Face Mask and Body Temperature Based Automatic Entering System

Ankit Roy[1], Gunjan Rao Naik[2], Saloni Bhanwariya[3], Pushpendra Sengar[4],

Satish Alaria[5]

[1,2,3,4]Student, [5]Assistant Professor

Department of Computer Science & Engineering, Arya Institute of Engineering & Technology, Jaipur

ABSTRACT: -

COVID 19 pandemic is causing a global health epidemic. The most powerful safety tool is wearing a face mask according to medical dept. in public places and everywhere else. The COVID 19 outbreak forced governments around the world to implement lockdowns to reduce virus transmission. According to surveys, wearing a face mask at public places reduces the risk of transmission of COVID 19. In this paper, an IoT-enabled Automatic Entering System that uses a machine learning model for monitoring face mask detection and body temperature. The proposed model can be used for any shopping mall, hotel, apartment entrance or anywhere people needs to enter or pass through etc. As an outcome a cost-effective and reliable method of using AI and sensors to build a healthy environment. Evaluation of the proposed model is done by the Face Mask Detection algorithm using the TensorFlow software library. Besides, the body temperature of the individual is monitored using a non-contact temperature sensor.

Keywords

COVID-19, Face mask detection, Machine learning, Raspberry Pi, Sensors, Temperature detection.

INTRODUCTION: -

The coronavirus disease, or COVID-19, which originated primarily in Wuhan, China, has rapidly spread to several countries, including India, the world's second-most populous country with a population of more than 134 billion people. With such a large population, India would have trouble preventing the spread of the coronavirus. Face masks and sanitizers are the most effective ways to minimize transmission. When it comes to reducing disease transmission, this has shown good results. Fever, sore throat, tiredness, loss of taste and smell, and nasal congestion are all common symptoms of coronavirus infection. The majority of the time, it is transmitted indirectly through surfaces. The incubation period can be very long, ranging from 10 to14 days in extreme cases, and the virus can attack directly (from one individual to other individuals) by respiratory droplets . Governments implemented a variety of protection and safety initiatives to reduce disease transmission, including social distancing, mandatory indoor mask-wearing, quarantine, restricting citizens' traveling within state boundaries and abroad, self-isolation, and the exclusion and cancellation of big social occasions and meetings . From work activities to social relationships, all kinds of sports activities, as well as off-screen and on-screen entertainment have all been affected due to this COVID-19 pandemic .

Individuals with high body temperature are not to be permitted to enter public places because they are at a high risk of infection and spreading the virus; wearing a mask is essential. At the entrances to any city, workplaces, malls, and hospital gates, temperature and mask checks are also necessary. As a result, a smart entry device that automatically monitors human body temperature and detects a mask at the door opening system is developed. An advanced idea is used in this system approach, which is a combination of all three including temperature detection, total people count, and mask detection.

PROPOSED METHOD FOR GESTURE RECOGNITION: -

System Overview: -

Face Mask Detection: -

To implement the mask detection algorithm depending on the Tensor flow library, it contains two parts: the Face Detection Caffe model and phases of the face mask detection model.

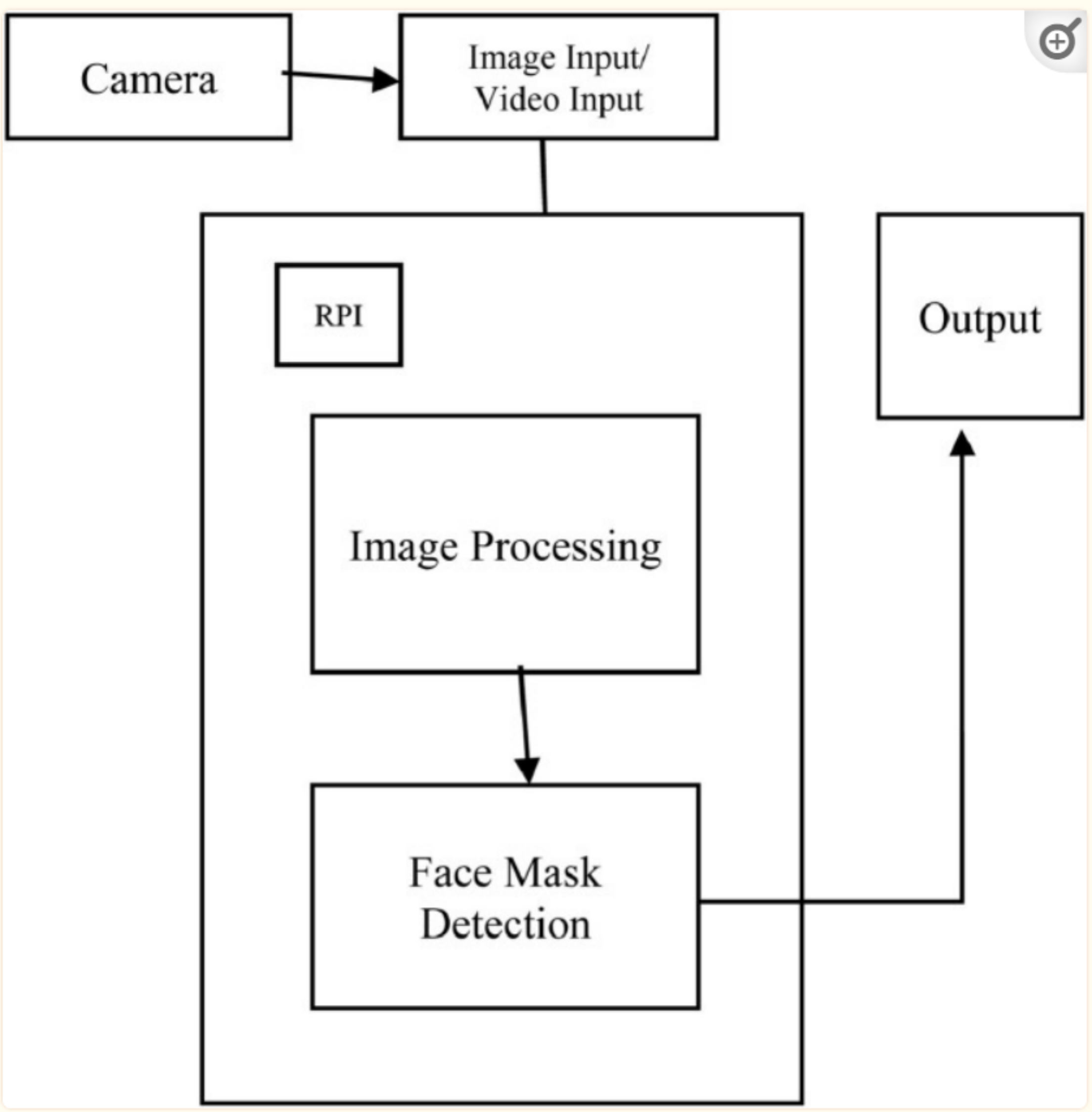

Fig 1: Face Detection Caffe model

CNN Algorithm:-

Convolution Neural Networks (CNN) Algorithm In this paper, a deep learning algorithm is used to identify face mask recognition and, Convolution Neural Networks (CNN) classification. A CNN is a form of artificial neural network that is specifically built to interpret pixel input and is mainly used for image recognition and analysis, in which each layer applies to a different set of filters. Around 100's to 1000's of filters is combined to give a final result and then the obtained output is sent to the next layer in this neural network. Evaluation of the proposed framework is done by the face mask detection algorithm using the TensorFlow software library. The Mask detector model is trained by using Keras and TensorFlow.

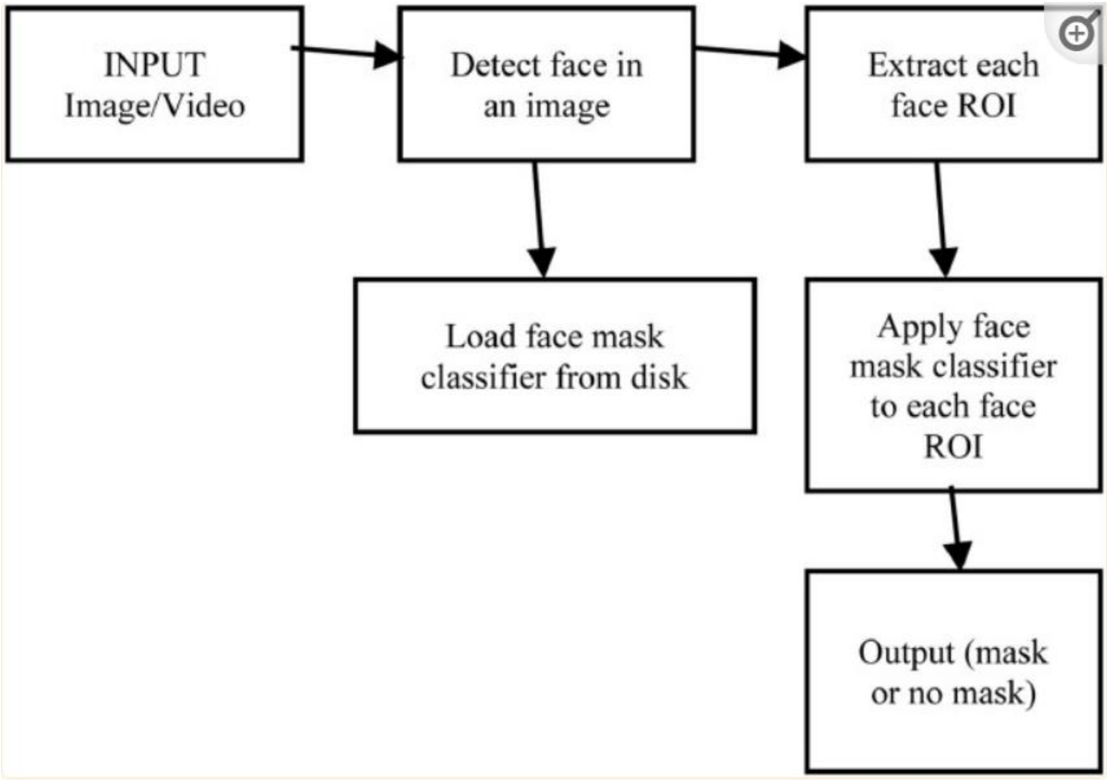

Fig2: Face Mask Detection

STEP 1: DATASET COLLECTION

STEP 2: PRE-PROCESSING

STEP 3: SPLITTING

STEP 4: TRAINING

STEP 5: TESTING/EVALUATION

Dataset Collection:-

The images used for training and testing the model were obtained from the internet. The dataset used in this project was designed by Prajna Bhandary. This dataset contains 1,376 photos divided into two classes: 690 images with masks and 686 images without masks. To create this dataset, they took regular photographs of people's faces and then used a custom-designed computer vision Python script to apply face masks to the pictures, yielding an artificial dataset. Facial landmarks allow the users to instantly infer the position of facial components such as the eyes, nose, eyebrows, mouth, and jawline. Then, using facial landmarks, the dataset of faces wearing masks can be created. To determine the bounding box region of a face in an image, start with an image of an individual who's not wearing a face mask and then apply face detection. It can capture the face Region of Interest (ROI) after determining where the face is now in the picture, and then utilize facial landmarks to detect the position of mouth, eyes, nose, and other features. Initially, an image of a mask is required, which will be put to the face automatically utilizing facial landmarks (particularly, the regions around the mouth and chin) to determine where the mask should be placed. After that, the mask is scaled and twisted before being fitted to the face, and the process is repeated for each of the input images, yielding an artificial face mask dataset.

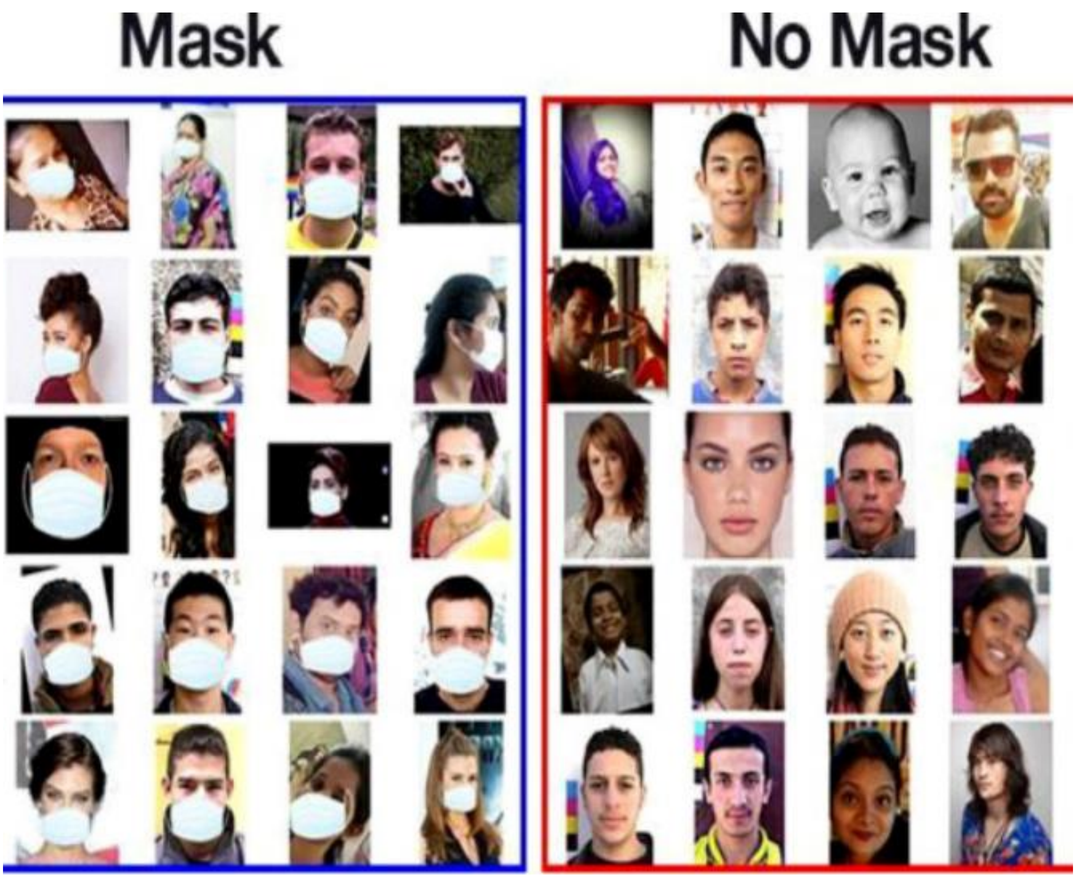

Fig 3: Data Collection

Temprature Detection: -

The MLX90614 temperature sensor is connected to the RPi's GPIO Pin, and appropriate code is written for the sensor. Output is Celsius, and if the temperature reaches the standard alarm is given as a warning. The connection of temperature sensor, Pi cam, and IR sensors with Raspberry Pi is in given Fig.

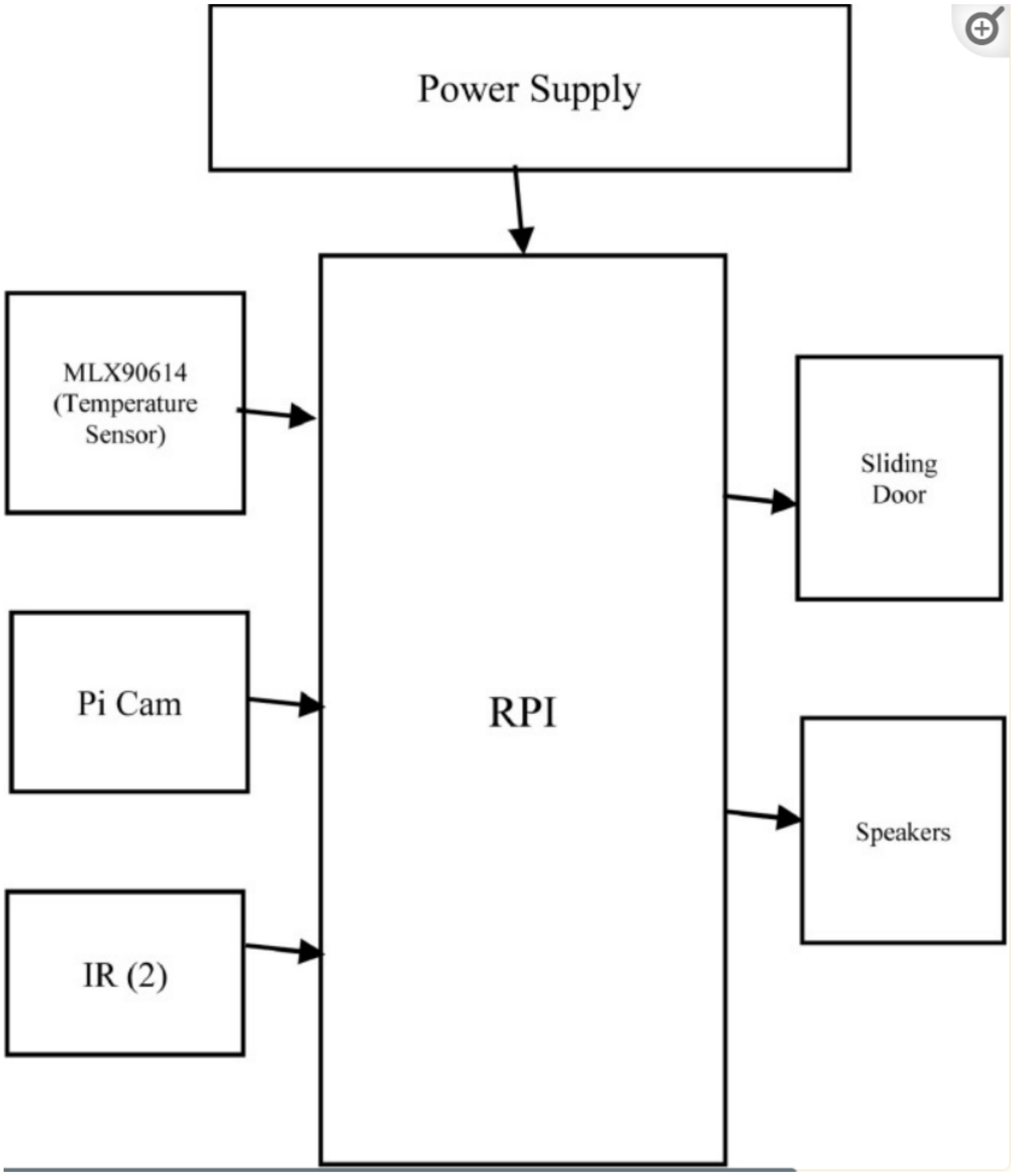

Fig 4: Connections

Software Requirement: -

1. TensorFlow
2. PuTTY
3. VNC

Hardware Requirement: -

Raspberry Pi:-

The Raspberry Pi is a low-cost tiny computer that connects to a computer monitor or television and operates with a regular keyboard and mouse. It is a handy little gadget that focuses on teaching people of all ages about scripting languages like Scratch and Python. It can perform all the functions of a desktop computer, such as internet surfing and viewing greater-definition clip, worksheets, and playing games. It has been used in several digital devices, including tweeting birdhouses, music machines, and detectors, as well as weather stations and infrared cameras since it is capable of interacting with the outside environment.

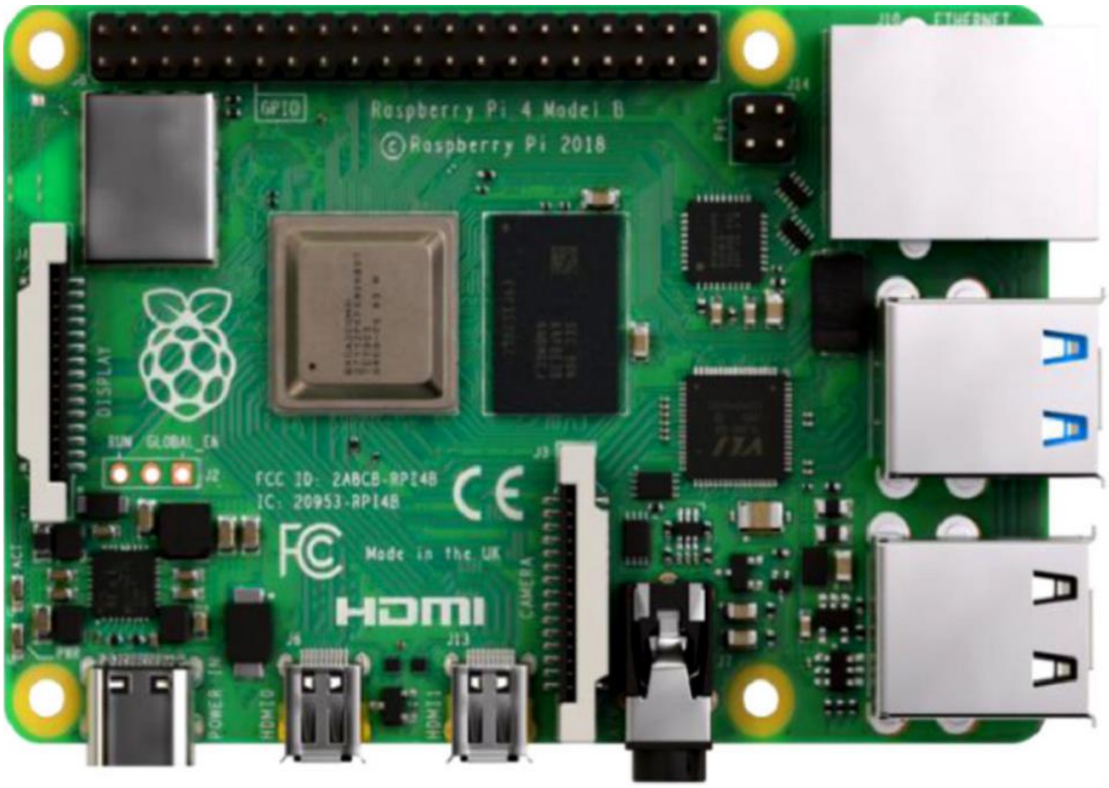

Fig 5: Rasberry Pi

We are using Rasberry Pi 3 b+ module in our system.

R pi's Cam (Raspberry Pi Camera):-

An 8-megapixel sensor Pi Camera of Raspberry is used in this project. This camera module consists of 1080p30, 720p60, and 640 × 480p90 video support and support resolution of 3270 × 2444 pixels resolution. Below Fig shows a Raspberry Pi camera module. It has a fixed lens and a Sony IMX219 image sensor that was specifically made for the R Pi as an add-on board. The Pi module is linked to the RPi through one of the board's little ports on the top part, and it also makes use of the specialized CSI gui, which is specifically made for camera connectivity.

Fig 6: Rasberry Pi Camera

Temperature Sensor:-

The temperature sensor (MLX90614) acts as an infrared non-contact temperature reader that reads the temperature without contacting them. Below Fig shows MLX90614 temperature sensor. Both the Signal ASSP and the IR Sentiment Detector Chip are in the same TO-39(is a type of 'metal can' (also known as 'metal header') package for semiconductor devices.). The thermometer's noise reducer amplifier, with a 17-bit ADC, and powerful DSP efficient unit is used which helps in achieving more correctness. The sensor does have a digital System Management Bus (SMBus) output, with PWN which has been factory calibrated and prepared. A 10-bit PWN is programmed to continuously broadcast the recorded temperature of approximately -19 to 130°C with an outcome resolved up to 0.15°C.

Fig 7: Temprature Sensor

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 06 | June - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Servo Motor:-

A servo motor is used to demonstrate the opening and closing of the main door. Blow Fig shows a diagram of a Servo Motor , that produces velocity and torque based on the voltage and the amount of current supplied. It also works as a part of a closed-loop system providing velocity and torque as commanded from the servo controller with a feedback device to close the loop.

Fig 7: Servo Motor

System:-

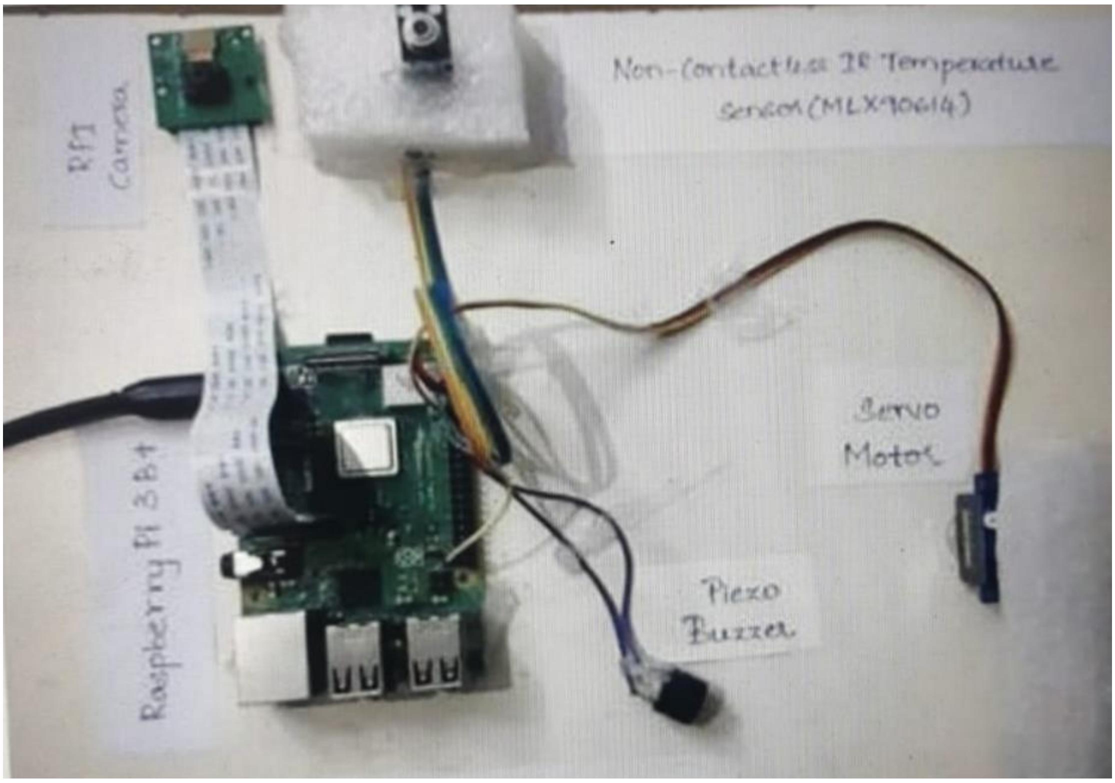

Fig 8: Proposed System

RESULT :-

We are able to recognize the people with or without mask and their tempreture.

Results

IR Count	Temperature Check	Mask Detection	Door Open/Close
Count < 5	Temp < $39^{\cdot c}$	Mask detected	Open
Count > 5	Temp < $39^{\cdot c}$	Mask detected	Close
Count < 5	Temp > $39^{\cdot c}$	Mask detected	Close
Count < 5	Temp < $39^{\cdot c}$	Mask not detected	Close
Count > 5	Temp > $39^{\cdot c}$	Mask not detected	Close

Equation:-

Train for 34 steps, validate on 276 samples

Epoch 1/20

Loss: 0.6431 - Accuracy: 0.6676 - Val-loss: 0.3696 – vale-Accuracy: 0.8242

Epoch 2/20

Loss: 0.3507 - Accuracy: 0.8567 - Val-loss: 0.1964 - vale-Accuracy: 0.9375

Epoch 3/20

Loss: 0.2792 - Accuracy: 0.8820 - Val-loss: 0.1383 - vale-Accuracy: 0.9531

Epoch 4/20

Loss: 0.2196 - Accuracy: 0.9148 - Val-loss: 0.1306 - vale-Accuracy: 0.9492

Epoch 5/20

Loss: 0.2006 - Accuracy: 0.9213 - Val-loss: 0.0863 - vale-Accuracy: 0.9688

Epoch 16/20

Loss: 0.0767 - Accuracy: 0.9766 - Val-loss: 0.0291 - vale-Accuracy: 0.9922

Epoch 17/20 loss: 0.1042 - Accuracy: 0.9616 - Val-loss: 0.0243 - vale-Accuracy: 1.0000

Epoch 18/20

Loss: 0.0804 - Accuracy: 0.9672 - Val-loss: 0.0244 - vale-Accuracy: 0.9961

Epoch 19/20

Loss: 0.0836 - Accuracy: 0.9710 - Val-loss: 0.0440 - vale-Accuracy: 0.9883

Epoch 20/20

Loss: 0.0717 - Accuracy: 0.9710 - Val-loss: 0.0270 - vale-Accuracy: 0.9922

Loss/Accuracy

Conclusion:-

New developments and the availability of smart technologies force to the creation of new models, which will help meet the needs of developing countries. In this work, an IoT-enabled smart door is developed to monitor body temperature and detect face masks that can enhance public safety. This will help to reduce manpower while also providing an extra layer of protection against the spread of Covid-19 infection. The model uses a real-time deep learning system using Raspberry pi to detect face masks, and temperature detection as well as monitor the count of people present at any given time. The device performs excellently when it comes to temperature measurement and mask detection, the trained model was able to achieve a result of 97 percent. The test results demonstrate a high level of accuracy in detecting people wearing and not wearing facemasks, as well as it also generates alarms monitored and recorded. Furthermore, there are numerous techniques to enhance performance to improve results. Future development will include improving the accuracy of these steps, using a combination of various features, and improving performance, as well as producing a mobile app with a user friendly interface for monitoring. As a result, authorities will be able to take immediate action following pandemic safety standards.

Validation/Accuracy

	precision	recall	f1-score	support
With mask	0.99	1.00	0.99	138
Without mask	1.00	0.99	0.99	138
Accuracy			0.99	276
Macro avg	0.99	0.99	0.99	276
Weighted avg	0.99	0.99	0.99	276

Temperature Measurements compared with mercurial thermometer

Temperature measurement in mercurial thermometer (°C)	Experiment temperature in this system (°C)	Temperature measurement error absolute value (°C)
36.8	36.03	0.05
37.2	37.16	0.04
38.0	37.92	0.08
38.5	38..52	0.02

REFERENCES:-

1. A. Rosebrock,"COVID-19: Face Mask Detector with OpenCV, Keras/TensorFlow, and Deep Learning", May 4, 2020, https://www.pyimagesearch.com/2020/05/04/covid-19-face-mask-detector-with-opencv-keras-tensorflow-and-deep-learning/.

2. A. Hidayat, Subono, V.A. Wardhany, A.S. Nugroho, S. Hakim, M. Jhoswanda, "Designing IoT-Based Independent Pulse Oximetry Kit as an Early Detection Tool for Covid-19 Symptoms ", 2020 3rd International Conference on Computer and Informatics Engineering (IC2IE).

3. Carlo Alberto Boano Matteo Lasagni Kay Romer Tanja Lange. "Accurate Temperature Measurements for Medical Research using Body Sensor Networks".

4. Cristina S..........-.C......, B-P BUTUNOI and Calin C......," IoT Based Intelligent Building Applications in the Context of COVID-19 Pandemic", 2020, 10.1109/ISETC50328.2020.9301124

5. Yahaya F.H., Yusoff Y.M., Abidin H.Z., Rahman R.A. IEEE International Conference on Information Management and Engineering. 2010. Development of a PIC-based wireless Sensor node utilizing XBEE Technology. [Google Scholar]

6. Deora Gayatri. IEEE Conference on Advances in Signal Processing. 2016. Ramakrishna Godhula and Dr. Vishwas Udpikar "Study of Masked Face Detection Approach in Video Analytics. [Google Scholar]

7. https://www.electronicwings.com/arduino/servo-motor-interfacing-with-arduino-uno.

8. https://www.robocarstore.com/products/raspberry-pi-4-model-b-board-with-1gb-lpddr4-sdram.

9. K Baskaran, Baskaran P., N. Kumaratharan, Rajaram V., "IoT Based COVID Preventive System for Work Environment", the Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC) IEEE Xplore Part Number: CFP20OSV-ART; ISBN: 978-1-7281-5464-0.

10. Lim, M.G., & Chuah, J.H. (2018). Durian Types Recognition Using Deep Learning Techniques. 2018 9th IEEE Control and System Graduate Research Colloquium (ICSGRC). doi:10.1109/icsgrc.2018.8657535.