Human Emotion Detection System

A Project Report Submitted to

Rajiv Gandhi Proudyogiki Vishwavidyalaya

Towards Partial Fulfillment for the Award of

Bachelor of Engineering in *Computer Science & Engineering*

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EXAMINER APPROVAL

The Project entitled ***"Human Emotion Detection System"*** submitted by **Aditya Paliwal (0827CS201015)**, **Aman Khan (0827CS201024)**, **Aman Kumawat (0827CS201025) Aditya Kumar Soni(0827CS201014).**

This has been examined and is hereby approved towards partial fulfillment for the award of Bachelor of Engineering degree in Computer Science & Engineering discipline, for which it has been submitted. It understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the project only for the purpose for which it has been submitted.

(Internal Examiner) **(External Examiner)**

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GUIDE RECOMMENDATION

This is to certify that the work embodied in this project entitled **"*Human Emotion Detection System*"** submitted by **Aditya Paliwal (0827CS201015)**, **Aman Khan (0827CS201024)**, **Aman Kumawat(0827CS201025) Aditya Kumar Soni(0827CS201014).** It is a satisfactory account of the bonafide work done under the supervision of **Dr. Priyanka Jangde** are recommended towards partial fulfillment for the award of the Bachelor of Engineering (Computer Science & Engineering) degree by Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal.

(Project Guide)

(Project Coordinator)

(Dean Academics)

STUDENTS UNDERTAKING

This is to certify that project entitled **"*Human Emotion Detection System*"** has developed by us under the supervision of **Dr. Priyanka Jangde**. The whole responsibility of work done in this project is ours. The sole intension of this work is only for practical learning and research.

We further declare that to the best of our knowledge, this report does not contain any part of any work which has been submitted for the award of any degree either in this University or in any other University / Deemed University without proper citation and if the same work found then we are liable for explanation to this.

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Executive Summary

"Human Emotion Detection System"
This project is submitted to Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal (MP), and India for partial fulfillment of Bachelor of Engineering in Computer Science & Engineering branch under the sagacious guidance and vigilant supervision of **Dr*. Priyanka Jangde***.

The project is based on machine learning and artificial intelligence used to create a software to detect emotions of humans using software know as emotion sense The purpose of this project is to examine the ethical implications of emotion detection systems, particularly in terms of privacy and bias, and to propose potential solutions to address these concerns

Key words: - Emotion Recognition, Emotion Detection, Facial expressions

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Chapter 1 .Introduction

Emotion is a fundamental aspect of human experience, influencing our thoughts, behaviour, and relationships with others. As such, the ability to accurately detect and understand emotions is of great importance in a variety of fields, including mental health, education, marketing, and customer service. In recent years, there has been a growing interest in developing technologies that can automatically detect human emotions, leading to the emergence of the field of emotion detection systems. An emotion detection system is a technological solution that uses machine learning algorithms to analyse various forms of data, such as speech, facial expressions, and physiological signals, to detect and classify emotions. These systems have the potential to be highly beneficial, enabling more efficient and effective diagnosis and treatment of mental health disorders, as well as improving customer service experiences and enhancing marketing strategies.

However, the development of emotion detection systems also raises important ethical concerns, such as privacy and bias. As such, it is essential to carefully consider the potential benefits and risks of such systems before deploying them in real-world applications. This paper will provide an overview of the current state of the art in emotion detection systems, as well as discussing some of the key ethical considerations that need to be taken into account when developing and deploying these systems.

1.1 Overview

An emotion detection system is a technology that is designed to identify and analyze human emotions using various modalities, including speech, facial expressions. This system can be used in a wide range of applications, such as mental health diagnosis, marketing, and customer service.

The system typically uses machine learning algorithms to analyze data from multiple sources, such as video feeds. These algorithms can detect patterns in the data that are associated with different emotions, such as happiness, anger, and sadness.

The accuracy of the system depends on the quality of the data it receives and the sophistication of the algorithms used. Recent advances in deep learning and neural networks have led to significant improvements in the performance of emotion detection systems.

The ethical implications of emotion detection systems are an area of concern, particularly in terms of privacy and bias. Nevertheless, the potential benefits of such technology are vast, and it is likely to become increasingly prevalent in the future

A human emotion detection system typically uses various modalities, such as facial expressions, speech patterns, and physiological signals, to detect and classify emotions. The system typically consists of three main components:
Data acquisition: This component involves collecting data from various sources, such as cameras, microphones, and biometric sensors. The data could include video footage of facial expressions, audio recordings of speech patterns, and physiological signals such as heart rate and skin conductance.
Feature extraction: This component involves processing the data to extract features that are relevant to emotion detection. For example, facial expressions could be analyzed to detect changes in muscle movements, and speech patterns could be analyzed to detect changes in tone and pitch.
Emotion classification: This component involves using machine learning algorithms to classify the extracted features into specific emotions. The algorithms are trained using a dataset of labeled examples, which are used to teach the system how to recognize different emotions. The proposed invention could improve upon existing emotion detection systems by using innovative techniques to enhance the accuracy, contextualization, privacy, and ethical considerations of the system. For example, the invention could use advanced machine learning algorithms that incorporate contextual information, such as the user's history or environment, to improve emotion classification accuracy. The invention could also incorporate privacy-preserving technologies, such as secure data encryption, to protect users' personal data, and ethical considerations, such as ensuring that the technology is used in a transparent and responsible manner.

1.2 Problem Statement and Objectives

This system should be able to analyze and interpret various data points to determine the emotional state of a person and provide appropriate feedback or response based on that emotion. The system should be robust, reliable, and able to handle variations in individual expressions, cultural differences, and environmental factors that can impact emotional states. Additionally, the system should protect the privacy and security of the user's personal information while still providing accurate emotional analysis.

Objective1 – To provide an overview of the current state of the art in emotion detection systems, including the different techniques and algorithms used for detecting emotions in speech, facial expressions.

Objective 2: To discuss the potential benefits and risks of emotion detection systems in different applications, such as mental health diagnosis, marketing, and customer service.

Objective 3: To examine the ethical implications of emotion detection systems,

particularly in terms of privacy and bias, and to propose potential solutions to address these concerns.

Objective 4: To provide recommendations for future research in the field of emotion detection systems, including the development of more accurate and reliable approaches to emotion detection and the ethical considerations that need to be taken into account when deploying such systems in real-world applications.

1.3 Scope of the Project

As the project uses: Machine learning and Artificial Intelligence technology

- Real-time monitoring: Emotion detection technology can provide real-time monitoring of an individual's emotional state, allowing for timely interventions and support.

- Privacy preservation: Incorporating privacy-preserving technologies, such as data encryption and differential privacy, can help protect users' personal data and address concerns around privacy.

- Cost-effective: Emotion detection technology can be cost-effective compared to traditional methods of assessing emotional state, such as hiring human experts or administering questionnaires.

1.4 Team Organization

ADITYA KUMAR SONI: I am the project Manager of this project from Creating to executing all work is executed by me and my team.

ADITYA PALIWAL: I am the backend developer in this project Data integration is Done all by me

AMAN KHAN: I am the researcher in this project carrying out all the necessary research and analyzed it properly, according to analyzing the project, listing out all the weak sections in our work and improving them.

AMAN KUMAWAT: I am the researcher as well as tester for this project all the necessary steps of Testing is carried out by me **.**

1.5 Report Structure

The project ***HUMAN EMOTION DETECTION SYSTEM*** is primarily concerned with **MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE** and whole project report is categorized into five chapters.

Chapter 1: Introduction- introduces the background of the problem followed by rationale for the project undertaken. The chapter describes the objectives, scope and applications of the project. Further, the chapter
gives the details of team members and their contribution in development of project which is then subsequently ended with report outline.

Chapter 2: Review of Literature- explores the work done in the area of Project undertaken and discusses the limitations of existing system and highlights the issues and challenges of project area. The chapter finally ends up with the requirement identification for present project work based on findings drawn from reviewed literature and end user interactions.

Chapter 3: Proposed System - starts with the project proposal based on requirement identified, followed by benefits of the project. The chapter also illustrate software engineering paradigm used along with different design representation. The chapter also includes block diagram and details of major modules of the project. Chapter also gives insights of different type of feasibility study carried out for the project undertaken. Later it gives details of the different deployment requirements for the developed project.

Chapter 4: Implementation - includes the details of different Technology/ Techniques/ Tools/ Programming Languages used in developing the Project. The chapter also includes the different user interface designed in project along with their functionality. Further it discuss the experiment results along with testing of the project. The chapter ends with evaluation of project on different parameters like accuracy and efficiency.

Chapter 5: Conclusion - Concludes with objective wise analysis of results and limitation of present work which is then followed by suggestions and recommendations for further improvement.

Chapter 2. Review of Literature

Emotion detection systems have become increasingly popular in recent years, with numerous studies exploring the effectiveness of various techniques and algorithms for detecting emotions in different contexts.

Human Emotion Detection Systems have the potential to revolutionize the way we interact with technology and each other. The use of multiple data sources and machine learning algorithms has enabled the development of HEDS that can detect and classify emotions with high accuracy. However, there are still challenges that need to be addressed, such as the lack of a standard dataset and the interpretability of machine learning models. Future research should focus on addressing these challenges to improve the performance and usability of HEDS

2.1 Preliminary Investigation

Several studies have proposed different approaches to detecting and classifying human emotions. One approach is to use facial expressions as a data source. Facial expressions are a primary means of emotional communication and can be detected and analyzed using computer vision algorithms. In their study, Ekman and Friesen (1971) proposed the Facial Action Coding System (FACS), which identifies facial muscle movements associated with different emotions. In the early 1971 Ekman, P. & Friesen researched on this topic about human emotion and gesture system they created a record for western adult males, females and children with six categories of emotion disgust, surprise, angry, sad, happy .They created 3x5 inch of cropped photograph for processing image and filtered the results in a table according to categories of emotion with percentages. Despite the advances in human emotion detection system, there are still challenges that need to be addressed. One challenge is the lack of a standard dataset for training and testing machine learning models. Several datasets have been proposed, such as the AffectNet (Mollahosseini et al., 2017) and the EmoReact (Dhall et al., 2021) datasets, but there is a need for a more comprehensive and diverse dataset that can capture the variability of human emotions in different contexts and cultures.

Research efforts in human–computer interaction are focused on the means to empower computers (robots and other machines) to understand human intention, e.g. speech recognition and gesture recognition systems . In spite of considerable achievements in this area during the past several decades, there are still a lot of problems, and many researchers are trying to solve them. Besides, there is another important but ignored mode of communication that may be important for more natural interaction: emotion plays an important role in contextual understanding of

messages from others in speech or visual forms. There are numerous areas in human–computer interaction that could effectively use the capability to understand emotion . For example, it is accepted that emotional ability is an essential factor for the next-generation personal robot, such as the Sony AIBO . It can also play a significant role in intelligent room‘ and affective computer tutor‘ . Although limited in number compared with the efforts being made towards intention-translation means, some researchers are trying to realise man–machine interfaces with an emotion understanding capability. Most of them are focused on facial expression recognition and speech signal analysis . Another possible approach for emotion recognition is physiological signal analysis. We believe that this is a more natural means of emotion recognition, in that the influence of emotion on facial expression or speech can be suppressed relatively easily, and emotional status is inherently reflected in the activity of the nervous system. In the field of psychophysiology, traditional tools for the investigation of human emotional status are based on the recording and statistical analysis of physiological signals from both the central and autonomic nervous systems . Researchers at IBM recently reported an emotion recognition device based on mouse-type hardware . Picard and colleagues at the MIT Media Laboratory have been exerting their efforts to implement an affective computer‘ since the late 1990s . Although they demonstrated the feasibility of a physiological signal-based emotion recognition system, several aspects of its performance need to be improved before it can be utilized as a practical system. First, their algorithm development and performance tests were carried out with data that reflect intentionally expressed emotion. Moreover, their data were acquired from only one subject, and, hence, their emotion recognition algorithm

Human Emotion Recognition I.J. Image, Graphics and Signal Processing, 2012, 8, 50-56 is user-dependent and must be tuned to a specific person. It seems natural to start from the development of a user-dependent system, as the speech recognition system began with a speaker-dependent system. Nevertheless, a user-independent system is essential for practical application, so that the users do not have to be bothered with training of the system. To our knowledge, there is no previous study that has demonstrated a physiological signal-based emotion recognition system that is applicable to multiple users. Another problem with current systems is the required length of signals. At present, at least 2–5 min of signal monitoring is required for a decision. For practical purposes, the required monitoring time should be reduced further. In this paper, a novel emotion recognition system based on the processing of physiological signals is presented. This system shows a recognition ratio much higher than chance probability, when applied to physiological signal databases obtained from tens to hundreds of subjects. The system consists of characteristic waveform detection, feature extraction and pattern classification stages. Although the waveform detection and feature extraction stages were designed carefully, there was a large amount of within-class variation of features and overlap among classes.

This problem could not be solved by simple classifiers, such as linear and quadratic classifiers, that were adopted for previous studies with similar purposes

2.1.1 Current System

- There are different ways to approach the task of human emotion detection, and the current systems vary depending on the context and the type of data being used. Here are some examples of current emotion detection systems:

- Facial recognition systems: Some companies use computer vision technology to detect emotions by analyzing facial expressions. This involves using algorithms to detect key facial features such as eyebrow movement, eye dilation, and mouth shape, and then using machine learning techniques to classify these features into different emotional states.

- Wearable technology: Some companies are developing wearable devices that can monitor physiological signals such as heart rate, skin conductance, and muscle tension to detect changes in emotional states. These devices can provide real-time feedback to help people manage their emotions and improve their emotional wellbeing.

- Social media analysis: Social media platforms use machine learning algorithms to analyze the content of posts, comments, and messages to detect emotions and sentiment. This can be useful for tracking public opinion and identifying trends in consumer behavior.

Overall, the current systems for human emotion detection are still in the early stages of development, and there is ongoing research to improve the accuracy and reliability of these systems.

2.2 Requirement Identification and Analysis for Project

Requirement identification and analysis is a crucial step in any project, as it helps to ensure that the project meets the needs and expectations of stakeholders. Here are some steps that can be followed for requirement identification and analysis:

Identify stakeholders: The first step is to identify all the stakeholders who will be impacted by the project, including customers, users, sponsors, and other stakeholders. This will help to ensure that all perspectives are considered in the requirement identification and analysis process.

Gather requirements: Once the stakeholders are identified, it's important to gather requirements from them. This can be done through interviews, surveys, focus groups, and other techniques. It's important to capture both functional requirements (what the system must do) and non-functional requirements (how the system must perform).

Analyze requirements: Once the requirements are gathered, they should be analyzed to ensure that they are complete, unambiguous, and consistent. This may involve reviewing the requirements with stakeholders to clarify any uncertainties and resolve any conflicts.

Prioritize requirements: After analyzing the requirements, they should be prioritized based on their importance to the project and the stakeholders. This will help to ensure that the project focuses on the most critical requirements first.

Document requirements: The final step is to document the requirements in a clear and concise manner. This documentation should be shared with all stakeholders to ensure that everyone is on the same page and has a clear understanding of what the project will deliver.

By following these steps, requirement identification and analysis can help to ensure that the project meets the needs and expectations of stakeholders, and can help to minimize the risk of project failure.

2.3 Conclusion

Overall, emotion detection systems have the potential to be highly beneficial in a variety of fields, but careful consideration must be given to the ethical implications of their use. Further research is needed to address these concerns and develop more accurate and reliable approaches to emotion detection It has been suggested that emotion-oriented DL approaches can be designed and fused with IoT sensors. In this case, it is predicted that this will increase FER's performance to the same level as human beings, which will be very helpful in healthcare, investigation, security and surveillance. In conclusion, the development of a human emotion detection system is a promising field with great potential for various applications in areas such as healthcare, education, and marketing. Advances in machine learning and computer vision have enabled the creation of algorithms capable of accurately identifying and analyzing human emotions from facial expressions The integration of emotion detection systems into various technologies such as social robots, virtual assistants, and smartphones can enhance humanmachine interactions and provide personalized experiences for users. However, ethical concerns such as privacy and bias in the data used for training these systems must be carefully addressed to ensure that they do not harm individuals or perpetuate societal inequalities.

Chapter 3.Proposed System

3.1 The Proposal

A proposed system is a plan for a new or updated system that will meet specific requirements and improve upon an existing system. Here are some steps that can be followed when developing a proposed system:

Define the problem: The first step in developing a proposed system is to define the problem that the system is intended to solve. This involves identifying the current system's limitations and shortcomings, as well as any new requirements that the proposed system must meet.

Gather requirements: Once the problem is defined, the next step is to gather requirements for the proposed system. This can be done through surveys, interviews, focus groups, and other techniques, and should involve all stakeholders who will be impacted by the system.

Develop a system design: With the requirements in hand, the next step is to develop a system design. This should include a high-level architecture of the system, including hardware and software components, and how they will interact with each other.

Develop a prototype: With the system design in place, the next step is to develop a prototype of the system. This will allow stakeholders to see how the system will work in practice and provide feedback for further improvements.

Test and refine the system: Once the prototype is developed, it should be tested and refined to ensure that it meets all requirements and functions as intended. This may involve multiple rounds of testing and feedback from stakeholders.

Document the system: Finally, the proposed system should be documented in a clear and concise manner. This documentation should include specifications, user manuals, and any other relevant documentation that will be needed to support the system.

By following these steps, a proposed system can be developed that meets the specific requirements of stakeholders and provides a significant improvement over the existing system.

3.2 Benefits of the Proposed System

A proposed system can offer several benefits over an existing system, depending on the requirements and goals of the project. Here are some potential benefits of a proposed system:
Improved efficiency: A proposed system can streamline workflows, automate tasks, and reduce manual labor, resulting in improved efficiency and productivity.

Enhanced functionality: A proposed system can provide new or improved functionality that was not available in the existing system, such as additional features, more flexibility, or better performance.

Increased accuracy: A proposed system can reduce errors and improve accuracy by automating tasks, reducing manual data entry, and incorporating validation and verification checks.

Better integration: A proposed system can be designed to better integrate with other systems and tools, reducing data duplication and improving data sharing.

Improved accessibility: A proposed system can be designed to be more accessible, with better user interfaces, more intuitive navigation, and improved accessibility for users with disabilities.

Increased security: A proposed system can incorporate new or improved security features, such as user authentication, data encryption, and access controls, to better protect sensitive data and prevent unauthorized access.

Overall, a proposed system can offer significant benefits over an existing system, including improved efficiency, enhanced functionality, increased accuracy, better integration, improved accessibility, and increased security. These benefits can result in cost savings, increased productivity, and improved customer satisfaction.

3.3 Feasibility Study

A feasibility study is an analysis of the viability of a proposed project, which assesses whether the project is technically, financially, and operationally feasible. Here are some key steps that can be followed in conducting a feasibility study:

Define the project scope: The first step is to define the scope of the project, including its objectives, requirements, and expected outcomes.

Conduct market analysis: The second step is to conduct a market analysis to determine the demand for the product or service, potential competition, and market trends. This will help to determine the viability of the project and identify any potential challenges.

Analyze technical feasibility: The third step is to analyze the technical feasibility of the project, including whether the necessary technology and expertise are available, and whether any technical constraints or limitations may impact the project's success.
Evaluate financial feasibility: The fourth step is to evaluate the financial feasibility of the project, including whether the project is financially viable and whether the expected returns on investment are sufficient to justify the costs.

Assess operational feasibility: The fifth step is to assess the operational feasibility of the project, including whether the project can be implemented within the constraints of the existing operations and whether the project team has the necessary skills and resources to execute the project successfully.

Identify risks and mitigation strategies: The sixth step is to identify any potential risks and develop mitigation strategies to address these risks.

Develop a feasibility report: Finally, a feasibility report should be developed that summarizes the findings of the feasibility study and makes recommendations regarding the viability of the project.

3.4 Technical

The data gets automatically saved in the database, without requiring any manual effort for saving it.
For making the system technically feasible, there is a requirement of GPU built system with high processor for better performance.

3.4.1 Economical

Since the system is completely automated, there is a need of server to be online for it to operate 24X7.

Since the system uses high performance processors continuously, so to save any disaster from occurring due to very high temperatures, there is a requirement of a cooling system in the environment where it is implemented.

3.5 Deployment Requirements

There are various requirements (hardware, software and services) to successfully deploy the system. These are mentioned below :

3.5.1 Hardware

- 32-bit, x86 Processing system

- Windows 7 or later operating system

- High processing computer system without GPU or with GPU(high performance)

Processor: The processor should be capable of running the required software and processing data at the necessary speed.
Memory: The amount of memory required will depend on the size and complexity of the system, as well as the expected number of users. More memory will generally result in improved performance.
Storage: Sufficient storage capacity should be available for storing the system software, data, and any backups.
Network: A reliable and high-speed network connection is essential for the system to function effectively.
Security: Adequate security measures, such as firewalls and encryption, should be in place to protect against unauthorized access or data breaches.
Backup and recovery: A backup system should be in place to ensure that data is not lost in the event of hardware failure or other issues.

3.5.2 Software

- Visual studio code
- Google Colab
- Tensor Flow
- Jupyter

Chapter 4 . Implementation

The implementation of a human emotion detection system involves designing and developing the system architecture, selecting and integrating suitable hardware and software components, acquiring and processing data to train and fine-tune the machine learning algorithms, and testing and validating the system performance. The system should be optimized for accuracy, reliability, and real-time processing speed, and should be validated using appropriate metrics and data sets. Once the system is deployed, ongoing maintenance and support are necessary to ensure that it remains accurate, up-to-date, and aligned with user needs. Adequate user training and documentation should also be provided to facilitate effective adoption and use of the system.

4.1 Technique Used

There are several techniques that can be used in a human emotion detection system, depending on the specific requirements and design of the system. Here are some commonly used techniques:

Facial recognition: This technique involves analyzing facial features, such as expressions, movements, and patterns, to detect emotions. Facial recognition can use a combination of machine learning algorithms, including Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs).
Multimodal analysis: This technique involves combining multiple techniques, such as facial recognition, speech analysis, and physiological measures, to detect emotions. Multimodal analysis can use machine learning algorithms, such as Fusion of Heterogeneous Classifiers (FHC) and Joint Bayesian Networks (JBNs).
The selection and combination of techniques used in a human emotion detection system will depend on the specific requirements and limitations of the system, as well as the availability and quality of data.

4.1.1 Convolutional Neural Network

A convolutional neural network (CNN or convnet) is a subset of machine learning. It is one of the various types of artificial neural networks which are used for different applications and data types. A CNN is a kind of network architecture for deep learning algorithms and is specifically used for image recognition and tasks that involve the processing of pixel data.
There are other types of neural networks in deep learning, but for identifying and recognizing objects, CNNs are the network architecture of choice. This makes them highly suitable for computer vision (CV) tasks and for applications where object recognition is vital, such as self-driving cars and facial recognition.
A CNN can have multiple layers, each of which learns to detect the different features of an input image. A filter or kernel is applied to each image to produce an output that gets progressively better and more detailed after each layer. In the lower layers, the filters can start as simple features.

At each successive layer, the filters increase in complexity to check and identify features that uniquely represent the input object. Thus, the output of each convolved image -- the partially recognized image after each layer -- becomes the input for the next layer. In the last layer, which is an FC layer, the CNN recognizes the image or the object it represents.

With convolution, the input image goes through a set of these filters. As each filter activates certain features from the image, it does its work and passes on its output to the filter in the next layer. Each layer learns to identify different features and the operations end up being repeated for dozens, hundreds or even thousands of layers. Finally, all the image data progressing through the CNN's multiple layers allow the CNN to identify the entire object.

4.1.2 Support vector Machine

Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning.
The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane.
SVM chooses the extreme points/vectors that help in creating the hyperplane. These extreme cases are called as support vectors, and hence algorithm is termed as Support Vector Machine. Consider the below diagram in which there are two different categories that are classified using a decision boundary or hyperplane:

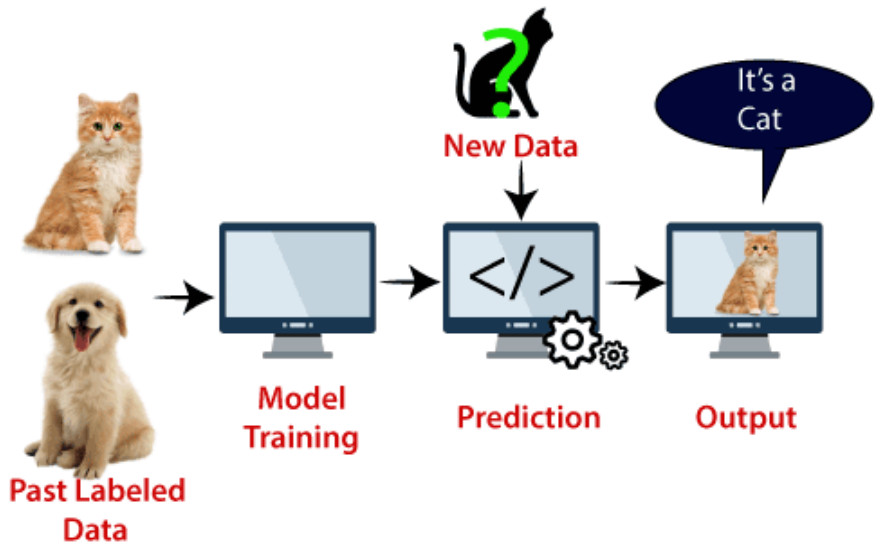

Fig.1.1

4.2 Tools Used

- Microsoft Visual Code
- Tensor Flow
- Matlab

4.2.1 Microsoft Visual Code 

Visual Studio Code, also commonly referred to as VS Code,] is a source-code editor made by Microsoft with the Electron Framework, for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality

Visual Studio Code is a lightweight but powerful source code editor which runs on your desktop and is available for Windows, macOS and Linux. It comes with built-in support for JavaScript, Typescript and Node.js and has a rich ecosystem of extensions for other languages and runtimes (such as C++, C#, Java, Python, PHP, Go, .NET)

4.2.2 Tensor Flow

Tensor Flow is an open-source library developed by Google primarily for deep learning applications. It also supports traditional machine learning. Tensor Flow was originally developed for large numerical computations without keeping deep learning in mind. However, it proved to be very useful for deep learning development as well, and therefore Google open-sourced it.
Tensor Flow accepts data in the form of multi-dimensional arrays of higher dimensions called tensors. Multi-dimensional arrays are very handy in handling large amounts of data.
Tensor Flow works on the basis of data flow graphs that have nodes and edges. As the execution mechanism is in the form of graphs, it is much easier to execute Tensor Flow code in a distributed manner across a cluster of computers while using GPUs.
Tensor Flow allows you to create dataflow graphs that describe how data moves through a graph. The graph consists of nodes that represent a mathematical operation. A connection or edge between nodes is a multidimensional data array. It takes inputs as a multi-dimensional array where you can construct a flowchart of operations that can be performed on these inputs

4.2.3 Matlab

MATLAB (matrix laboratory) is a fourth-generation high-level programming language and interactive environment for numerical computation, visualization and programming.
It allows matrix manipulations; plotting of functions and data; implementation of algorithms; creation of user interfaces; interfacing with programs written in other languages, including C, C++, Java, and FORTRAN; analyze data; develop algorithms; and create models and applications.

It has numerous built-in commands and math functions that help you in mathematical calculations, generating plots, and performing numerical methods.

4.3 Language Used

Programming languages: Various programming languages can be used to implement the system, including Python and MATLAB.
Machine learning libraries: Machine learning libraries can be used to develop the machine learning models required for emotion detection. Common libraries include scikit-learn, Tensor Flow, Keras, PyTorch, and OpenCV.
Signal processing software: Signal processing software can be used to pre-process data before inputting it into the machine learning models. MATLAB and Python libraries like NumPy, SciPy, and Pandas can be used for this purpose.
Data visualization tools: Data visualization tools can be used to visualize the results of the analysis and help identify patterns and trends in the data. Common tools include Tableau, matplotlib, and Seaborn.
Integrated development environments (IDEs): IDEs can be used to write, test, and debug the code. Popular IDEs include PyCharm, Eclipse, Visual Studio, and Sublime Text.

4.4 Screenshots

The Following are the screenshots of the result of the project :

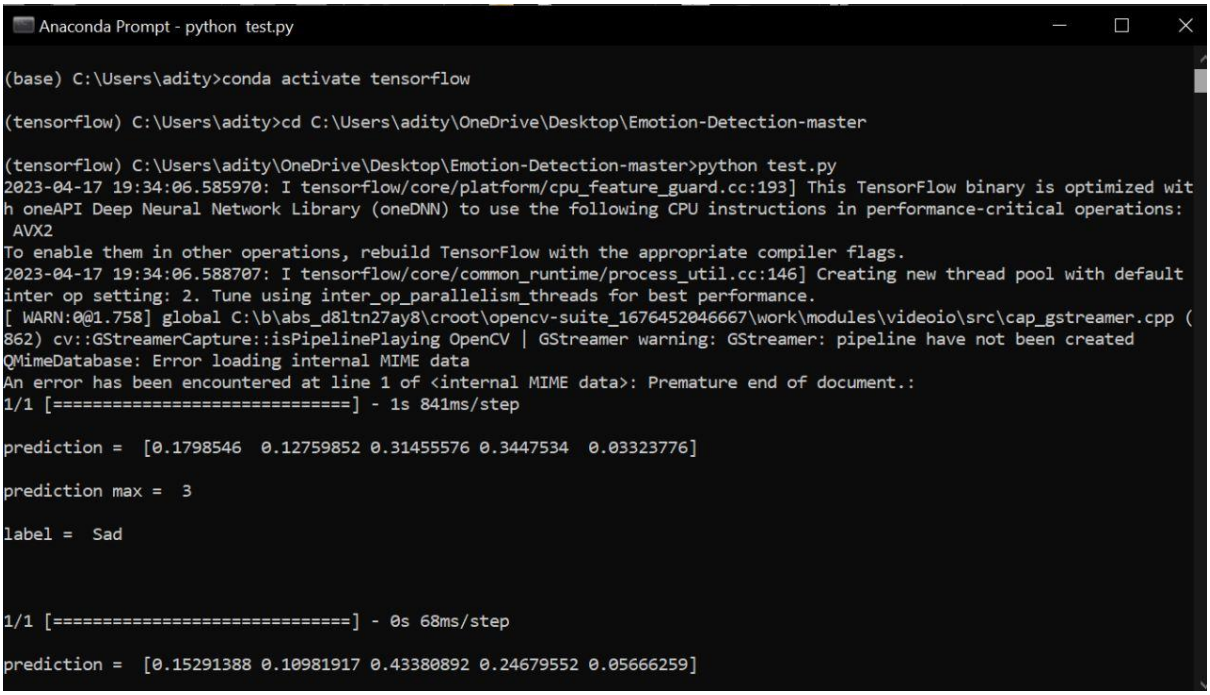

Fig 1.2

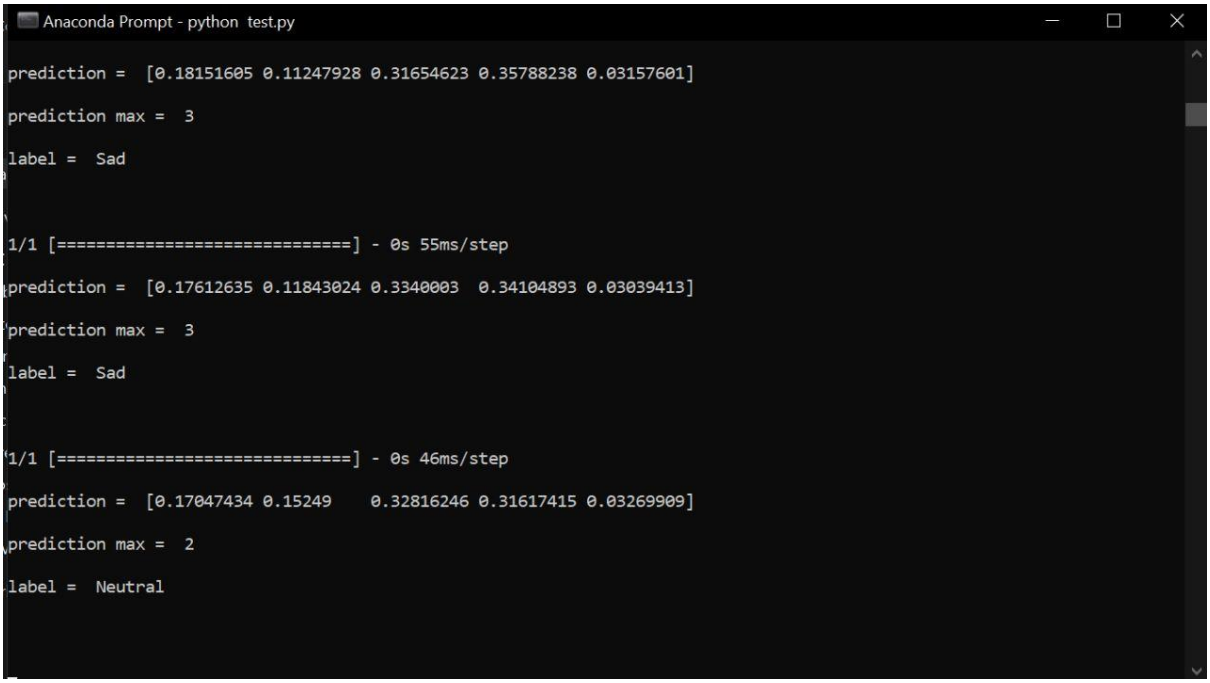
Anaconda Prompt - python test.py
prediction = [0.18151605 0.11247928 0.31654623 0.35788238 0.03157601]
prediction max = 3
label = Sad
1/1 [==============================] - 0s 55ms/step
prediction = [0.17612635 0.11843024 0.3340003 0.34104893 0.03039413]
prediction max = 3
label = Sad
1/1 [==============================] - 0s 46ms/step
prediction = [0.17047434 0.15249 0.32816246 0.31617415 0.03269909]
prediction max = 2
label = Neutral

Fig1.3

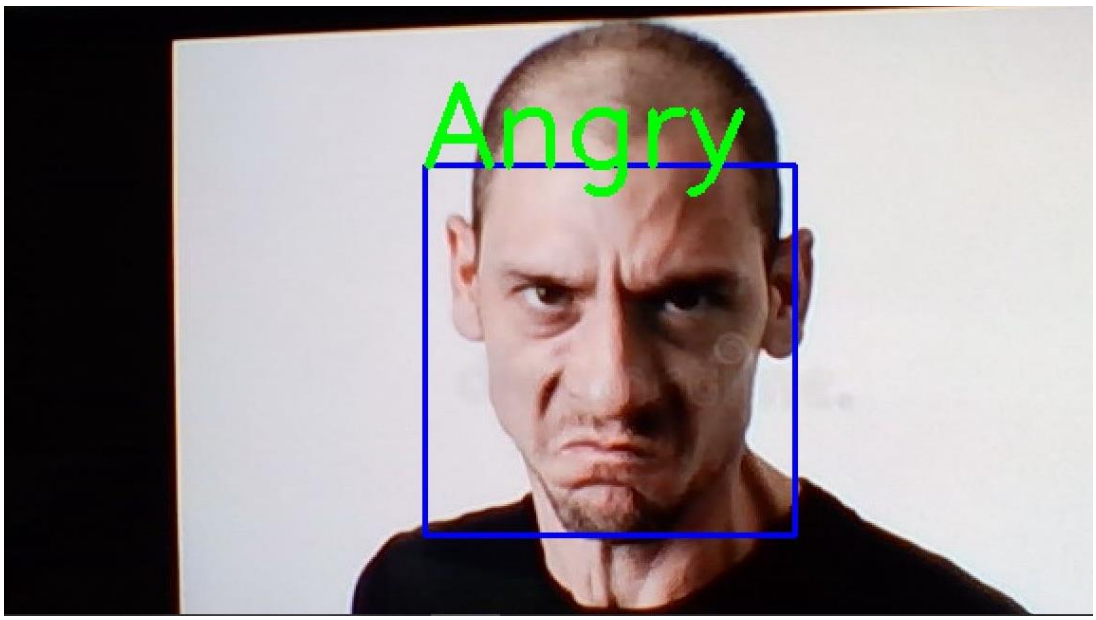
Angry

Fig1.4

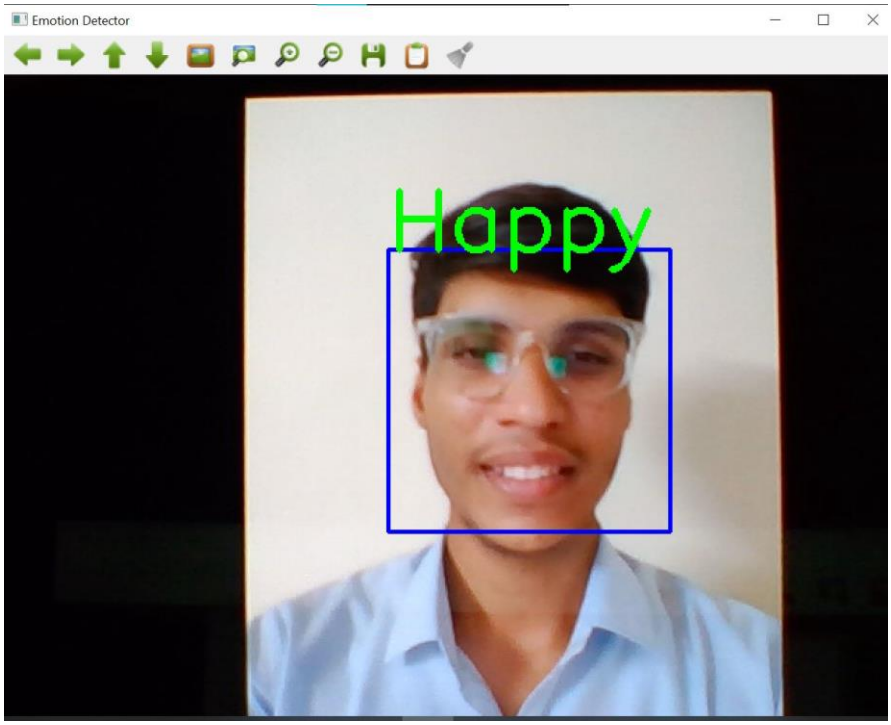

Fig1.5

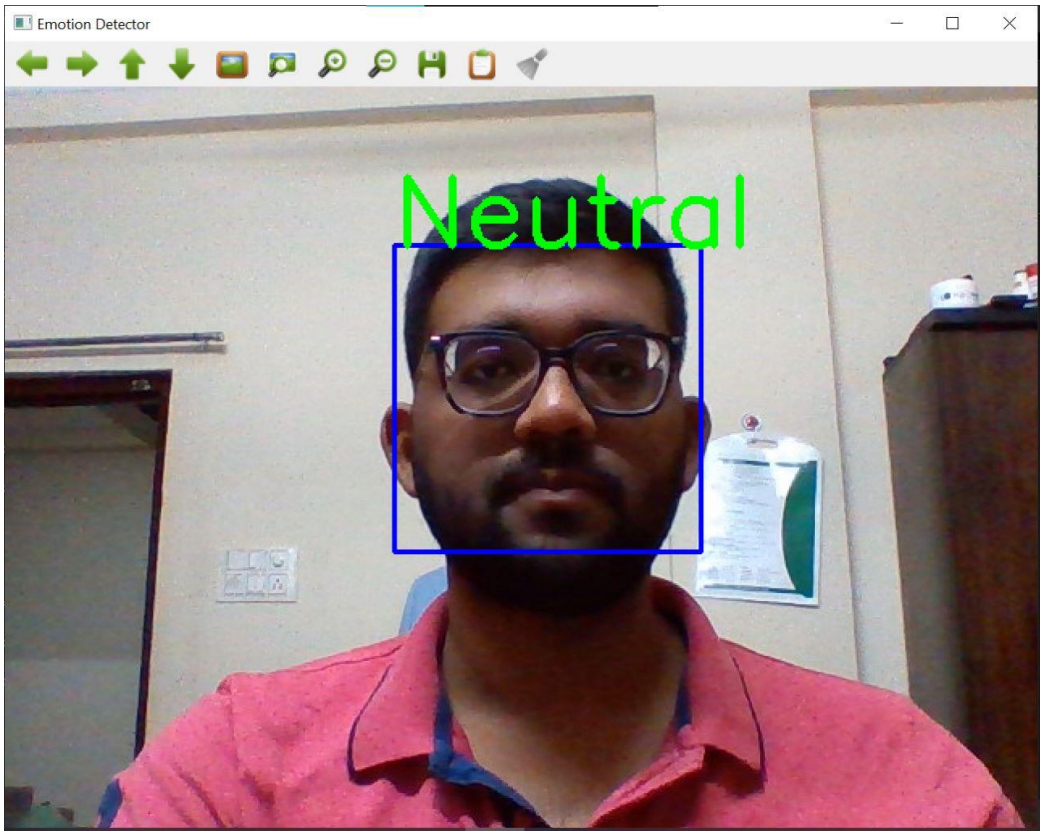

Fig1.6

4.5 Testing

Testing is the process of evaluation of a system to detect differences between given input and expected output and also to assess the feature of the system. Testing assesses the quality of the product. It is a process that is done during the development process.

4.5.1 Strategy Used

Tests can be conducted based on two approaches –

- Functionality testing
- Implementation testing

The texting method used here is Black Box Testing. It is carried out to test functionality of the program. It is also called 'Behavioral' testing. The tester in this case, has a set of input values and respective desired results. On providing input, if the output matches with the desired results, the program is tested 'ok', and problematic otherwise.

4.5.2 Test Case and Analysis

Test Case 1

Test Case ID	TC001
Test Case Summary	It will check whether the model detect the emotion type HAPPY or not
Test Procedure	Provide image to model
Expected Result	Model should Properly detect HAPPY Face
Actual Result	Actual results were 100%
Status	Pass

Output

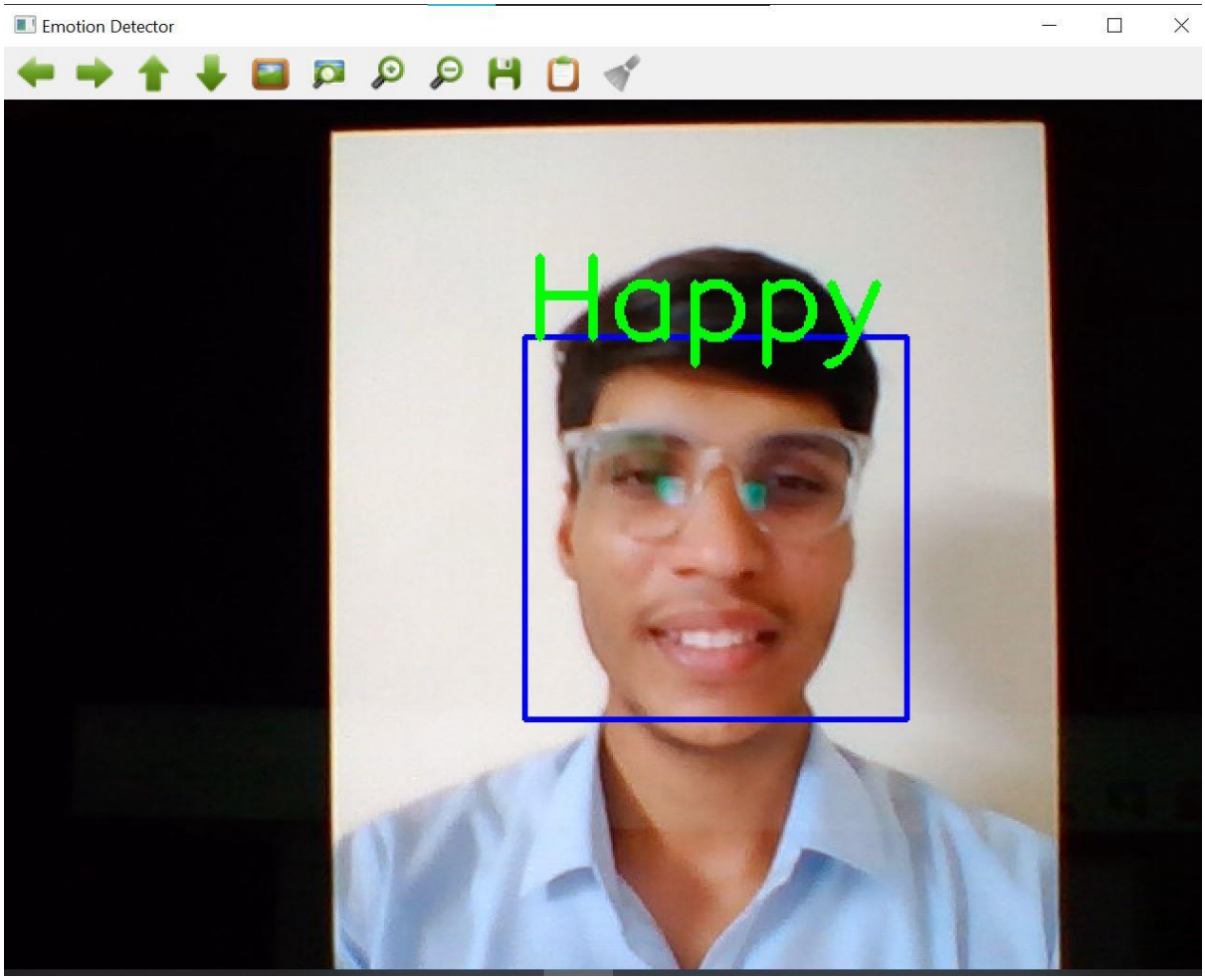

Fig2.1

TEST CASE: 2

Test Case ID	TC002
Test Case Summary	It will check whether the Model Detect Neutral mood or not
Test Procedure	Provide image to model
Expected Result	Results were 100%
Actual Result	Pass

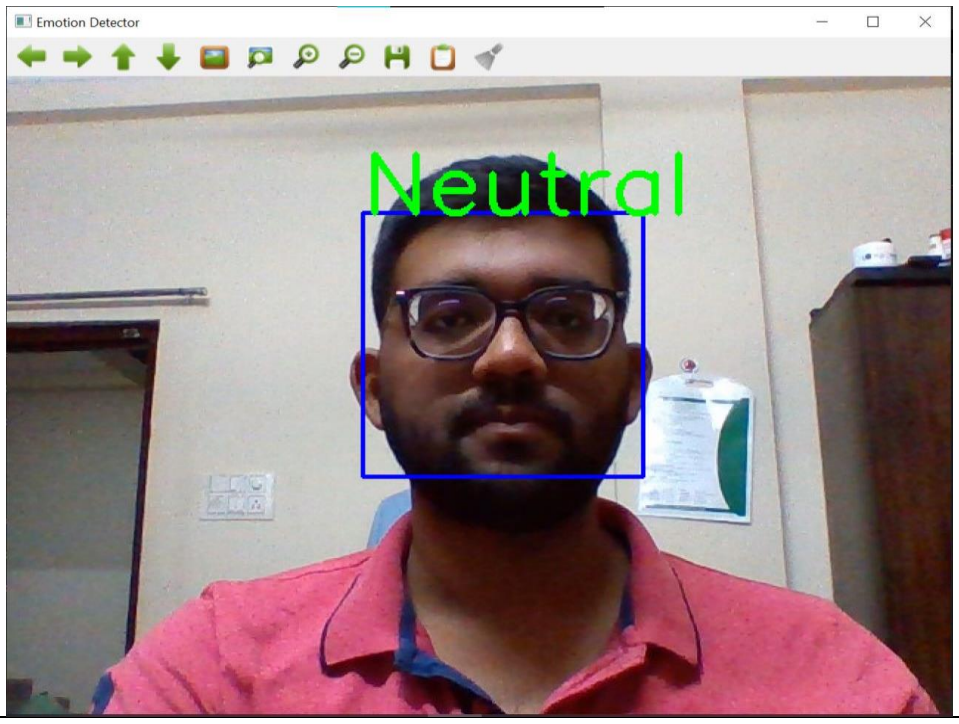

Fig .2.2

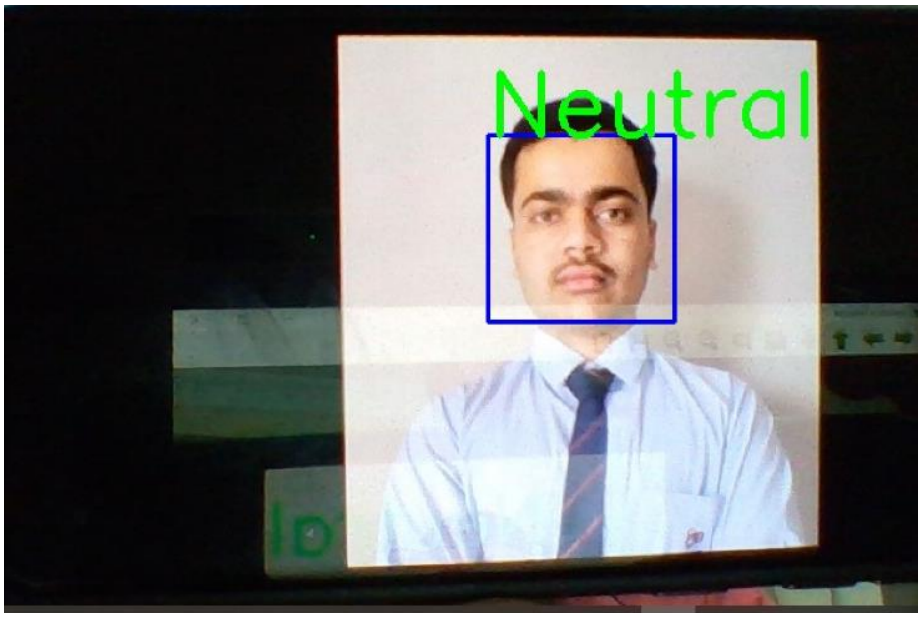

Fig.2.3

TEST CASE: 3

Test Case ID	TC002
Test Case Summary	It will check whether the Model Detect multiple faces or not
Test Procedure	Provide multiple image
Expected Result	Results were 100%
Actual Result	Pass

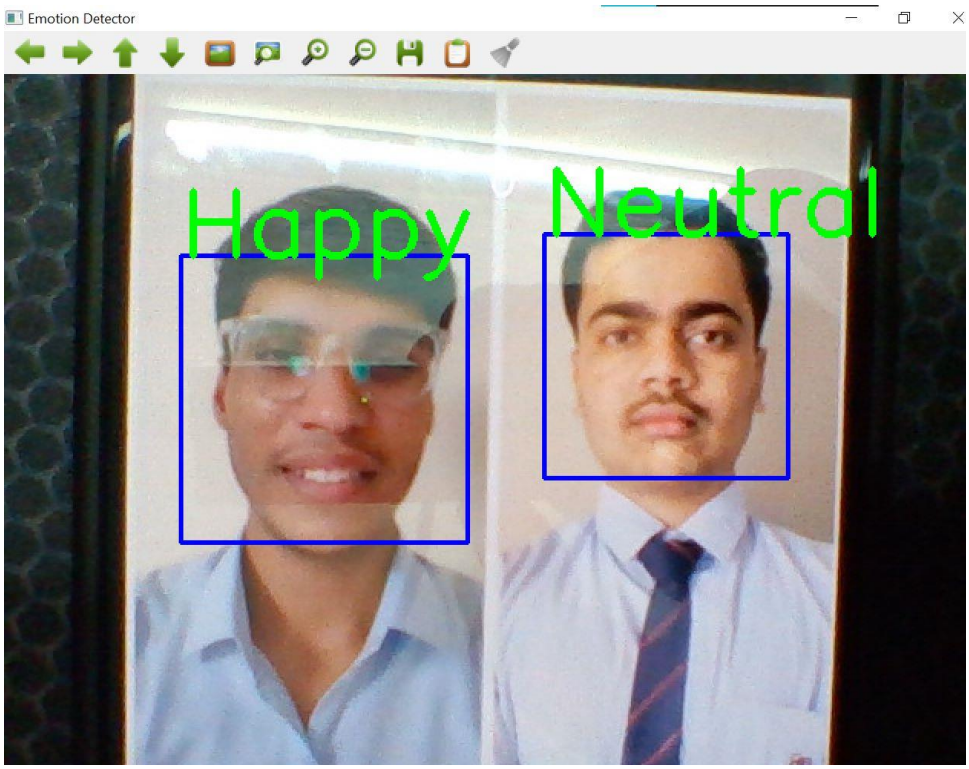

Fig 2.4

Chapter 5.Conclusion

5.1 Conclusion

In this project, a detailed analysis and comparison are presented on FER approaches. Additionally, different datasets related to FER are elaborated for the new researchers in this area. FER performance has increased due to the combination of DL approaches. In this modern age, the production of sensible machines is very significant, recognizing the facial emotions of different individuals and performing actions accordingly. It has been suggested that emotion-oriented DL approaches can be designed and fused with IoT sensors. In this case, it is predicted that this will increase FER's performance to the same level as human beings, which will be very helpful in healthcare, investigation, security and surveillance. In conclusion, the development of a human emotion detection system is a promising field with great potential for various applications in areas such as healthcare, education, and marketing. Advances in machine learning and computer vision have enabled the creation of algorithms capable of accurately identifying and analyzing human emotions from facial expressions The integration of emotion detection systems into various technologies such as social robots, virtual assistants, and smartphones can enhance human-machine interactions and provide personalized experiences for users. However, ethical concerns such as privacy and bias in the data used for training these systems must be carefully addressed to ensure that they do not harm individuals or perpetuate societal inequalities

Overall, emotion detection systems have the potential to be highly beneficial in a variety of fields, but careful consideration must be given to the ethical implications of their use. Further research is needed to address these concerns and develop more accurate and reliable approaches to emotion detection It has been suggested that emotion-oriented DL approaches can be designed and fused with IoT sensors. In this case, it is predicted that this will increase FER's performance to the same level as human beings, which will be very helpful in healthcare, investigation, security and surveillance. In conclusion, the

development of a human emotion detection system is a promising field with great potential for various applications in areas such as healthcare, education, and marketing. Advances in machine learning and computer vision have enabled the creation of algorithms capable of accurately identifying and analyzing human emotions from facial expressions The integration of emotion detection systems into various technologies such as social robots, virtual assistants, and smartphones can enhance humanmachine interactions and provide personalized experiences for users. However, ethical concerns such as privacy and bias in the data used for training these systems must be carefully addressed to ensure that they do not harm individuals or perpetuate societal inequalitie

5.2 Suggestion and Recommendations for Future Work

- Will update the dataset to increase the accuracy of model for detection of faces more accurately and precisely.

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