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Application of IoT in Covid -19 for Face Mask Detection

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ABSTRACT

The COVID-19 pandemic has underscored the importance of public health measures, with face masks playing a crucial role in mitigating the spread of the virus. In this context, the integration of IoT has emerged as a promising solution for effective face mask detection and enforcement of safety protocols. This paper explores the application of IoT in the context of COVID-19 for real-time face mask detection. The proposed system utilizes IoT devices equipped with advanced sensors and image processing capabilities to monitor individuals in public spaces. These devices capture and analyze visual data to identify the presence or absence of face masks on individuals. The collected data is then transmitted to a centralized system for further analysis and decision-making. Key components of the system include edge devices with embedded cameras, machine learning algorithms for image recognition, and a centralized IoT platform for data aggregation and management. The machine learning models are trained to accurately detect and classify faces with or without masks, ensuring high precision and real-time responsiveness. By providing immediate feedback to individuals without masks, the system promotes adherence to preventive measures, contributing to the overall public health efforts against COVID-19. Furthermore, the collected data can be used for analytics and monitoring compliance trends over time. This information can assist authorities in making data-driven decisions, optimizing resource allocation, and implementing targeted interventions in areas with lower compliance rates. The integration of IoT technologies for face mask detection presents a practical and efficient solution to enhance public safety during the COVID-19 pandemic. The proposed system leverages the capabilities of IoT to provide real-time monitoring, feedback, and valuable data insights, ultimately contributing to the collective efforts to control the spread of the virus.

Keyword: IoT, Covid 19, face mask detection, healthcare, image recognition

INTRODUCTION

Diseases caused by the newly discovered corona virus (COVID-19) have been identified. This virus causes mild to moderate respiratory infection in most persons infected, and they often recover without the need for further treatment. As you become older, you're more prone to get sick, especially if you've got underlying medical conditions like heart or diabetic disease, chronic lung disease, or cancer. Knowing as much as possible about the COVID-19 virus, the sickness it produces, and the method it spreads is the greatest strategy to reduce or stop its progress. Using an alcohol-based hand sanitizer or washing your hands often is a good way to keep yourself and others safe from illness. COVID-19 has a variety of effects on various persons. Hospitalization is seldom required for mild to severe cases of sickness. Fever, a dry cough, and exhaustion are the most typical symptoms. Sore throat, diarrhoea, conjunctivitis and headache are among of the more typical symptoms, although there are many more, such as aches and pains; sore throat; diarrhoea; conjunctivitis; and headache.

Causes & Precautions

Infection with the SARS-CoV-2 virus strain results in the development of COVID-19.

- **Transmission:** A person infected with COVID-19 distributes the disease mostly via coughing, sneezing, singing, talking or breathing. Respiratory droplets or aerosols, which contain virus-containing particles, may infect anyone who are in close contact with an infected person and whose mouths, noses, or eyes they come into contact with.

- **Virology:** Severe acute bronchospasm corona virus 2 is a new strain of corona virus that causes severe acute respiratory syndrome. Three persons with pneumonia linked to Wuhan's outbreak of acute respiratory sickness were the first to be found to have it.

- **Precautions:** You may help prevent the transmission of COVID-19 by frequently washing your hands. You may either use soap and water or an alcohol-based hand massage. Stay away from those who are sneezing or coughing. When you can't go as far away from the situation as you'd want, put on a mask.

Challenge & Issue

Stopping the illness from spreading may be accomplished by public awareness and education. For example, identifying high-risk locations, educating the general public, and stopping the spread of disease are all part of this effort. One of the best strategies to stop the spread of the illness is to focus heavily on education and prevention. Indian society is based on interdependence amongst families, friends, and even strangers. 'Social distance' during this epidemic was discouraged by the prevalence of close physical encounters such as living in crowded homes and other locations, pushing and bumping. Despite the curfew, people have been seen squeezing into religious buildings, on public transportation, and even in liquor stores.

Disparity in India is caused by "vertical distancing," yet the implementation of "horizontal distancing" after COVID19 has only made the problem worse. Worse still, those who would be most affected by the lockdown will be left without adequate safety nets. Because of the tremendous scope of the issue, current government initiatives are woefully insufficient. There is a heightened risk of malnutrition among low-income families as a consequence of the lockout.

Atmospheric remote Sensor

It is the goal of Atmosphere Remote Sensing to provide a forum for discussing how remote sensing may be used to increase our knowledge and understanding of atmospheric processes in the broadest sense. Remote sensing instruments, techniques, and retrieval algorithms, as well as their validation and evaluation, are sought by Atmosphere Remote Sensing. In particular, the use of remote sensing data and techniques in atmospheric research is encouraged. Remote sensing of the Earth's surface may be accomplished using the simplest and oldest sensors available: cameras and aerial photography. Ultraviolet (UV), visible, and near-infrared (NIR) wavelengths are all captured by photographic films (NIR).

Details of type of sensor used

Remote sensing instruments are of two primary types:

- Sensors using active power sources, such as LEDs, may light the things they are seeing.
- On the other hand, passive sensors use natural energy (radiation) released or reflected by the thing being watched to detect its presence.

Images from a variety of dimensions may be captured quickly using these sensors. In order to make predictions, these photos are analyzed. In order to minimize the file size of these collected photographs, image compression algorithms are used. Covid-19 is able to take images with the help of these devices. For the last several years, security equipment have been built to collect images such as cc cameras or alert security professionals in the event of fraud. However, in the wake of the heist, they will not take any action against the thief. "INTELLIGENT SECURITY SYSTEM" may be used without the need for user intervention to tackle this problem. During the robbery, it will communicate the action directly to the thief in a matter of moments.

To battle the adversary, MILITARY ROBOTS utilise intelligent defensive systems that pivot and fire in the direction of the enemy automatically. They may also be used in museums to provide extra security. Prescriptions in the age of COVID-19 are based on image processing with CNN healthcare systems. A touchless sanitization system may also benefit from image processing using AI. To minimise the transmission of viruses, smart sanitization allows for sanitization without the need of any physical contact.

Face Mask Detector

There have been instances when the usage of neural classifier technology has been used to verify that visitors are entering with a mask on their faces. When a person's face is captured by the camera, semantic segmentation is performed. Mask form may be detected using neural classifiers on the face. A face mask detection system is integrated into a smart video surveillance system. This helps in implementing the IoT based notification system in case of an absence of a mask. For security reasons, cameras are linked to the internet. In the absence of a mask pattern, IoT devices sound the alarm to alert authorities that a person is present. The use of intelligent CCTV surveillance systems is on the rise.

Smart IOT Based Camera Surveillance System

Integration with a video surveillance system has made smart IoT solutions more useful. The density of people in public locations is regularly monitored using such technologies. It is also possible to alert or activate an alarm if any individual in a crowded area is discovered to be without a face mask or to be at a smaller distance from other people. People without masks may be detected using such a technique. As a result of integrating various technologies, video surveillance systems have become more effective. In public places, such devices are routinely used to keep tabs on the current population density.

A face mask detecting system is linked to a sophisticated video surveillance system. In the absence of a mask, this makes it possible to create an intelligent alerting system. Internet-connected cameras are used for surveillance. Alarm is generated if the mask pattern is not detected utilizing sophisticated gadgets to depict the presence of an individual who is unmasked. Every day, more and more people are using intelligent surveillance systems. Public venues are tracked as well by the AI system. Many persons who have various illnesses are unable to go to the hospital or clinic as often as they would want. In addition, there is a risk of infection.

When diagnosing, the intelligent prescription method is shown to be useful. As an alternative, the results of routine tests that reveal positive instances are uploaded to a server, making it easier to identify those who have been infected. The status of an infected individual may be learned by another person who is in close proximity to the sick person. An infected person's isolation might benefit greatly from IoT technology. To keep tabs on COVID-19, the Indian government created an app powered by artificial intelligence (AI) called 'Aarogya Setu'. For COVID-19, researchers are considering the use of artificial intelligence.

Image proceeding technology

Unprocessed graphical samples obtained from cameras or sensors and sent on satellites are known as "Image Proceeding." Space probes and aircraft, as well as images used in everyday life, have been improved. Many image processing techniques have been developed throughout the years. Most of these techniques have been used to enhance the quality of images taken from spacecraft. A similar picture might be taken by space probes or military aircraft in charge of flight surveillance. Because of the power of personal computers, these graphical analysis techniques have become popular. Aside from that, things like high-capacity memory cards and specialized graphics software may alter performance.

Various algorithms for image proceeding technology

Scaling, resizing, comparing, and changing graphical material are common uses of image processing methods. Convolutional Neural Networks (CNNs) may be used to recognize face mask patterns in images. However, CNN-based categorization has a number of drawbacks. During COVID-19, there has been no effort to enhance face mask detection. However, despite the fact that several studies have been done in the field of image processing, it has been shown that the time required to forecast is too long. In addition, visual stuff takes up a lot of space. The proposed study is designed to reduce the amount of time and space required to make accurate predictions. A major emphasis of research has been to analyze and eliminate the limitations of current image processing studies and methodologies. Edge-based convolution neural network approach is proposed in research for the identification of face masks.

The time required to apply Convolutional Neural Networks has been lowered thanks to the removal of extraneous elements from the graphical representation. Furthermore, the graphical dataset's storage requirements were lowered as a result of this. It becomes more difficult to compare data sets as the number of data sets grows. It is expected that MATLAB would be used to implement the suggested technique. During simulation, the new approach and algorithm are compared to the conventional algorithm. Traditional face mask identification methods are proven to be less efficient than the suggested approach. The proposed work in COVID-19 is intended to enhance the decision-making capabilities of convolution neural networks. As opposed to the previous method, the proposed work is believed to be more accurate To increase face mask identification performance, the suggested study will combine the CNN technique with edge detection algorithms. Connected to smart video surveillance systems, these devices may provide alerts when a mask fails to appear. Unless a mask pattern can be detected, an alert is sounded to indicate the presence of an unmasked individual.

Application and algorithms used for proceeding technology

Research is making use of CNN and edge detection mechanism in order to improve the performance during image preceding.

Convolutional Neural Network

The Convolutional Neural Network (CNN) is a well-known deep-learning machine learning algorithm. The vast majority of the times, convolutional neural networks (CNNs) are trained using massive troves of graphical data. As a result of such

massive data sets, CNNs might learn detailed representations of a wide range of graphical properties. In many cases, it is better than features like HOG, LBP or SURF that are hand-created. Using a trained convolutional neural network as a characteristics capturer is the greatest approach to use the capability of convolutional neural network without wasting time and effort on teaching.

The examination of current face mask detection methods and the elimination of their shortcomings has been the subject of research. In this study, an edge-based CNN algorithm is used to recognise face masks. Prior to applying CNN, the graphic picture was cleaned up to remove any extraneous information. Furthermore, the graphical dataset's storage requirements were lowered as a result of this. As the number of data sets grows, the size and time required for each comparison deteriorate dramatically. During simulation, the new approach and algorithm are compared to the conventional algorithm. It has been shown that the suggested approach is more efficient than the usual methods utilised in pattern recognition.

Canny Edge Detection

The ability to discern the edges of a picture has become more important in today's technologically advanced society. It is mostly used in the medical area and in military applications. As a result, research into edge detection algorithms is seen as critical. The notion of image processing relies heavily on the detection of the edges. Edge detection is able to identify changes in the intensity or pixel value of an image when the intensity or pixel value varies quickly. There are a variety of edge detection methods on the market now. Edge detection plays a significant part in image processing techniques. It may be used in a variety of ways, including image distortion, sample verification, image segmentation, and image abolition, among others. Using the edge detector on a picture yields a plethora of strange edges in the extreme.

Edge Detection is a piece of image processing that's used to find the picture's border. It uses the graphical material to emphasize the finding and extraction of the information. When the quality of a photo varies dramatically, it's a good idea to utilize this tool to check for focus confirmation in an advanced image. A picture's graphical content may be reduced by using the edge detection approach after additional processing has taken place. By combining these odd corners, the object's shape may be formed in three dimensions.

Canny Edge Detection Mechanism

In order to improve its edge detection, Canny is concentrating its efforts there. The best edge detector to use in these situations is one that can reliably identify objects at the edge. The method identifies the real edges that exist in the picture. It's deemed an excellent placement if the defined margins are fairly near to the edge of the actual picture.. A single try is all it takes to get a response since the noise in photos does not generate fake borders. Thus, an edge in a picture can only be seen once and when it's convenient to do so.

LITERATURE REVIEW

Face mask detection has been investigated throughout study. According to Semantic Segmentation [1] and Facial Mask Detection, research on Facial Mask Detection was reviewed. IoT-based Smart Video Surveillance mechanism and a concept to enhance neural classifier for micro screw form identification [3] were created. IoT-based smart surveillance security system with the aid of raspberry Pi [5], Privacy and Security in Internet-Connected Camera [6], and intelligent surveillance systems [7] have become more popular. In previous studies, smart surveillance is described in terms of its applications, technology, and consequences [8].

A number of researchers proposed intelligent video surveillance systems for public places [9] and intelligent CCTV surveillance systems [10]. Vision-dependent intelligent home automation and security mechanisms have been studied by a number of researchers. As a part of our study, we looked at papers on Digital Image Processing [14] and adaptable, high-performance CNNs for graphical categorization [15]. For handwritten character classification, CNN investigations have been conducted [16] and image processing using neural networks have also been studied [17]. [18] Deep CNNs, a kind of CNNs that includes face detection, were used in ImageNet classification research [19]. Edge detection approaches, histogram-based picture augmentation, and a hybrid face feature optimization strategy employing Bezier curves were all examined in this study.

It was in 2019 when a Recurrent Convolutional Neural Network Based FDTD Approach was researched by L Guo et al. CNN's selection process has been heavily influenced by the model. Bug Localization has been enhanced using character-level CNN and RNN in 2018 [24]. CNN-based Speech-Emotion Recognition was suggested by B Abdul Qayyum et al. [25] in 2019. Speak is the most widely used and most natural form of communication out there. In 2020, G. Lou et al. [26] proposed CNN-based facial picture recognition.

To this end, they conducted studies that took into account the identification of facial features. In order to do feature characterisation, the CNN was deemed the process for obtaining the feature. In 2019, Almakky et al. [27] conducted research on text localisation using deep convolutional neural networks. Figures from the medical literature were used in the study. However, this study is confined to the processing of textual information. In 2019, P. Samudre et al. [28] suggested using a computational method to improve the performance of a CNN. On the basis of an EDA mechanism, a graphical edge detection system was suggested by S. U. Lihua and colleagues [29] in 2010.

This study employs a novel approach to feature selection. A comparison of video graphics edge detection operators over red blood cells was provided by S. Suwanmanee et al. in 2013. Graphic image processing has benefited greatly from research. Multi-level morphological fuzzy edge detection for colour graphics was suggested by E. Perumal et al. [31] in 2017. To make decisions, fuzzy logic relies on the 0 and 1 process. Real-time flood monitoring was used in an experiment in 2019 by Q. Zhang and colleagues [32].

Problem Statement

Pattern recognition has been aided by algorithms such as SVM, CNN, and Random Forest, to name a few. Most of the traditional research's goals have been achieved via current research. It was a review of the accuracy of the data categorization. Each algorithm's efficiency and efficacy have been evaluated in terms of the accuracy of the data. Based on a literature analysis, we conclude that SVM works better with textual data, whereas CNN is more effective with graphical assessments and classification of graphical data. As a result, given the advantages of CNN, additional work on pattern detection models is required.

Despite these drawbacks, the current CNN model still has a lot of room for improvement. When comparing graphical stuff, it takes a long time. As a result, the classic CNN model's performance must be enhanced. SVM was traditionally found to be the best method for text data analysis, while convolution neural networks (CNNs) have been shown to be effective in picture analysis and classification tasks. As a result, further work is needed on a pattern identification model to take use of CNN's advantages. But it has been observed that existing CNN based research did limited work on Accuracy and performance. Thus propose research has focused on accuracy along with performance enhancement during face mask detection

RESEARCH METHODOLOGY

IoT and CNN based pattern detection have all been studied in past studies. Then, the concerns arising from these studies were examined. Researchers in this field are dealing with a lack of performance and accuracy. Compression and edge detection would then be used to create a efficient learning model. Finally, the suggested model's performance and accuracy are assessed.

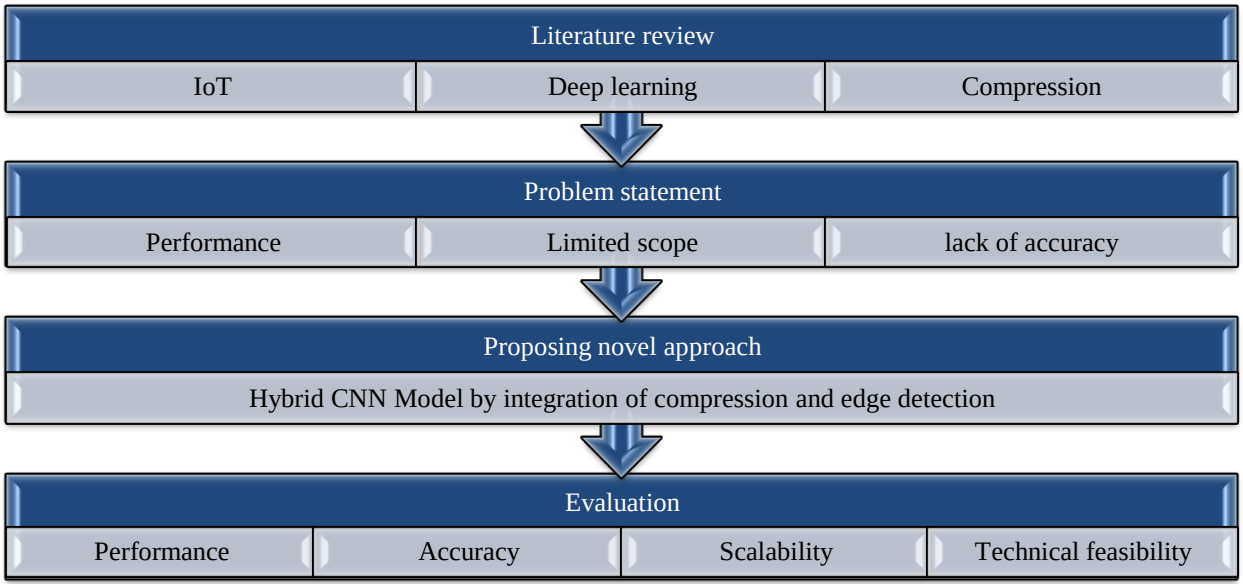

Fig 1 Research Methodology

PROPOSE WORK

A method for refining raw photographs taken from spacecraft, space probes, and aeroplanes, as well as images taken in ordinary life, is called Image Processing. Various image processing approaches have been developed during the previous four to five decades. Most of the approaches have been developed to improve photographs taken from unmanned spacecraft, space probes, and military surveillance aircraft. As powerful personal computers, big memory devices, graphics tools, and more are readily available, image processing systems are becoming more popular.

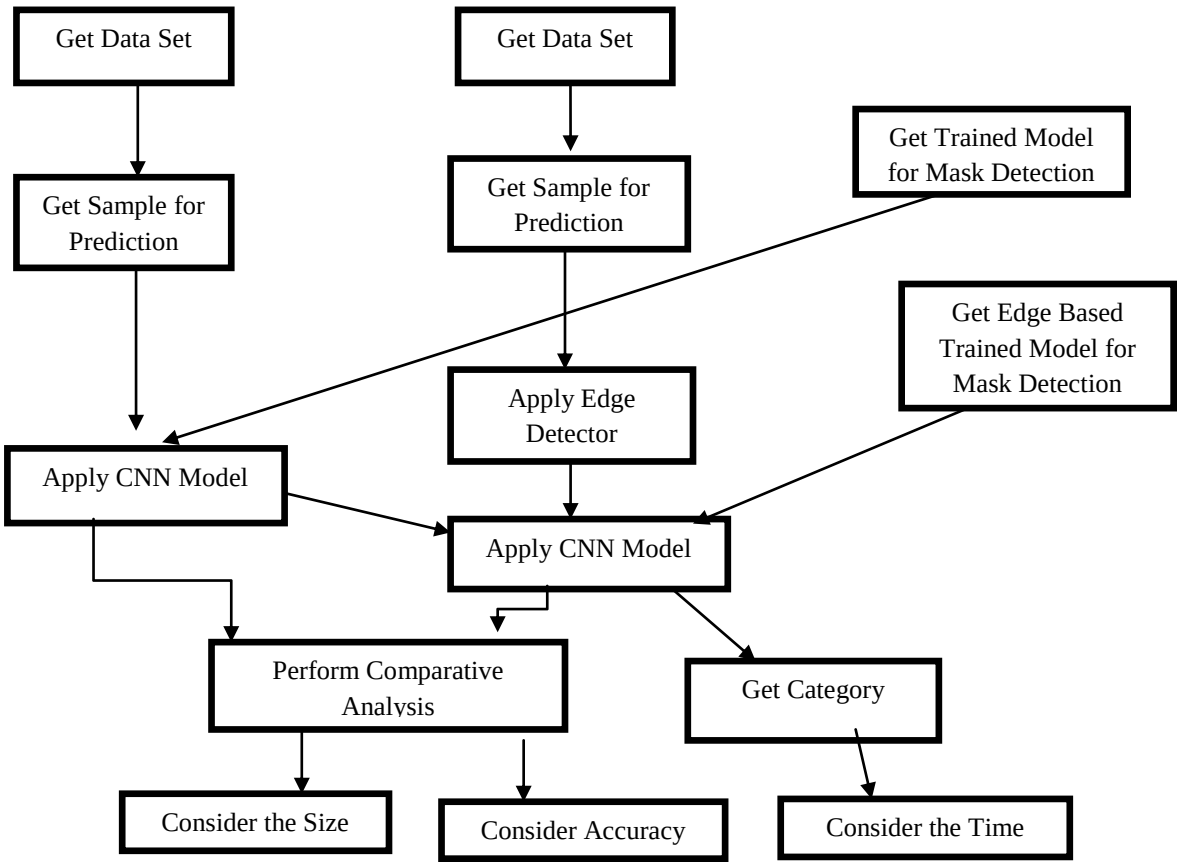

Figure 2: Process Flow of Work

An image capture system might be as simple as a video camera. An picture captured with an optical or analogue camera may be utilised as the input. Cameras with USB ports, such as CCD or CMOS sensors, are considered digital cameras. MATLAB is now making use of augmented reality to capture real-world video feeds. For example, MATLAB employs built-in tools called adapters in order to access or communicate with the PC (Image Processor). It is possible to manipulate photographs by eliminating functional information from them. There are various strong features of an item, such as colour and pattern, boundaries, strength and shape, that must be noted if an object is to be characterised. A microcontroller developed for control applications is employed in the Intelligent Protection System, which uses both image processing and the embedded system. This technique allows a camera to focus on a single picture. The camera consistently and constantly takes pictures at predetermined intervals.

These photos are submitted to the MATLAB software as input. A comparison is made between the gathered photos and the original image using MATLAB software. The microcontroller receives the position of the unexpected item in the image as an input from the MATLAB application. The microprocessor targets the unexpected item by rotating the motors horizontally and vertically using a laser beam focused on its specific position. Security is provided via an intelligent protection system that takes action when an unexpected item is identified in a picture during capture. This machine completes its task without human intervention in a matter of milliseconds. First, a camera is drawn to track the image that is to be covered. The camera takes a picture every few seconds. The collected photos are transferred to the PC's MATLAB application for image processing, which is used to analyse the data. When using MATLAB, a user provides the initial

picture that was taken, known as the original image. After the initial shot, the gathered images are compared to the original picture in a continual process of comparison.

Process Flow of Proposed Methodology

1. In the first step, a camera-based data set would be compiled into an image database. The picture resizing function is used to pre-process the graphical material collected by the camera.
2. Second, run a traditional CNN classifier to see how much space and time the picture dataset takes up. In the event of an edge detection mechanism, the time and space variable is saved so that it may be compared to the forthcoming time and space variable.
3. In step 3, use the edge detection method to analyze the images. The edge detector would remove the unnecessary parts of the picture. The file size and feature extraction time are reduced by the use of edge detection.
4. Consider how much space and time the suggested CNN classifier would take up. As far as I know, the CNN classifieds do include a lot of features. The picture collection can be adequately trained using just the previously trained CNN. An picture collection that has been trained is used to make judgments.
5. Compare the conventional and suggested work in terms of performance and space usage.

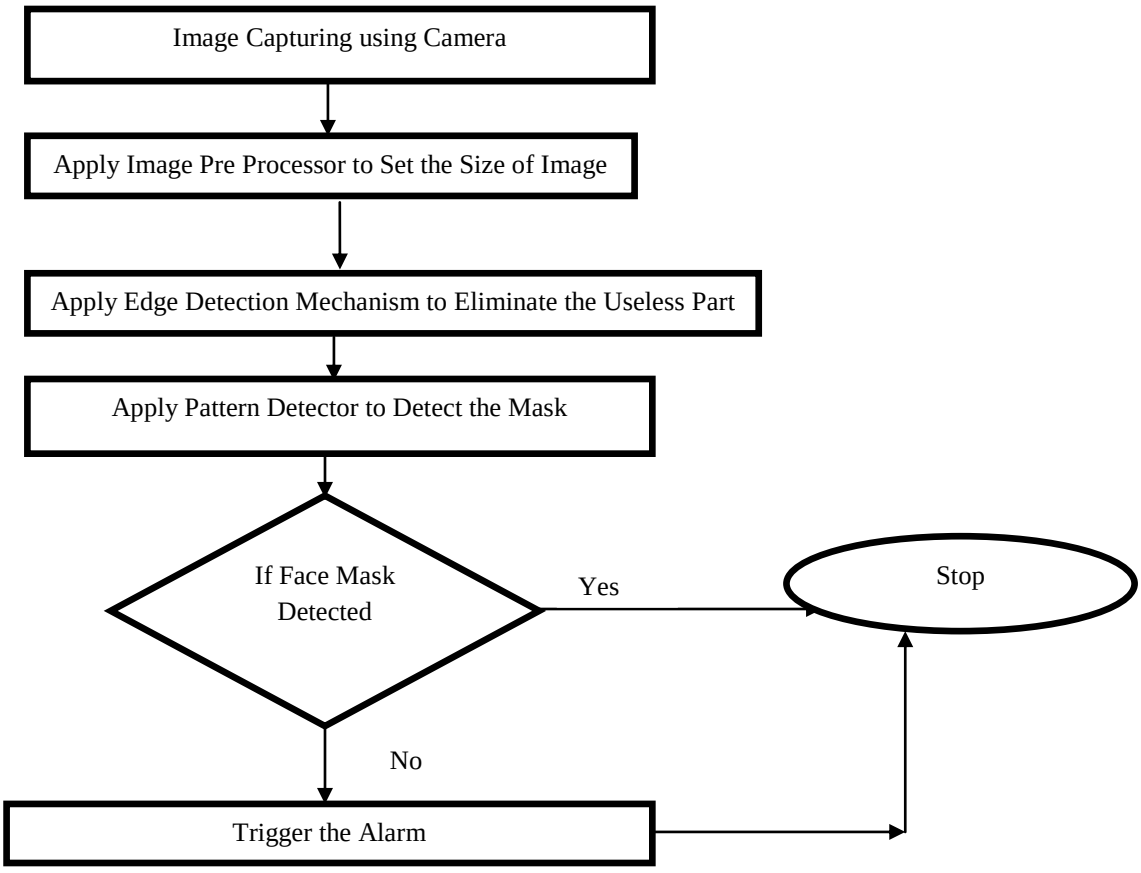

Figure 3: Process Flow

An investigation of face mask detection methods is the topic of proposed research. During the course of the investigation, the flaws in the classic pattern detecting methods were discovered. The edge-based CNN technique has been proposed for mask identification in research. It is expected that MATLAB would be used to implement the suggested technique. The new approach and algorithm have been compared to the standard algorithm. Traditional methods are expected to be more time-consuming than the suggested approach.

NEED OF RESEARCH

The COVID-19 pandemic has emphasized the significance of public health measures, with face masks playing a vital role in reducing the transmission of the virus. Within this particular framework, the incorporation of IoT has arisen as a viable

remedy for efficient identification of face masks and implementation of safety measures. This article examines the use of IoT in the context of the COVID-19 pandemic to detect the presence of face masks in real-time. The suggested system employs IoT devices that are equipped with sophisticated sensors and image processing capabilities to surveil persons in public areas. These gadgets use visual data to detect and evaluate whether persons are wearing face masks or not. Subsequently, the gathered data is transferred to a centralized system to undergo further analysis and facilitate decision-making. The system comprises edge devices equipped with integrated cameras, machine learning algorithms designed for image identification, and a centralized IoT platform responsible for aggregating and managing data. The machine learning models are taught to precisely identify and categorize faces, regardless of whether they are wearing masks or not. This guarantees a high level of accuracy and immediate reactivity. Ultimately, the incorporation of IoT technology for the purpose of detecting face masks offers a pragmatic and effective means of improving public safety within the COVID-19 epidemic. The suggested system utilizes the functionalities of IoT to provide immediate monitoring, feedback, and significant data insights, eventually aiding in the joint endeavors to manage the dissemination of the virus.

FUTURE SCOPE

The research might make use of canny edged detection with CNN model in another project that are IoT based. The image processing based projects are requiring such enhancements. Moreover the space taken by graphical sample could be managed easily. There would be not an impact of the categorization and prediction mechanism after performing these changes. Utilization of the proposed work in medical science is capable to enhance the functionality of CNN during decision making. Upcoming work is supposed to be more accurate and accuracy could change as per size of image. Moreover research is considering new changes in graphical contents in future.

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