not
- So we can use this technique which can automatically detect whether the person is wearing a mask as well as the body temperature without the actual physical contact

PROPOSED MODEL

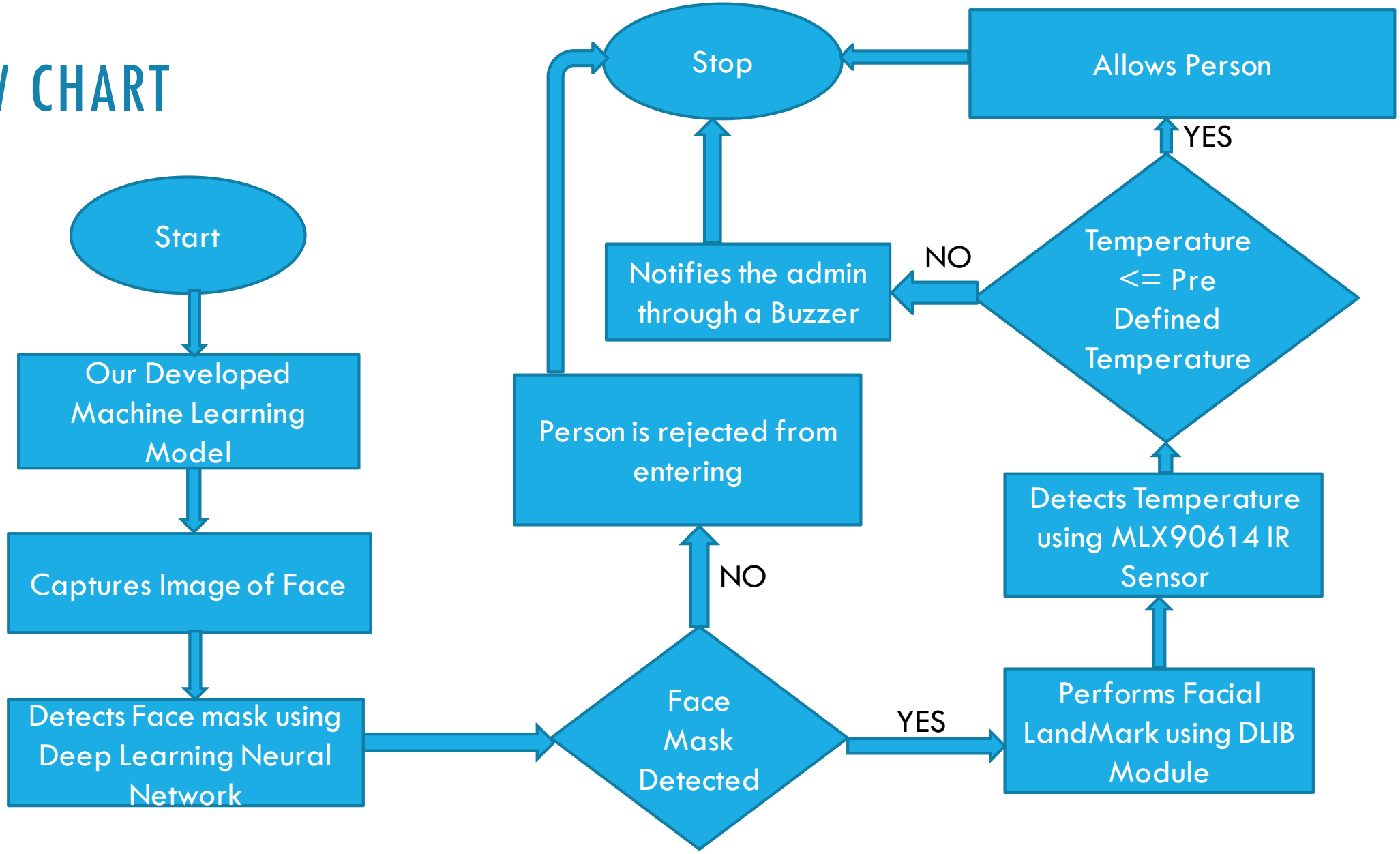
- The proposed model exhibits two main tasks
- The first is to capture the face of the person
- If the person's face is covered with mask, we proceed to the next task which is detection of the person's body temperature
- If any of the mentioned conditions failed, an alert is sent to concerned authorities
- The system is developed using Tensor Flow, Machine Learning. Therefore the key concepts in this model are:

  - Image capturing
  - Image processing
  - Convolution neural network
  - Temperature detection using sensor

DETAILED DESCRIPTION OF PROPOSED MODEL

- Firstly, the Tensorflow based Deep Learning Neural Network tries to detect if the person is wearing a mask or not.
- The system has been made robust by training it with many different examples to prevent its false positives.
- Once, the system has detected the mask, it performs Facial Landmarking. The System is using DLIB Module for Facial Landmarking to find the best Spot on the forehead of the person to take temperature from it.
- If the temperature is within normal human body temperature range, it allows the person to proceed. We are using mlx90614 to detect the temperature of person.

FLOW CHART

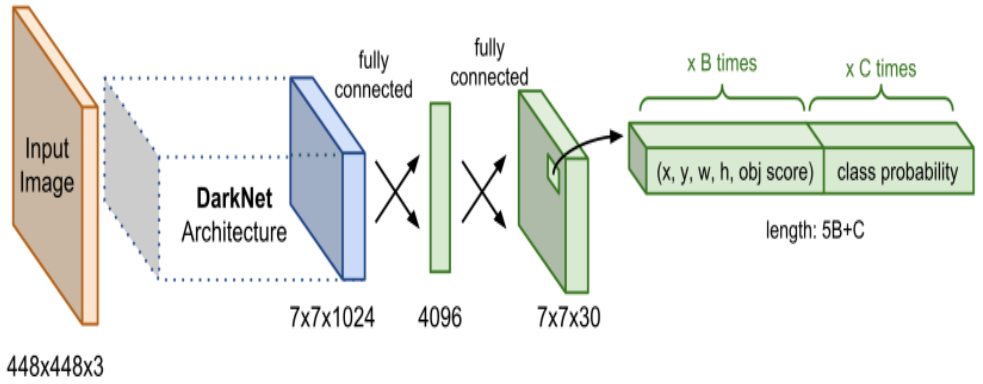

Start
Our Developed Machine Learning Model
Captures Image of Face
Detects Face mask using Deep Learning Neural Network
Face Mask Detected
NO
Person is rejected from entering
Stop
Notifies the admin through a Buzzer
NO
Temperature <= Pre Defined Temperature
YES
Allows Person
Detects Temperature using MLX90614 IR Sensor
Performs Facial LandMark using DLIB Module
YES

FASTER R-CNN: TOWARDS REAL-TIME OBJECT DETECTION WITH AREA PROPOSAL NETWORKS

- Region Proposal Network (RPN) that shares full-image convolutional features with the detection network, thus enabling nearly cost-free region proposals
- An RPN is a fully convolutional network that simultaneously predicts object bounds and objectness scores at each position
- The RPN is trained end-to-end to generate high-quality region proposals, which are used by Fast R-CNN for detection.
- RPN and Fast R-CNN is merged into a single network by sharing their convolutional features using the recently popular terminology of neural networks with 'attention' mechanisms, the RPN component tells the unified network where to look

YOLO ARCHITECTURE

- The YOLO algorithm stands for You Only Look Once, this algorithm is a state of art, which works on a real-time system, build on deep learning for solving various Object Detection as well as Object Tracking problems.
- YOLO is extremely fast
- It sees the entire image during training and test time so it implicitly encodes contextual information about classes as well as their appearance.



BACKGROUND SUBTRACTION TECHNIQUES: A ANALYSIS

- Background Subtraction is a preliminary technique used for video surveillance, moving object detection, human machine interaction, gait recognition, multimedia applications etc.
- The goal of this study is to provide a comparative analysis of available background subtraction algorithms classified as basic, statistical, machine learning, and others techniques.
- The methods are compared based on their advantages, disadvantages and performance against the challenges like shadow detection, camera jitter and dynamic background.
- This paper presents a framework (techniques, dataset, application) for researchers in identifying the unfertile areas of background subtraction analysis.

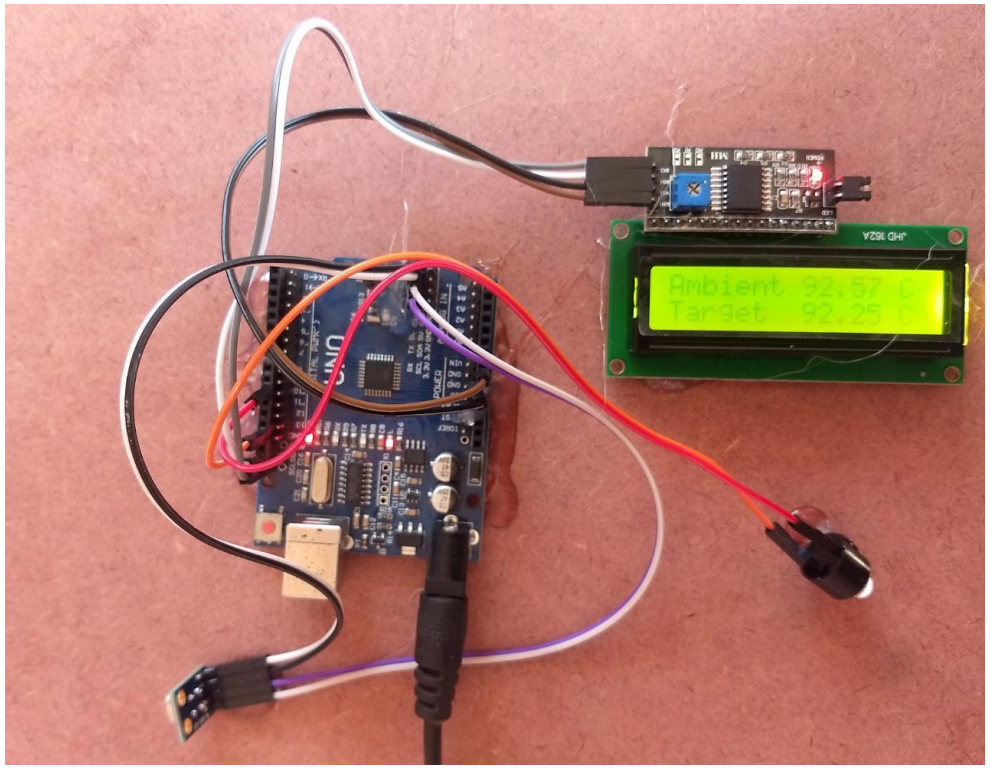
SOFTWARES USED

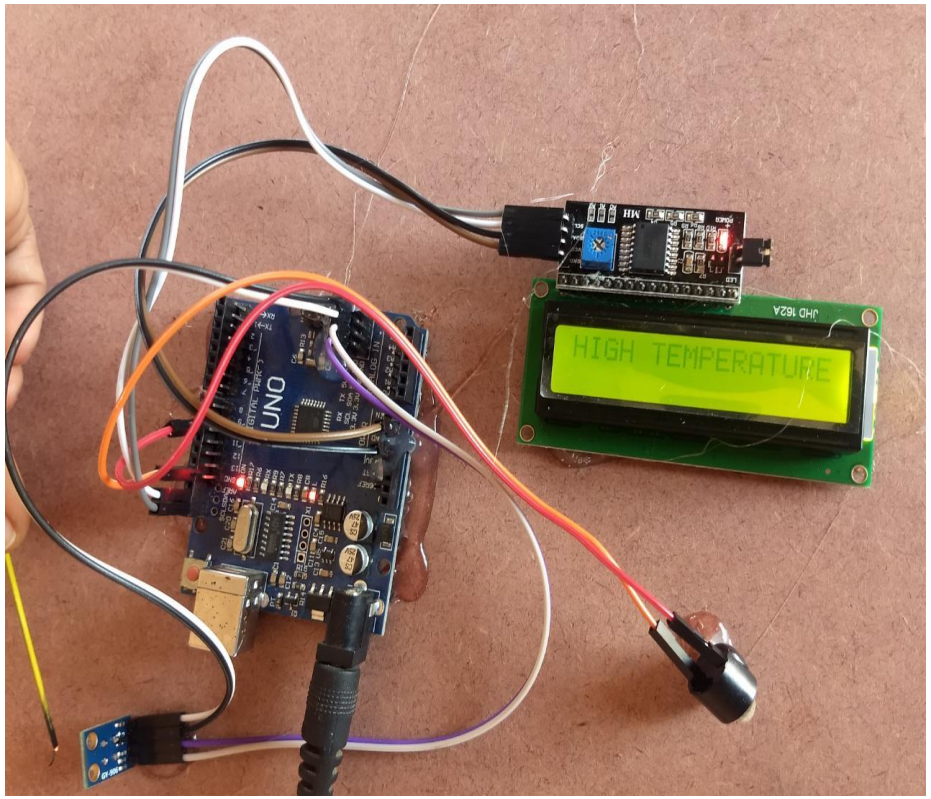
- Pycharm
- Python

HARDWARE COMPONENTS

- Arduino Uno
- Infrared Sensor
- I2C Adapter
- LCD Display
- Buzzer

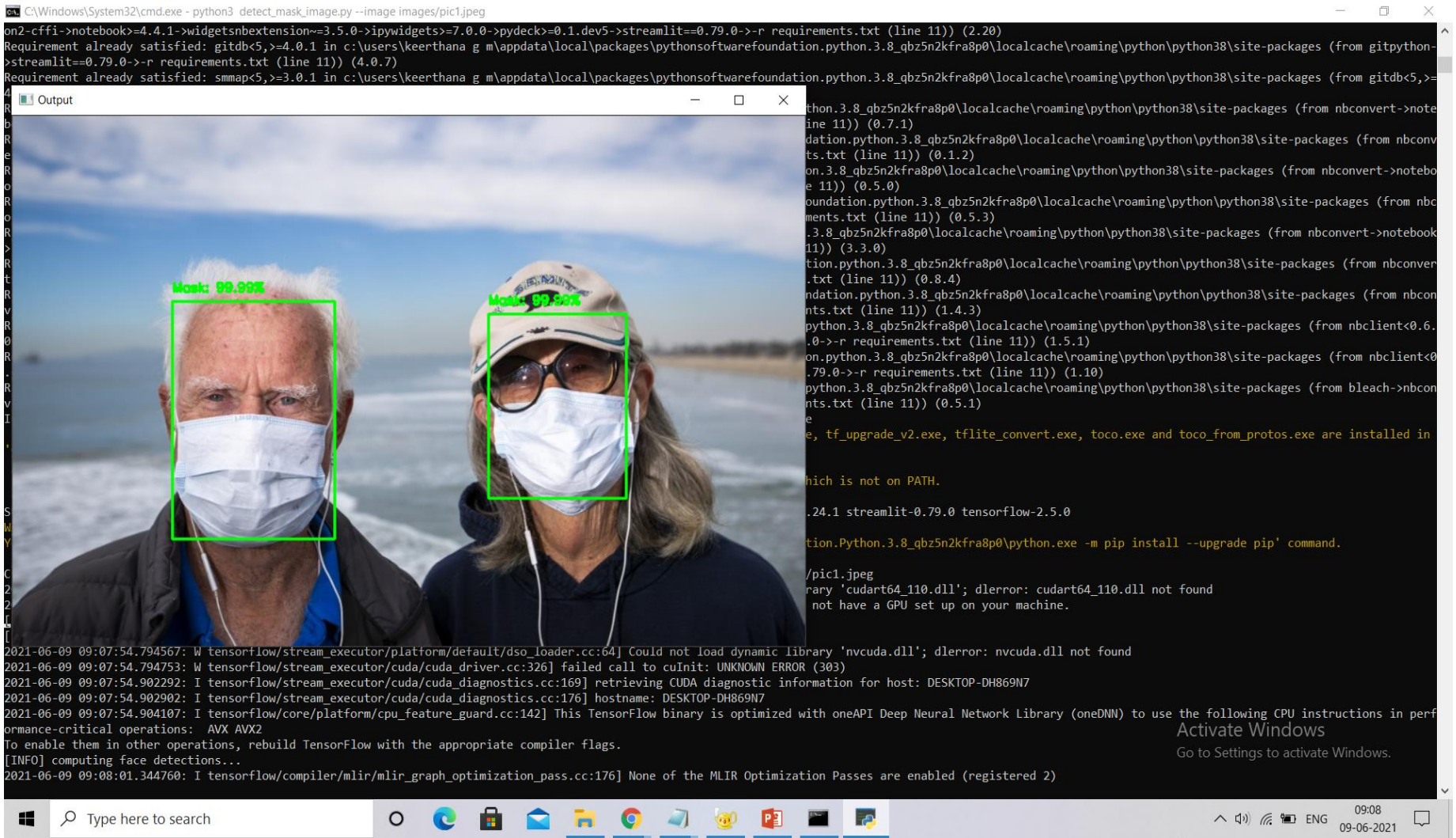
HARDWARE COMPONENTS



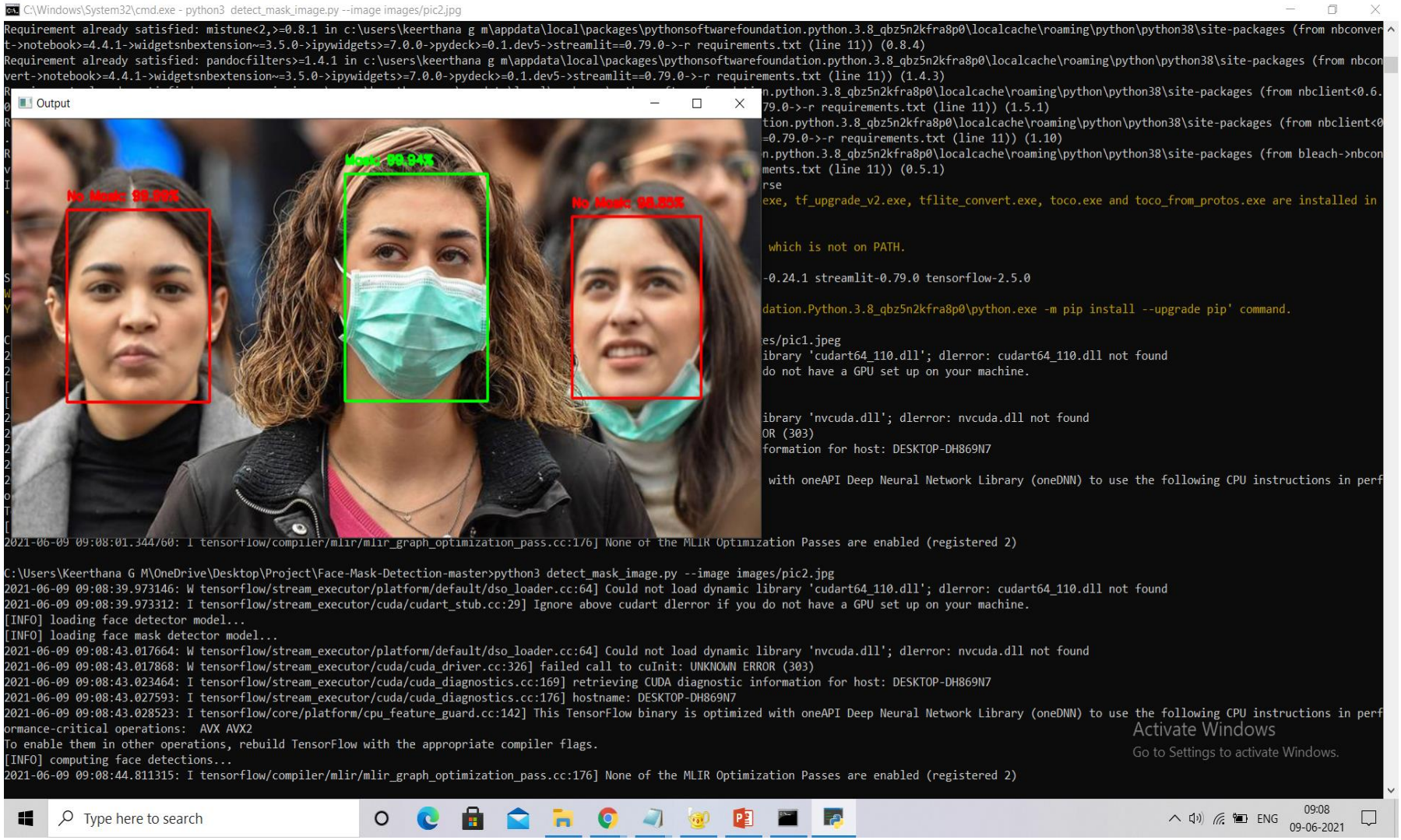


RESULTS WITH JUSTIFICATIONS

Face Mask Detection for image as an input

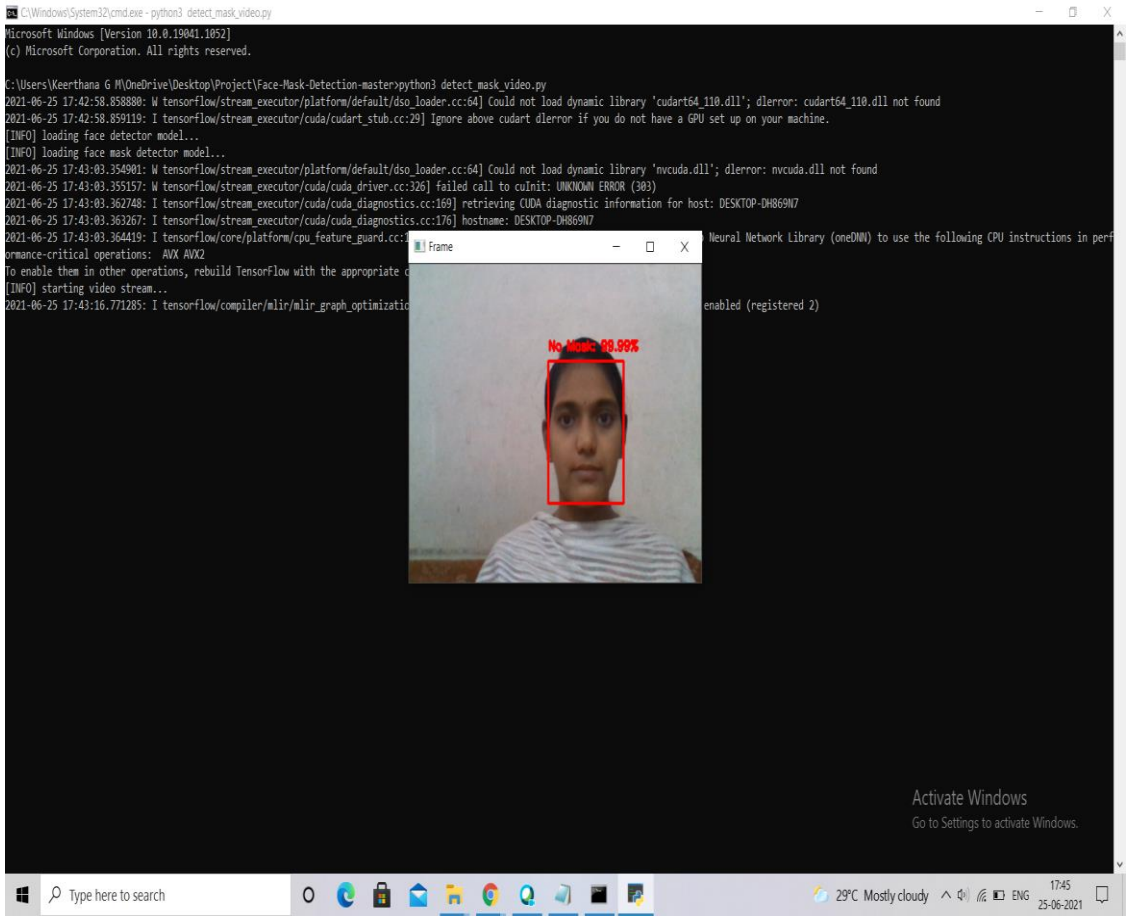


RESULTS

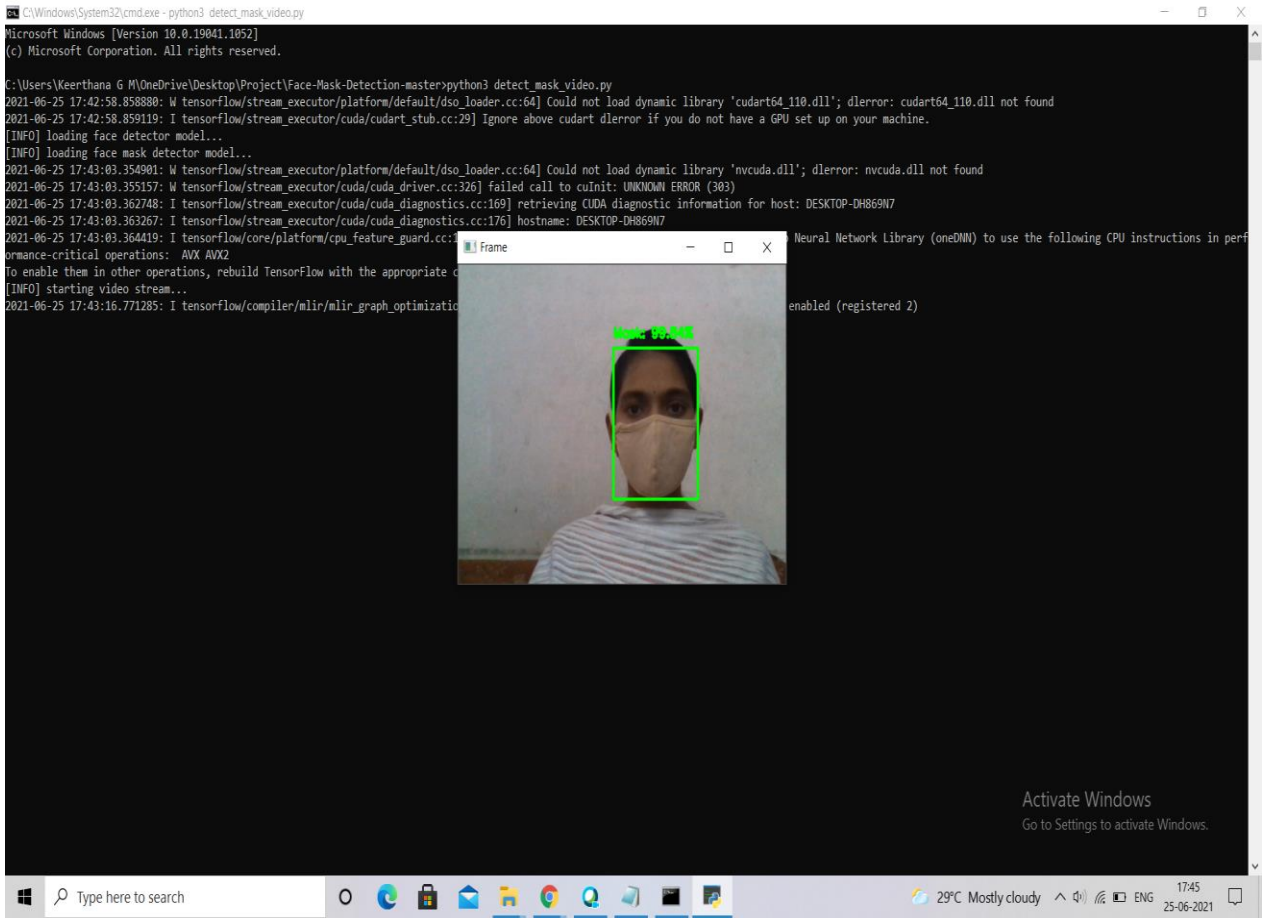

C:\Windows\System32\cmd.exe - python3 detect_mask_image.py --image images/pic2.jpg
Output
Mask: 99.94%
No Mask: 88.85%
Requirement already satisfied: mistune<2,>=0.8.1 in c:\users\keerthana g m\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\roaming\python\python38\site-packages (from nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.0.0->pydeck>=0.1.dev5->streamlit==0.79.0->-r requirements.txt (line 11)) (0.8.4)
Requirement already satisfied: pandocfilters>=1.4.1 in c:\users\keerthana g m\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\roaming\python\python38\site-packages (from nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.0.0->pydeck>=0.1.dev5->streamlit==0.79.0->-r requirements.txt (line 11)) (1.4.3)
which is not on PATH.
-0.24.1 streamlit-0.79.0 tensorflow-2.5.0
dation.Python.3.8_qbz5n2kfra8p0\python.exe -m pip install --upgrade pip' command.
es/pic1.jpeg
ibrary 'cudart64_110.dll'; dlerror: cudart64_110.dll not found
do not have a GPU set up on your machine.
ibrary 'nvcuda.dll'; dlerror: nvcuda.dll not found
OR (303)
formation for host: DESKTOP-DH869N7
with oneAPI Deep Neural Network Library (oneDNN) to use the following CPU instructions in perf
2021-06-09 09:08:01.344760: I tensorflow/compiler/mlir/mlir_graph_optimization_pass.cc:176] None of the MLIR Optimization Passes are enabled (registered 2)
C:\Users\Keerthana G M\OneDrive\Desktop\Project\Face-Mask-Detection-master>python3 detect_mask_image.py --image images/pic2.jpg
2021-06-09 09:08:39.973146: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_110.dll'; dlerror: cudart64_110.dll not found
2021-06-09 09:08:39.973312: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your machine.
[INFO] loading face detector model...
[INFO] loading face mask detector model...
2021-06-09 09:08:43.017664: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvcuda.dll'; dlerror: nvcuda.dll not found
2021-06-09 09:08:43.017868: W tensorflow/stream_executor/cuda/cuda_driver.cc:326] failed call to cuInit: UNKNOWN ERROR (303)
2021-06-09 09:08:43.023464: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169] retrieving CUDA diagnostic information for host: DESKTOP-DH869N7
2021-06-09 09:08:43.027593: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: DESKTOP-DH869N7
2021-06-09 09:08:43.028523: I tensorflow/core/platform/cpu_feature_guard.cc:142] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use the following CPU instructions in performance-critical operations: AVX AVX2
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
[INFO] computing face detections...
2021-06-09 09:08:44.811315: I tensorflow/compiler/mlir/mlir_graph_optimization_pass.cc:176] None of the MLIR Optimization Passes are enabled (registered 2)
Activate Windows
Go to Settings to activate Windows.
Type here to search
ENG
09:08
09-06-2021

Face mask detection during Video streaming

Without Mask

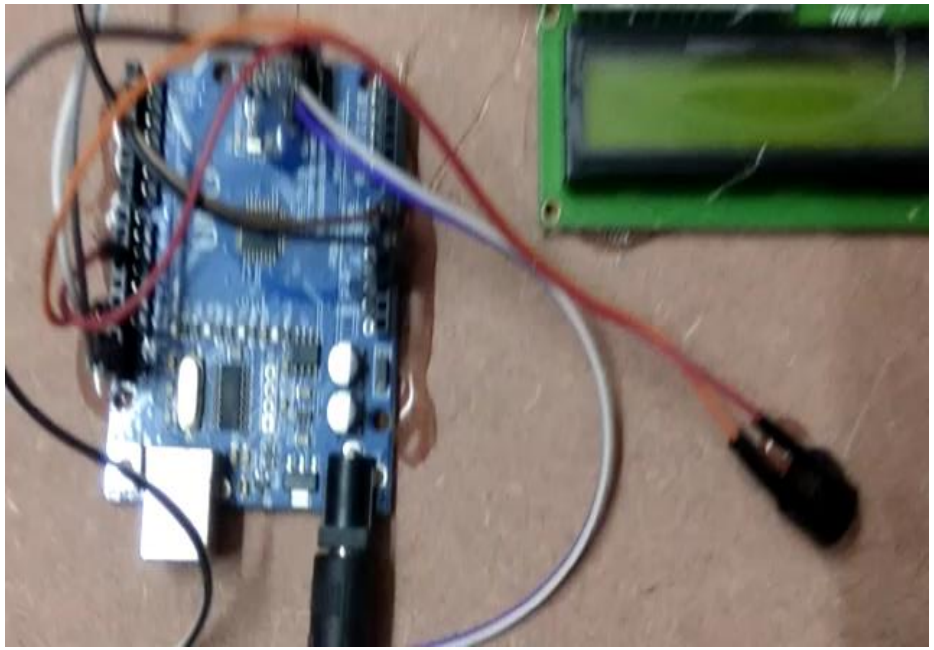


With Mask

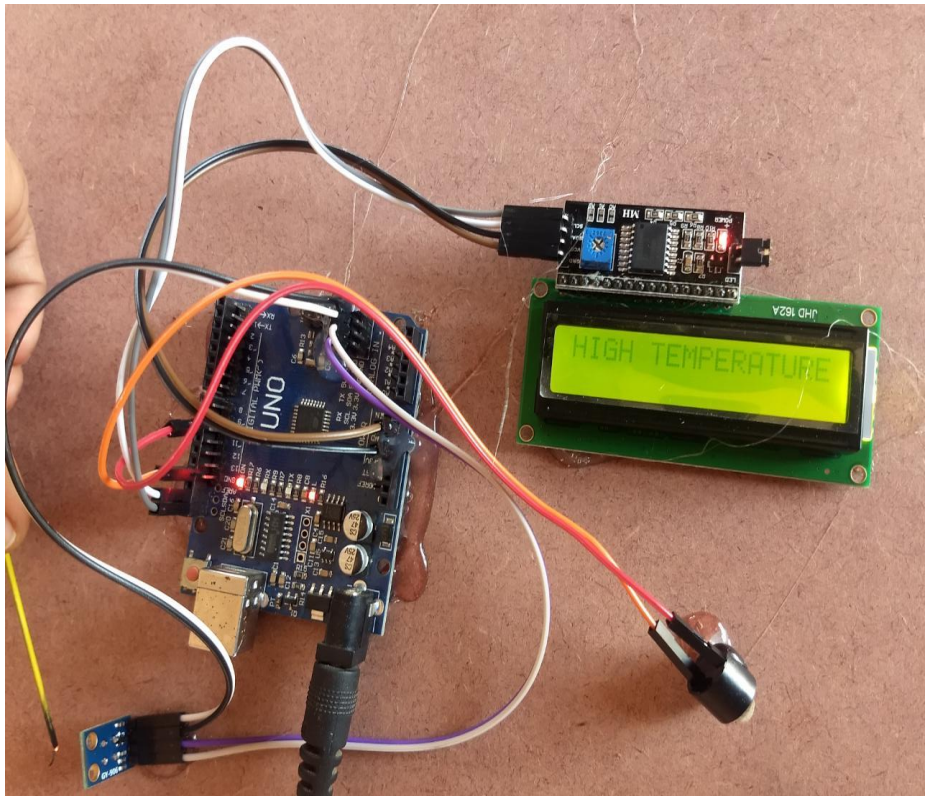


RESULT SHOWING TEMPERATURE DETECTION

Video Demonstration



Picture showing high temperature



CONCLUSION

- This proposed system will operate in an efficient manner in the current situation where there is a high need to track human body temperature without the actual contact.
- We have addressed in depth, the identification of face masks that prevent the virus spread along with temperature detection.
- This solution has the potential to significantly reduce violations by real-time interventions, so the proposed system would improve public safety through saving time and helping to reduce the spread of coronavirus.
- This solution can be used in places like temples, shopping complexes, metro stations, airports etc.

FUTURE SCOPE

Several of the currently under development features are listed below in brief:

1) Coughing and Sneezing Detection: Chronic coughing and sneezing is one of the key symptoms of COVID-19 infection as per WHO guidelines and also one of the major routes of disease spread to non-infected public. Deep learning based approach can be proved handy here to detect & limit the disease spread by enhancing our proposed solution

2) Temperature Screening: At present scenario thermal screening is done using handheld contactless IR thermometers where health worker need to come in close proximity with the person needed to be screened

- The proposed use-case can be equipped with thermal cameras based screening to analyze body temperature of the people in public places that can add another helping hand to enforcement agencies to tackle the pandemic effectively

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Any Questions ?

Thanks