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Paper Authors
V. S. R. K. Prasad G. , G.Jhansi Lakshmi, T.Sai Swetha, G.Mahesh, T.Divya Sai

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IOT BASED COVID-19 MONITORING SYSTEM FOR MASK &TEMPERATURE USING PI

[1]V. S. R. K. Prasad G. , [2]G.Jhansi Lakshmi, [3]T.Sai Swetha, [4]G.Mahesh, [5]T.Divya Sai

[1]Associate Professor in CSE, PSCMRCET, Vijayawada.

[2,3,4,5] Student, CSE, PSCMRCET, Vijayawada.

[1]prasad.kdpl@pscmr.ac.in, [2]gandabathulajhansilakshmi0415@gmail.com,

[3]saiswethathallapaka10@gmail.com, [4]maheshgunti9063@gmail.com,

[5]divyasaitiru@gmail.com

Abstract

After the arrival of covid in the modern era, survival has become a major issue that must be addressed and taken care of. As prevention is better than cure, it is necessary to take some preventive measures to limit the spread of coronavirus, such as wearing a mask, checking our body temperature, and sanitizing our hands. This can be done manually, but there are some drawbacks, such as many people may come into contact, which is a major source of spreadingthe disease, and it also costs high labor. So, in order to mitigate these issues, we intend to createa device that automatically detects a person when he approaches the device and determines whether the person is following preventive measures or non. Detects face masks using a Pi camera integrated with the Raspberry Pi, and then measures temperature using a non-contact less temperature sensor; if a person is tiring a mask and has a normal temperature, the final sanitization process is performed using a servo motor; otherwise, if there is no mask or the measured temperature is higher than the specified value, the process is aborted. Then a buzzer sound is produced, indicating that the person is not following up on preventive measures. These types of devices are most commonly used in entry detection areas.

Keywords: USB Camera, MLX90614 Contactless Temperature Sensor, Servo Motor, IR Sensor.

I. INTRODUCTION

Since December 2019, the entire world has been experiencing numerous difficulties as a result of the entry of the coronavirus, also known as COVID-19, which originated in Wuhan, China and has rapidly spread to several countries, including India, the world's second-most crowded country with a population of over 134 billion persons [20- 22]. It has swallowed many lives and still many lives are in danger. We've been fighting this condition for two years, but there is still no proper vaccine or therapy for it, therefore the best approach to get rid of it is to take preventive measures, as prevention is better than cure. In densely populated countries like India, however, limiting disease spread is a difficult undertaking. Government authorities or any private institutions cannot take care of each and every person so every individual should take care of themselves by following the necessary precautions.

This project of covid guiding system based on IOT provides an efficient automatic detection of a person whether

he/she is following the necessary preventive measures or not. Using a device also gives us a count of the number of people passing from the device. We have used the Internet of things in this because IOT is influencing our lifestyle in every way. It is a huge network of internet supporting devices, gadgets share data with the help of embedded sensors and a common platform is provided by IoT for storage data from different sensors.

This covid monitoring device performs three necessary actions which prevent coronavirus. Namely Face mask detection, Thermal scanning, and Sanitization. When the person comes near to the device, it first performs the detection of face mask if it detects the mask then goes to the next process of detecting the person's body temperature and performs the final process of sanitization. If a person has no mask or if the temperature is higher than the specified value, then the device gives us a buzzer sound. The person can only enter the place he/she is with a mask and with low body temperature. In addition, with preventing from covid the data of person who visit the device is stored in local server. So, this type of device can be efficiently used at places where we can do entry detection.

II. RELATED WORK

In [1] B Varshini et.al, This smart door would use a machine learning model to screen body temperature and detect face masks. So that we can recognize whether the person is following preventive measures and are not affected with any fever at the time of entry itself. The requirements and the methodology can be defined as for efficient face mask detection, the tensor flow software library and pi camera of raspberry were used. Tensor flow and keras are used to train the mask detection model in this project these can include steps like data, pre-processing, training and testing etc. A deep learning algorithm is used to identify the face mask and to check the individual's body temperature, a non- contact temperature sensor called MLX90614, is used to measure the temperature which are integrated with Raspberry Pi. Not only mask and temperature detection this smart door can also keep a count of people entering and
leaving the room by making use of IR sensors and servo motors do the work of opening and closing the doors and this system also generates alarms. This reduces manpower and also protects against the spread of covid-19.

In [2] Chen et.al, The entire world is aware of the most terrifying disease, coronavirus, and its consequences. We lost many lives due to this virus and still many lives are in danger. The transmission of small respiratory droplets from one person to another can be the primary cause of covid19. So, to avoid its spread wearing a mask is a necessary, convenient, and effective measure. This project proposes a detection system based on mobile phones. We first extract four features from the grey level cooccurrence matrices (GLCM8) of the face mask's micro photos, and then we use the k nearest neighbor (KNN) algorithm to detect the next three results. In this project we also propose a service stage detection method based on a mobile microscope which can be used to obtain the micro- photos of the face mask being used. Mask detection is one of the necessary prevention methods that can be performed in this way. The mobile microscope can be used to regulate whether a person is wearing a mask or not.

In [3] Harish Adusumalli et.al, The Covid- 19 widespread is producing a global health-care emergency. Because anticipation is better than treatment. It is vital to take some measures, such as wearing masks, as this is one of the most common ways for the disease to spread. Using OpenCV, this project identifies the face mask. This project provides a method for detecting face masks that uses TensorFlow and OpenCV. At a certain time, this project identifies a person's face mask. For the identification of face masks on humans, this project uses OpenCV, Caffe based face detector, Keras, TensorFlow, and MobileNetV2. The Kaggle Repository dataset was split into two parts: 75 percent for training and 25 percent for testing. Faces were obtained using the default OpenCV module. A database that stores info about a person. If any person is not wearing the mask, the person's face is saved in the database after checking the face mask detection. It uses the details contained in the database to detect that person's name, and an email is sent to that individual notifying them that they are not wearing a mask, so they can take precautions.

In [4] Tanima Bhowmik et.al, The monitoring of body temperature has become one of the important bases for pandemic stoppage and testing. Intelligent pandemic prevention temperature measurement system (ITMS) and pandemic prevention situation analysis (PPAS) are proposed in this study. The high cost of detecting body temperature can be encountered by the above measurements. It can be used for promote health and as well as promote more applications. For checking the body temperature, the traditional forhead thermometer is the quickest and most appropriate solution. The main advantage is low cost for maintaining and also give accurate body temperature. It supports any power supply. Here instant warning is raised when the person is at high temperature. It only performs by using internet of things (IOT) technology to prevent the body temperature.

In [5] Dharmveer Singh Rajpoot et al., design IOT devices coupled with a programmable-Ultra-Violet (UV) based system for sanitising a bundle of objects to prevent such circumstance dwell mental situation whether to touch the goods or not to contemplate in covid pandemic. In this study, an artificial intelligence-based IOT- UV system for sanitization of package shells is highlighted, as well as an unique algorithm for IOT-UV-based devices to improve the effectiveness of decontamination devices while using less energy. IOT-UV will be more efficient than Programmable-UV light in terms of evaluating performance due to its low energy usage. IOT Ultraviolet (UV) used for sanitising object surfaces such as transporting products and other grabbing items.For optimization, the artificial intelligence algorithm could be used. The created system can be linked in a variety of locations, including stores, industries, malls and markets, railway stations, banks, airports, and pantry's.

III. PROPOSED SYSTEM

This entry detection system was an integration of three operations mask detection, temperature detection and sanitization. The foremost mask detection process was proposed based on deep learning- model, named Mobile Net Mask, to prevent human-to-human spreads of the covid-19 by detecting faces with or without mask. These two different datasets contain over 3833 images to train and test the model. Mobilenetv2 was used here because it contains less parameters and

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more accuracy. For further temperature detection we are using a non-contact less temperature sensor. If both the rules are satisfied then sanitization will be performed simultaneously all these information will be stored in the local server. By this whole process we can detect whether the person is properly following the covid measures or not. If a person was following the rules, then the gate will be opened for him/her or else the entry is restricted for them.

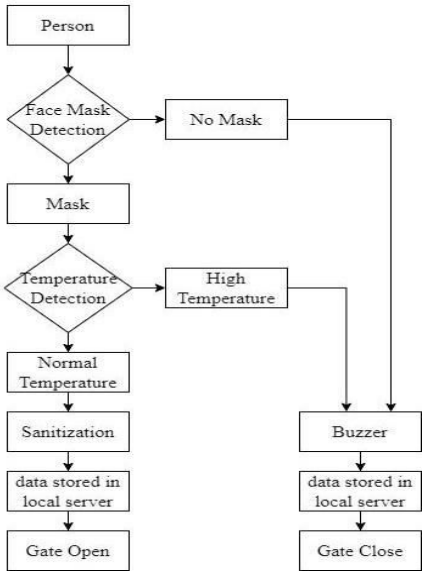

Fig 1: System Architecture

Figure 1 illustrates the proposed system's system architecture. When the person is near to the device then automatically system detect the face mask if the wearing the face mask then next step temperature detection is performed, if the person having low body temperature then automatically sanitization will be done and then gate opens then the person allowed to the particular place. Otherwise, buzzer sound will on and the person not allowed to the particular place.

1. FACE MASK DETECTION

The foremost amount to prevent the spread of coronavirus is to wear a mask. So, the main objective of this project is to notice whether a person is wearing a mask or not in any public gatherings or organizations. To achieve this objective the algorithm used is MobileNetV2. Face mask detection involves few processes which are preprocessing, data augmentation, training, testing and image segmentation. The two input data sets used are images of few people wearing a mask and without wearing a mask. Then, the model is implemented using a usb camera where we get the result of people tiring a mask or not along with accuracy percentage. By performing this detection, we can restrictthe entry to that particular person who iswithout mask.

A. DATA PREPROCESSING

Data preprocessing is process of cleaning the unwanted data. There are four steps in preprocessing: -

- Resizing image size.
- Converting the image to the array.
- Preprocessing input using MobileNetV2.
- Hot encoding and labels.

The resizing image is a grave preprocessing step in a computer vision due to the efficiency of training module. The main aim of preprocessing is to decrease unwanted distortions and improve image data along with enhancing few important features. The small size of image, the better the modelwill run. In this study the resizing image is making the image into 224*224 pixels. The next step is to process all the image in the data set into an array. The image is converted into the array for calling them by the loop function. After that, the image will be

used to preprocess input using MobileNetV2. The last step in this phase is performing hot encoding on labels because many machine learning algorithms cannot operate on data labelling directly. They require all input variables output variables tobe numeric, including this algorithm. The label data transform into a numeric label, so that the algorithm can understand and procedure the data.

B. TESTING

First, we apply data augmentation to images. Here we generate multiple images from single image. We use Image DataGenerator() function by performing operations as crop, shift, rotate and flip etc.

1.We have used flip operation which will flip the image to desired one as horizontal or vertical flip. Vertical flip is equal to rotating image to 180 degrees.

2. For rotating we rotate to desired position but the shape of image will not change.

3.In shift operation the pixels are going to move in horizontal or vertical motion.

There are 2 models in mobilenetv2, base model and head model. Base model will perform first. The output of base model is input to head model. The head model will perform average pooling, flattening, dense, dropout. Output of head model and input of base model will store in model. We need to freeze the layers in base model for first training process. Next give internal rate as 1 exponent 4. for compilation we giving binary cross entropy, adam optimizer as well as track the accuracy metrics. We generate augment images by imagedatagenerator asto train more images because we have less datasets. In training for validation data, we use testX, testY datasets. After evaluate the network by predict method. Similarly, each image in testing set we need to find the index of label corresponding to largest predicted probability, np.arg method use for this operation. By this classification report is generated. Save the model by save method as h5 format. By last, we are going to plot the accuracy, metrics, by math plot lib and save image from math plot lib. By the end we should have 2 files saved to our desk, model file and plotting file.

C. IMPLEMENTATION

Load the facenet for face detection under the face detection file. Save the path in a variable and read the variable and DNN module. DNN stands for deep neural network. Similarly, we are loading the face detection model. Now we have a model for face detection and a model for mask detection. After the model we need to load the camera, for this we use a video stream. First by camera we read a frame, frame is nothing but an image. Frame size of 400. Facenet, masknet and frame arguments are sent to a function for manipulation. We return location and prediction from the function. Location means the X,Y coordinates for face surrounding. Prediction means the accuracy of a person wearing a mask or not. store the predicted fromfunction in label of with mask or without mask. Now we are ready to apply the predictions on the box that have returnedfrom the function. For color we choose BGR color coding standards.in

CV2. (0,255,00 indicating green color and (0,,255) as red color. Green for people with masks and red for people without masks. After we display labels for the box Prediction in the format of 80% or 90% label. After prediction, destroy all the windows that have opened.

2. TEMPERATURE DETECTION

After performing mask detection, the device performs temperature detection. During pandemic there was a strict rule that the people with high body temperature should isolate themselves because there was a high risk that virus attacks them easily. So, this device detects the temperature of a person by using a temperature sensor(mlx90164). We assign a specified value of temperature to the temperature sensor. If a person's body temperature is low than the specified temperature then it will move to the next process in case the body temperature is higher than the specified temperature then it will make a buzzer sound indicating that the person is not allowed. This is how temperature detection can be performed.

3. SANITIZATION

After the mask and temperature detection the process of sanitization begins. This sanitization will only be performed if the person is tiring a mask and having normal body temperature otherwise if person has no face mask or having high body temperature the device doesn't sanitize the person. As we know prevention is better than cure, we should beware of viruses. Even though we take care of ourselves sometimes unknowingly we may touch objects or persons having multiple physical contacts. These contacts may include infected personstoo. So, it is necessary to sanitize ourselves. After the mask and temperature detection the process of sanitization begins. This sanitization will only be performed if theperson is tiring a mask and having normal body temperature otherwise if person has no face mask or having high body temperature the device doesn't sanitize the person.

4. ENTRY/EXIT

Along with this sanitization process there is a gate system which indicates the entry is allowed to that person or not. If a person violates any of these measures of wearing a mask or having normal body temperature then it gives a buzzer sound and the gate will be closed in order to restrict the entry ofthe person.

If person is following the measures perfectly then the gate will be opened. Along with this whole process this device also allows to store the information of the person wearing a mask yes or no and degree of their temperature in a local server.

IV. EXPERIMENTAL RESULTS

A. Accuracy

Machine learning model accuracy is the dimension used to determine which model isbest at identifying relationships and patterns between variables in a dataset based on the input, or training data.

Formula:

$$\text{Accuracy} = \frac{\text{(Total Number of correct predictions)}}{\text{(Total number of samples)}}$$

B. Precision

Precision is one indicator of a machine

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learning model's performance the quality of a positive prediction made by the model. Precision refers to the number of true positives divided by the total number of positive predictions.

C. Recall

Recall literally is how many of the true positives were recalled, i.e. how many of thecorrect hits were also found.

Formula:

$$\text{Recall} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Negatives})}$$

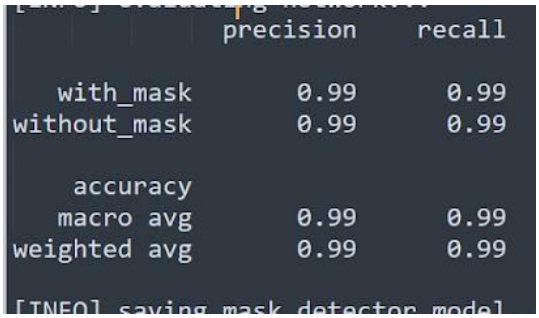

Fig 2: Analysis

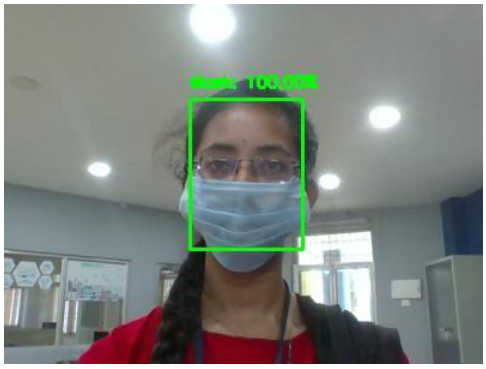

Fig 3: Mask detection

If the person having mask, then temperaturedetection step is performed

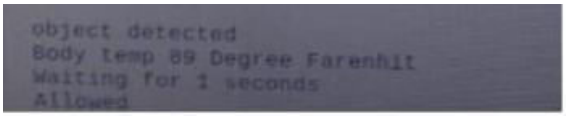

Fig 4: Temperature Detection

If the person wearing a mask and having lowbody temperature then automatically sanitizeand gate opens.

Fig 5: Automatic Sanitizer

Person having mask and low body temperature then next step automatic hand sanitization will perform.

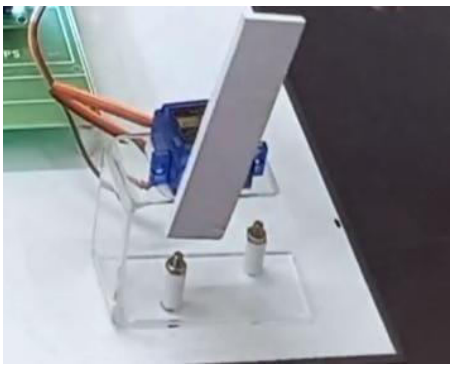

Fig 6: Gate Open

Person having mask and low body temperature then automatically sanitize and gate will open.

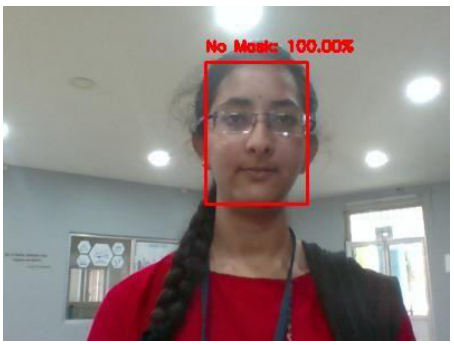

Fig 7: No Mask Detected

Person not wearing mask then buzzer sound will on and not allow to the particular place.

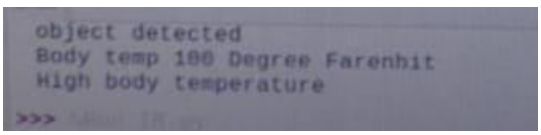

Fig 8: High Body Temperature

If no mask or having high body temperature then automatically buzzer sound will on and the person not allowed to the particular place.

V. CONCLUSION

This study provides a covid guiding system device. The only way to escape from the spread of covid is by following preventive measures. This device is for detecting masks, checking body temperature and sanitizing hands in public places by using internet of things technology. All the three main measurements are done by the IOT device. The person can enter the place if they wear a mask and have low body temperature in order to avoid spreading the corona virus disease. The buzzer sound and notification to corresponding employer is sent, so the employer will take care of. We use a raspberry pi processor for connecting all 3 modules. By this device we can remove human negligence activities.

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