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Face Mask Detection and Attendance System

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Abstract - *Computer vision could solve many problems in the real world that cannot be solved by usual means. During this tough COVID-19 pandemic , we can use computer vision to deploy a solution to prevent contraction of this deadly virus. Our project aims to create a system which detects whether a user has worn a mask or not and notifies him to wear it if he hasn't. It also marks his/her attendance using barcodes/RFID tags which eliminates biometrics which require touch. Touchless attendance and proper masks would contribute to containing this virus. Here using opencv and a few other libraries in python, the software would accept a video feed and process it. In processing it would reduce the feed to a grayscale image, eliminating RGB colours. From the grayscale image the facial features which are nose, mouth, eyes would be detected by several HAAR cascades. Here a decision logic is applied and based on the features detected the system would prompt whether the mask has been worn appropriately or not. When the mask is successfully detected, the user would be asked for a touchless RFID tag or barcode which identifies the individual from the database and hence marking his/her attendance safely. This system would be completely touchless and would promote social distancing and hygiene . The system could be used everywhere in industries, offices and schools to create a safe environment from COVID-19 virus and it could also help in avoiding future pandemic outbreaks around the world.*

Key Words: Face mask-detection, Attendance, Barcode, OpenCV, Keras, Face, mask, detection

1.INTRODUCTION

Computer Vision is a part of Computer Intelligence that trains the data processing machine to learn and interpret the feed from visual world . With the help of video feed or camera feed from several capturing devices, a computer can precisely detect, examine, identify, and classify objects to respond to what it sees if trained well. We can use computer vision to solve many real life problems efficiently. The ongoing COVID-19 pandemic is one such example of an urgent situation that can be addressed to using computer vision.

The COVID-19 pandemic is an unparalleled crisis which has affected more than 215 countries across the globe by infecting more than 13 million people. In order to reduce the spread of coronavirus, people often wear masks and sanitise surfaces to protect themselves and it is also mandated by law in several countries.

Many workspaces need to have individuals at their offices or workplaces physically and in such situations work from home can't be possible. at least in the near future . The pandemic has also hit the economy of nations and hence opening offices or public transport has become more important. In these tough times, we need to find a solution and way to live or coexist with the virus as no cure or vaccine is available yet and in the near future

In this project, our sole purpose is to deploy an application that detects whether a user has worn a mask or not and also maintain a record of attendance without disturbing precautionary steps taken for avoiding the COVID-19 virus. This would play a crucial role in helping countries to maintain strictness and keeping the pandemic in control while not disturbing workspaces, productivity and safety of individuals.

1.1 Project Importance

World won't be the same post Covid-19 pandemic. Entire system will have to undergo major changes to adjust with repercussions of the pandemic. At many places, Work culture has already started changing and will further change to meet the requirements of the current time.As people are getting back to work again, it is important to create a safe working environment for them. Many countries have issued some guidelines that require people to wear masks, follow social distancing and record temperature while entering the workplace.

Face Mask Detection with Attendance System is a contactless approach that fulfills many countries' policies and creates a safer and working environment.

1.2 Scope of Project Work

The following problem scope for this project was arrived at after reviewing the literature on face detection and attendance systems, and determining possible real-world situations where such systems would be of use. The following system(s) requirements were identified

Airports: The proposed System can be of great importance at airports to detect travelers without masks. Visitors' data can be captured as videos in the system at the entrance.

Hospitals: The proposed system can be integrated with CCTV cameras and that data may be administered to see if their staff is wearing masks.

Offices: The proposed system can help in maintaining safety standards to prevent the spread of Covid-19 or any such air borne disease. If some employee is not wearing a

mask, they can receive a reminder notification to wear a mask.

Colleges: The proposed system helps in identifying whether a student/staff has worn a mask and uses Barcode/RFID tags to mark his/her attendance.

The choice of a system must be based on the best performance. Hence the above

performance metrics may be considered for coming out with the best system so that it can be implemented at large scale.

1.3 Survey of Existing System

From the survey paper published by the team , paper deduces the following:

2: In this proposed system,The system converts the image to grayscale and checks for facial features of eyes, nose and mouth by HAAR cascade. and then on the basis of decision logic. It detects the facial features and also detects the presence of masks. if the face is detected and if then either any of the face features is not detected , the mask is absent else mask is present . In this proposed system we get accuracy of 92.8% with mask and 97.4% without mask.

3: In this proposed system, it uses machine learning to detect object on the basis of facial features and various algorithm. in this system the picture is converted to grayscale by eliminating RGB colours and uses rectangles to distinguish edges and identify the facial features this system is named as Viola-jones method. by this system we get accuracy of 94.8% and also it is 15 times faster than any other algorithm. so it consumes very less time to detect facial features.

4: In this proposed system, it uses deep learning to identify objects on the basis of certain functions and algorithm, it uses ResNet or mobileNet as backbone Transfer learning , and attention mechanism for face and mask detection the proposed system achieve State-of-the-art result on a public face mask dataset, where we get 2.3% and 1.5% higher than the baseline result in the face and mask detection.

5: In this proposed system, the design's preliminary method combines HAAR like features descriptors to detect the face as well as key features of the face from the camera based acquisition of a mobile phone; namely detection of eyes, nose and mouth,the system basically checks whether a user worn mask properly or not. this system was implemented and experimented in which it works perfectly.

6: This system is trained to identify accurately whether a person wore a face mask or not, if not an alarm should be generated by an algorithm which alerts the people around or concerned authority nearby. This system was built on various different classifiers from which ADAM performs very well and accurately.

1.4 Limitations in existing system

As the COVID-19 pandemic came so abruptly, due to which the requirement for a Face Mask Detector came into existence but only a limited amount of research was made for Face Mask Detection, due to which there's a large amount of research gap, limitations and no. of drawbacks.

Few of them are listed below:-

A research was conducted for Face Mask Detection using deep learning and neural networks of two types ie. One-Stage Detector and Two-Stage Detector, In One-Stage Detector single neural network is used, but it Sacrifices its Accuracy for high Speed detection whereas Two-Stage there is High Accuracy but low Speed.

The system is still learning and optimisations are needed, it is giving inaccurate results and different classifiers are being tested.

2. Proposed System

With this rapidly changing Environment we also need to change the way we work so that we can survive this pandemic without affecting our growth. Currently, masks are mandatory in all public places and in crowds.The system we propose will provide a safe approach to workspaces and maintain hygiene as well.

The system will check whether a user has worn a mask or not and hence ask them to wear it if they haven't worn a mask. The detector would also maintain an attendance database with it. Biometrics that are in use currently cant be deployed in the current pandemic situation. Hence we propose providing unique RFID tags / Barcodes for identification of individuals and keeping a record of them. This ensures that no surface is infected and is clean as well as the workspaces remain active.

The entire system would be deployed and this would help to be safe from the current pandemic and ensure safety of workers, students and others.

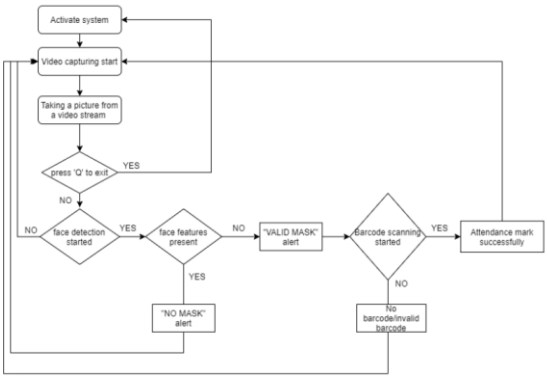

Chart -1: Flow Chart of the program

2.1 Details of Requirements

We will require the following Hardware-

1) Camera-480p / 720p

This ensures a clear camera feed for more accurate and better detection of facial features as well as mask.

2) Barcode / RFID tags

This will be issued to all on id cards or separately , it would identify the person in the system's database.
3) Barcode Scanner /RFID tag scanner
This would detect and recognise the person using tags and databases.
4) CPU Requirements
a) Ram-4GB
To give accurate and better performance with processing
b) Graphic Card with CUDA Cores (NVIDIA)-2GB
A Graphic card with CUDA cores is necessary for maintaining a non-stuttering video feed to python for processing. Without CUDA cores the video feed received has delay and inaccuracies.
c) Intel i3 Processor or equivalent
To maintain good performance and is required by python and face_recognition modules.
We will require the following software-
1) Python Version -3.8.0
For processing the feed received from the camera , retrieving and accessing databases and controlling the flow of the software as backend language python is used here.
2) Python Libraries-
The following libraries are used to process the image data, creating friendly user interfaces and maintaining the databases with attendance and records.
a) OpenCV
b) face_recognition
c) Tkinter for User Interface
d) And a few miscellaneous libraries.
3) Database- SQL
It will be used to keep records and identities of individuals in database SQL would be used and it will be accessed using python. It will also mark attendance and keep records of the same .

2.2 Implementation

The entire project is developed, maintained using GIT. To ensure that the team can work smoothly and efficiently each module was classified into different files with their own classnames.
The project was implemented in the following phases -
The design was proposed and structured using figma
The proposed interface was evaluated and created in python's Tkinter library.
The user interface comprises of two parts;-
Activating the entire attendance and face mask system
Opening the administrator panel to manage database and attendance
An ER diagram of the database was sketched out and was implemented in the database.
The database queries were coded and methods were created in python which interacts with the User Interface. All these methods were included in 'database.py'
To detect Face Mask and facial features we used a combination of HAAR Cascade, ADAM classifiers and a well trained model for detecting the mask. The Model was trained and tested on the basis of a few cases :-
Mask Detected
No Mask Detected
Mask Detected but improperly worn
The trained model was fetched in the file 'facemask.py' and using opencv for video feed capture, the model is compared. Upon successful detection of the face mask, the attendance module is invoked.
The attendance module is used to mark the attendance using pandas, pyzbar. The attendance of all the students in the database is recorded in a csv file which is updated daily. The default values set for all users is absent.
To mark a user present, a barcode is read. Pyzbar module in python is used with opencv which detects a barcode and reads it. This module is coded in 'barcode.py' and it returns a string value of read barcode back to the attendance module.
The attendance module fetches this barcode and searches for the same if it already exists in the csv file else adds it to the csv file by comparing it with the database. When the attendance is marked the default value is modified to 'present' for that particular barcode number.
The system loops entirely so that there is no need to activate it repeatedly. The system can be stopped by pressing the 'q' key on the keyboard.

2.3 Testing

The entire program is tested well and in a different set of conditions. Some of the conditions tested are displayed in the following diagram as detected by our face mask module:-
In the testcase 1 : All 3 facial features, mouth , nose and chin are visible so our system is indicating that the user has not worn a mask .
In the testcase 2 : In this test case user has not worn mask properly and some facial features are visible so it is indicating "NO MASK"
In the testcase 3 : In this test case all 3 facial features are hidden so our system is indicating the proper mask.

While detecting "NO MASK" our system has accuracy of 95% which we have observed while testing test cases and for "VALID MASK" we have got the accuracy of around 88% to 92% in proper surroundings.

MASK NOT WORN AT ALL	MASK WORN IMPROPERLY	MASK WORN PERFECTLY
		

It still needs optimisations according to different light conditions and different environments. This can be achieved by making minor adjustments to code.

For the Barcode module, the tests were conducted under different lighting conditions and distances with edge cases involved. It works in almost every condition. It returns and approximate accuracy of 99 % when scanned at a distance of 20 to 30 cms

2.4 Results

In our program we have successfully implemented a Face mask detection and attendance system, and we have detected that our system has a very easy and minimal interface for better interaction.our database is optimal and can successfully hold a very large amount of data efficiently.

Our Face mask detection works quite well with accuracy of 95% which we have seen while testing and to increase the accuracy we can improve the camera quality and while face mask detection we should keep the distance of 0.7 meter for better accuracy.

Our Barcode scanning program for the attendance system works perfectly well with 99% accuracy which we have seen while testing but to achieve 99% accuracy users should keep the barcode 20 to 25 cm away from the camera.

To improve the accuracy of face mask detection and barcode scanning we can optimize our system according to a particular environment for better experience.

And we have stored the attendance data list in a CSV file with proper date and time for proper attendance management and the administrator can easily access it and make changes if required.

3. CONCLUSIONS

In this paper, we have designed a novel face mask detector with an attendance system, which can possibly contribute to public healthcare. However, during the coronavirus pandemic, it is advised that wearing a mask properly can reduce the coronavirus transmission significantly.
Coronavirus spreads from touching the infected surface and the finger biometric system requires putting a finger on the surface of the biometric attendance system.
The barcodes or RFID tags will be helpful in such pandemic situations that would be attached at the back of each student's ID card and the information that would be embedded in the barcodes will contain unique information of the student. Students will be able to mark his/her attendance by just waving their identity card through the barcode/RFID scanner.
For instance, this application can be employed in colleges or offices where the doors open automatically to detect whether a student/staff is wearing a mask or not and also mark his/her attendance.
This system can be scaled in the future according to different requirements and environments. For example, the image processing could be scaled to identify multiple individuals in a crowd not wearing a mask in streets.

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