Smart Art Board using AI

Submitted in partial fulfilment of the

requirements of the degree of

Bachelor of Engineering (B.E.)

in

INFORMATION TECHNOLOGY

by

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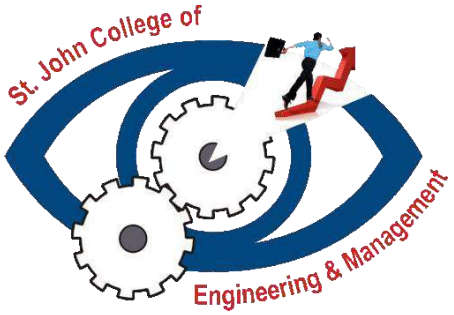

Department of Information Technology

St. John College of Engineering and Management, Palghar

University of Mumbai

2022–2023

CERTIFICATE

This is to certify that the B.E. project entitled **“Smart Art Board using AI”** is a bonafide work of **“Shreya Jayesh Thakur” (EU1194014)**, **“Keyur Bharat Prajapati” (EU1194016)**, **“Chaitanya Sunil Sharma” (EU1194010)** submitted to University of Mumbai in partial fulfilment of the requirement for the award of the degree of **“Bachelor of Engineering”** in **“Information Technology”** during the academic year 2022–2023.

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B.E. Project Report Approval

This project report entitled ***Smart Art Board using AI*** by ***Shreya Jayesh Thakur , Keyur Bharat Prajapati,*** and ***Chaitanya Sunil Sharma*** is approved for the degree of ***Bachelor of Engineering*** in ***Information Technology*** from ***University of Mumbai***.

Examiners

1. _____

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We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date:

Place:

Abstract

Smart Art Board using AI, utilizes the power of Artificial Intelligence and Machine Learning to enable users to create virtual sketches and drawings through hand gestures, without the need for a mouse, keyboard, pointer or touch screen. We distinguish between automation-focused applications like robotics and the broader potential of recent advancements in deep learning to act as a general-purpose invention method. Our research indicates a significant shift towards application-oriented learning and development. By leveraging the capabilities of AI, we can achieve greater efficiency in the economy and potentially revolutionize the innovation process and R&D organization through a new general-purpose "method of invention. "We aim to create an immersive virtual meeting experience similar to Zoom, where we will showcase our AI Virtual Art Board and Augmented Reality features. Our interactive whiteboard fosters hands-on and collaborative learning. our interactive board allows creators to work hands-on, collaborative learning. Artificial intelligence (AI) is advancing the capabilities of automated systems. The progress of advanced education is closely tied to advancements in technology and computing power of intelligent machines. With the rapid progress in artificial intelligence, new opportunities and challenges are arising for tutoring and literacy in advanced education. This could also potentially cause changes in the way institutions of advanced education are governed and structured.

Keywords— *Smart Art Board, Artificial Intelligence, Machine Learning, Smart Board*

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List of Abbreviations

SJCEM	St. John College of Engineering and Management
AI	Artificial Intelligence
WBS	Work Breakdown System
DFD	Data Flow Diagram
GUI	Graphical User Interface

Chapter 1

Introduction

The way humans engage with technology has been fundamentally changed by artificial intelligence (AI). AI is gradually playing a central role in our lives, from self-driving cars to personal assistants like Siri and Alexa. As technology develops, AI is being incorporated into a wider variety of gadgets, allowing them to carry out functions that were previously regarded to be the sole preserve of humans. AI-enabled gadgets are capable of understanding speech, recognize things, making choices, and even picking up new skills. The influence of this technology, which is altering the way we work and live, will only grow in the ensuing years. In light of this, this essay will examine how AI is altering the technological environment as well as its advantages and disadvantages.

The Educational System has been significantly impacted by artificial intelligence, which has changed how humans teach and learn. Educational institutions may adapt the learning experience for each student based on their unique requirements and learning preferences using AI-powered technology. AI tools may also assist instructors in monitoring student development and identifying areas that require further attention. In addition, AI has made it feasible for students to access learning materials at any time and from any location, allowing them to progress at their own speed. Moreover, AI-powered technologies like chatbots and virtual assistants are being utilised to give students quick help and respond to their questions, which lightens the strain on teachers.

Artificial Intelligence (AI) has the potential to enhance the capabilities of smart boards, making them even more valuable tools in the classroom. Smart boards controlled by hand gestures are an exciting application of artificial intelligence in education. With gesture recognition technology, smart boards can recognize and respond to hand gestures, allowing teachers and students to interact with the content in a more intuitive and natural way.

1.1 Motivation

To develop a platform with Interactive User Interface which enables user to express their creativity. Illustrations not only help your followership retain information- they insure they are more likely to recall your brand. The point is with a picture, you can convey so much further information than you can with words. In fact, it can take a thousand words just to describe what's in one picture. And, filmland have the capability to convey abstract and complex generalities similar as facial expressions. The brain absorbs and synthesizes visual information briskly than any other stimulants, making visual content an incredibly effective medium. Because we reuse visual stimulation at lightning speed, images are likely to prompt strong emotion, which in turn can lead to action. It lets the preceptor to explore from the board, he she does not need to go to his PC, turn his reverse to the class, and be more concentrated around the invention than on the literacy procedure of the understudies. They say that scent is the sense that's utmost nearly tied to memory. I don't know how true that is, but I can imagine that there's an element of verity to it. What we 're talking about is your sense of sight. filmland can incontinently change your mood and leave prints much briskly and much more directly than words can.

1.2 Problem Statement

There are now several types of smart digital board software available on the market that can be utilized with a mouse and other hardware devices. However, if there are hardware faults, we must suspend our current task, such as taking notes or creating art, until replacement gadgets arrive. Traditional smart boards are likewise becoming dull due to the lack of new content. As a result, we are developing an AI Virtual Smart Board that can be used to take notes or create art using hand gestures caught by a camera (Webcam).

1.3 Objectives

To develop a smart board platform that is able:

- Accommodate different learning styles.
- Boost peoples' engagement.
- Digital learning helps humans understand much efficiently.
- Assistive technology in special education for disabled persons.
- Reducing physical disabilities and impairments barriers while involved in technology.

1.4 Scope

Hand gestures are recognized by the camera of the device with the help of OpenCV2 library. Different gestures will be allotted to different functions on the art board scale in the UI of the application. User will be given options to choose as per there needs and apply their imagination. A tutorial of the whole working of the application will be provided to the user. PyCharm IDE will be used to develop the system with environment which will help the user to easily access all the tools and functions in the system.

Chapter 2

Review of Literature

[1] Does The Use Of Smart Board Increase Students' Higher Order Thinking Skills (HOTS)?

In 2019, Xabdul Halim Abdullah, Mahani Mokhtar, Zakiah Mohamad Ashari, Norazrena [1] proposed a study which reviewed on how students' ability to deal with the world's rapid change depends on their ability to develop Higher Order Thinking Skills (HOTS). In conclusion, most of the teaching and learning activities for mathematics in primary schools emphasize the development of knowledge, but not HOTS. The literature shows that HOTS is critical in educating people to cope with the rapidly changing world.

[2] The Impact Of Artificial Intelligence On Teaching And Learning In Higher Education.

In 2018, Stefan A. D. Popenici and Sharon Ker [2] presented a study about the use of technology in higher education should not be limited to distributing, controlling, and assessing materials. Rather, it should enhance and support human thinking. The rise of AI makes it impossible to ignore a serious debate about its future role of teaching and learning in higher education and what type of choices universities will make in regard to this issue.

[3] The Impact Of Artificial Intelligence On Innovation.

In 2018, Iain M. Cockburn Rebecca Henderson Scott Stern [3] proposed a study that AI art is indeed creative and that those who are interested in exploring it have the opportunity to experiment with new technologies and discover new forms of art. The paper emphasizes the potential of computational abstraction processes in re-creating the human psychological process of creating art. Preliminary analysis highlights a few key ideas that have not been central to the economics and policy discussion so far.

[4] Impact Of SMART Board Technology An Investigation Of Sight Word Reading And Observational Learning

In 2007, Linda Mechling David L Gast [4] presented a study that aims to investigate the effectiveness of using computer-assisted instruction with SMART Board technology to teach sight words to a small group of students with disabilities. The procedure was Linda Jungle evaluation for technical, sight word, reading with moderate. Intellectual disability is within a small group arrangement was concluded.

[5] Towards Emotionally Aware AI Smart Classroom: Current Issues And Directions For Engineering And Education

In 2017, Yelin Kim, Tolga Soyata, and Reza Feyzi Behnagh [7] presented a study that proposes a smart classroom system that uses real-time sensing and machine intelligence to enhance learning experiences and communication between students and teachers. Procedure was Linda Jungle evaluation for technical, sight word, reading with moderate. Intellectual disability is within a small group arrangement was concluded.

[6] A Study On Smart Board Effectiveness In Teaching-Learning Experience

In 2019, Geeta Sharma and Divya Nambiar [10] presented research which indicates that college students generally prefer a combination of traditional and smart board teaching methods to better understand concepts. While students find smart board teaching easy to use and like it, it is not the only factor that aids in recalling content. Teachers' direction and perception also play a crucial role in comprehending various concepts.

2.1 Comparative Study

Table 2.1 Literature Analysis

Sr. No.	Paper Title	Authors	Conclusion	Research Gaps
[1]	The Impact Of Artificial Intelligence On Innovation. (2007) [JADD]	Iain M. Cockburn Rebecca Henderson Scott Stern	Preliminary analysis highlights a few key ideas that have not been central to the economics and policy discussion so far.	Eraser could be added rather deleting whole art.
[2]	Does The Use Of Smart Board Increase Students' Higher Order Thinking Skills (HOTS)? (2020) [IEE]	Xabdul Halim Abdullah, Mahani Mokhtar, Zakiah Mohamad Ashari, Norazrena	In conclusion, most of the teaching and learning activities for mathematics in primary schools emphasize the development of knowledge, but not HOTS. The literature shows that HOTS is critical in educating people to cope with the rapidly changing world.	Use of finger tip could be used instead of only figure tips. Eraser could be added rather deleting whole art. Use of Hand Gesture could be used.
[3]	Exploring The Impact Of Artificial Intelligence On Teaching And Learning In Higher Education. (2017) [Springer]	Stefan A. D. Popenici and Sharon Kerr	The rise of AI makes it impossible to ignore a serious debate about its future role of teaching and learning in higher education and what type of choices universities will make in regard to this issue.	Different colour pens could be have been used in board.
[4]	Impact Of SMART Board Technology An Investigation Of Sight Word Reading And Observational Learning. (2014) [Springer]	Linda Mechling	Procedure was Linda Jungle evaluation for technical, sight word, reading with moderate. Intellectual disability is within a small group arrangement was concluded.	Use of Hand Gesture could be used.

[5]	The Effect Of Smart Board On Students' Engagement And Achievement (2020) [IEEE]	Noor Qassim Muhammad, Dr.Bushra Saadoon Mohammed Alnoori	The paper was concentrated on the ideas put forth by Hativa, on the cognitive-thinking component of effective teaching methods, when seeking to examine the impact of adopting smart boards as a mechanism of change in the educational system.	Use of finger tip could be used instead of only figure tips.
[6]	A Study On Smart Board Effectiveness In Teaching-Learning Experience (2019) [JETIR]	Geeta Sharma, Divya Nambiar	Procedure was Linda Jungle evaluation for technical, sight word, reading with moderate. Intellectual disability is within a small group arrangement was concluded.	Can provide a more engaging user interface. Use of Hand Gesture could be used.
[7]	The Creativity Of Artificial Intelligence In Art (2022) [Proceedings]	Mingyong Cheng	This paper suggests that people who are committed to AI art are in the right place because by doing so, they have the opportunity to explore new AI technologies	Can provide with a better Interaction and collaborative system.
[8]	Towards Emotionally Aware AI Smart Classroom: Current Issues And Directions For Engineering And Education. (2017) [IEEE]	Yelin Kim, Tolga Soyata and Reza Feyzi Behnagh	Procedure was Linda Jungle evaluation for technical, sight word, reading with moderate. Intellectual disability is within a small group arrangement was concluded.	Eraser could have been added in the smart board system.
[9]	Using Interactive Whiteboard Technology To Support Collaborative Modeling (2008) [Springer]	Michiel Renger ,Gwendolyn L. Kolfschoten, and Gert-Jan de Vreede	The purpose of this paper is to provide first insights in the various settings in which interactive whiteboards can be used to support collaborative modeling	Hand Gesture could have been used. Different colour pens could be added in the system.

[10]	An evaluation of the effectiveness of smart board technology by evaluating the students ability of completing their work with focus on students with disabilities. (2020) [IJEDICT]	Melanie K. Handler	A research to assess student engagement rates and their capacity to complete their task in order to determine the efficacy of SMART Board technology. The study focuses on pupils who have difficulties, particularly those caused by health conditions like attention deficit hyperactivity disorder.	The focus was more on how the smart board was pursued by every individual student than the primary focus of checking if the smart board is any good enough for every different individual.
[11]	The effect of SmartBoard use on academic achievement: a Meta-analytical and Thematic study. (2020) [IJEMST]	Hüseyin Akar	The study's goal is to comprehend how employing a smart board affects academic performance. Mixed methods, such as quantitative and qualitative methods, are blended and employed for this aim.	Articles speculated had differences in them and varied a lot form each other.

Chapter 3

Requirements Analysis

3.1 Hardware Requirements

- **Operating System:** Windows 10 Home Single Language
- **Processor:** Intel(R) Core(™) i5-7200U CPU @ 2.50GHz 2.70 GH
- **Hard Disk Storage:** 1 TB
- **Installed RAM:** 8.00 GB (7.87 GB usable)

3.2 Software Requirements

- VS Code
- Different libraries
- 64-bit Windows OS / macOS
- Python

Chapter 4

Design

4.1 Dataflow Diagrams (DFDs)

The following figures represents the Dataflow Diagram of the proposed system.

4.1.1 Level 0 DFD

Figure 4.1.1: Level 0 DFD diagram

4.1.2 Level 1 DFD

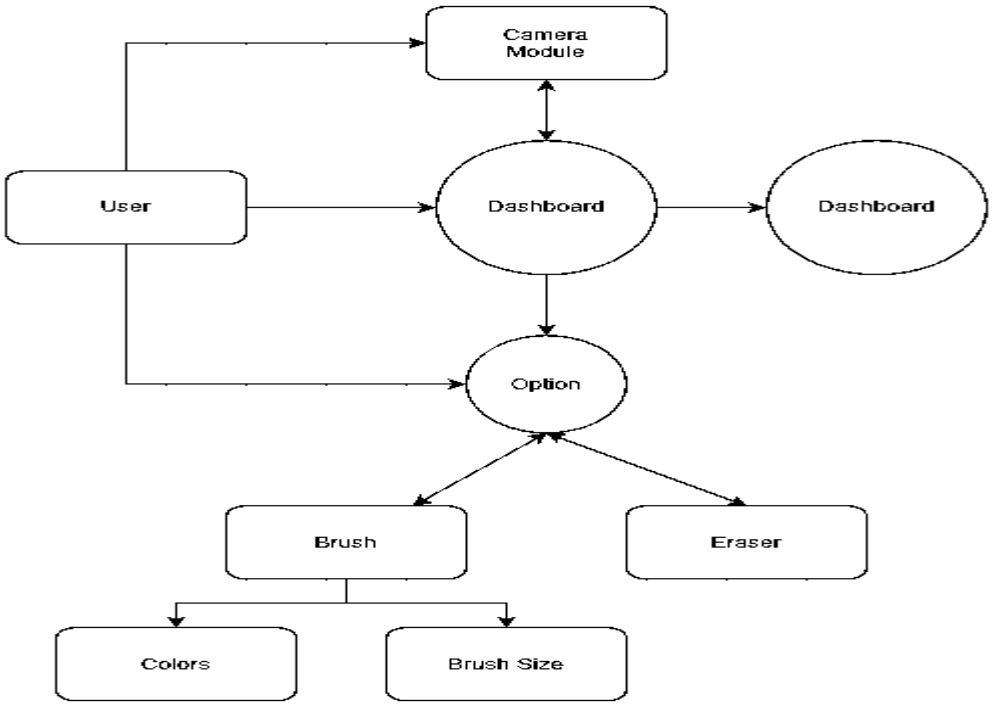

Figure 4.1.2: Level 1 DFD diagram

4.2 UML Diagrams

The UML diagram of the proposed system is shown below as Use Case, Activity Diagram and Sequence Diagram.

4.2.1 Use case Diagram

The following Fig 4.2.1 shows the Use Case Diagram of the proposed system.

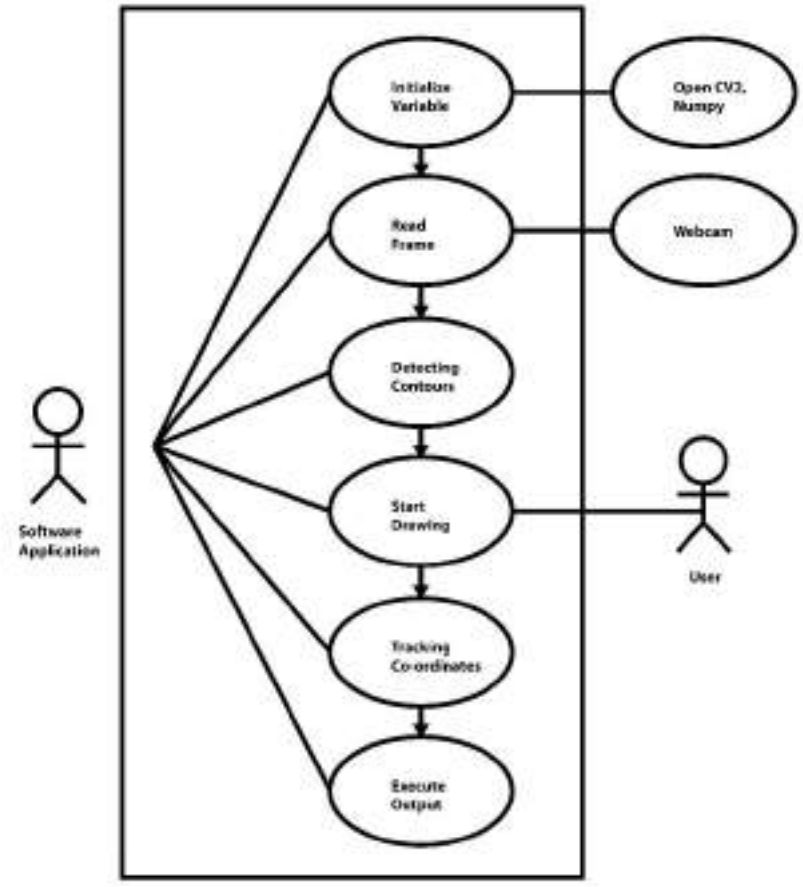

Figure 4.2.1: Use case diagram

4.2.2 Activity Diagram

The below Fig 4.2.2 shows the Activity Diagram of the proposed system

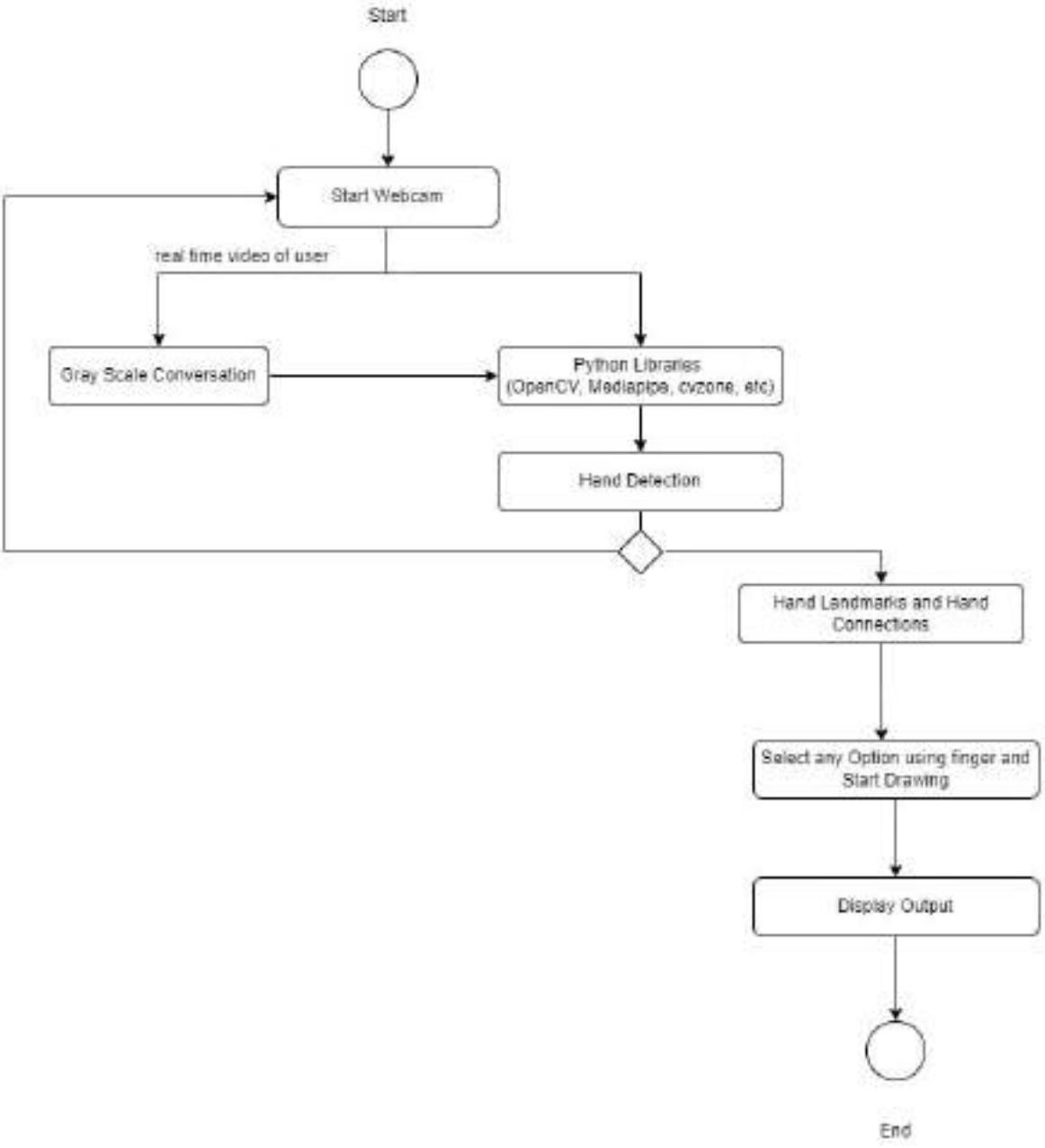

Figure 4.2.2: Activity diagram for Smart Art Board

4.2.3 Sequence Diagram

The below Fig 4.2.2 shows the Sequence Diagram of the proposed system

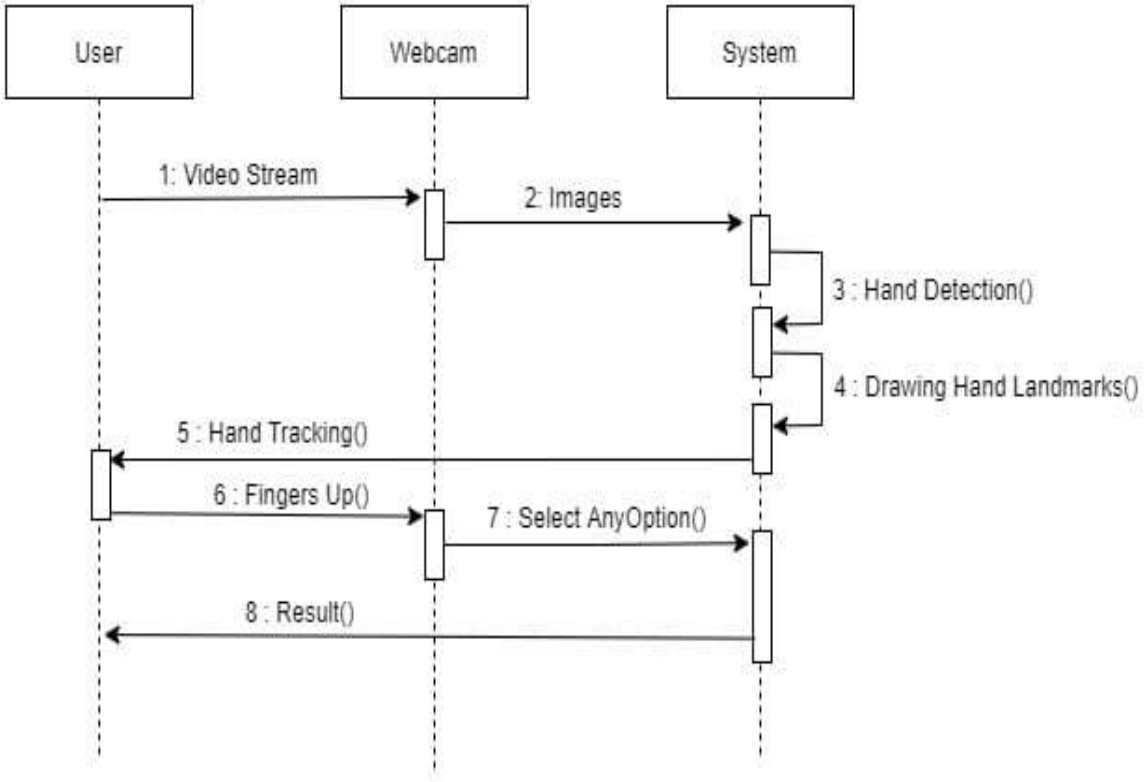

Figure 4.2.3: Sequence diagram for Smart Art Board

4.2.4 Gantt Chart

The Timeline of the project is presented below in the form of Gantt Chart in Fig.4.2.4

Figure 4.2.4: Timeline for Smart Art Board

4.2.5 Work Breakdown Structure (WBS) Chart

The Work Breakdown Structure explains the workflow of the entire plan of the project in Fig 4.2.5.

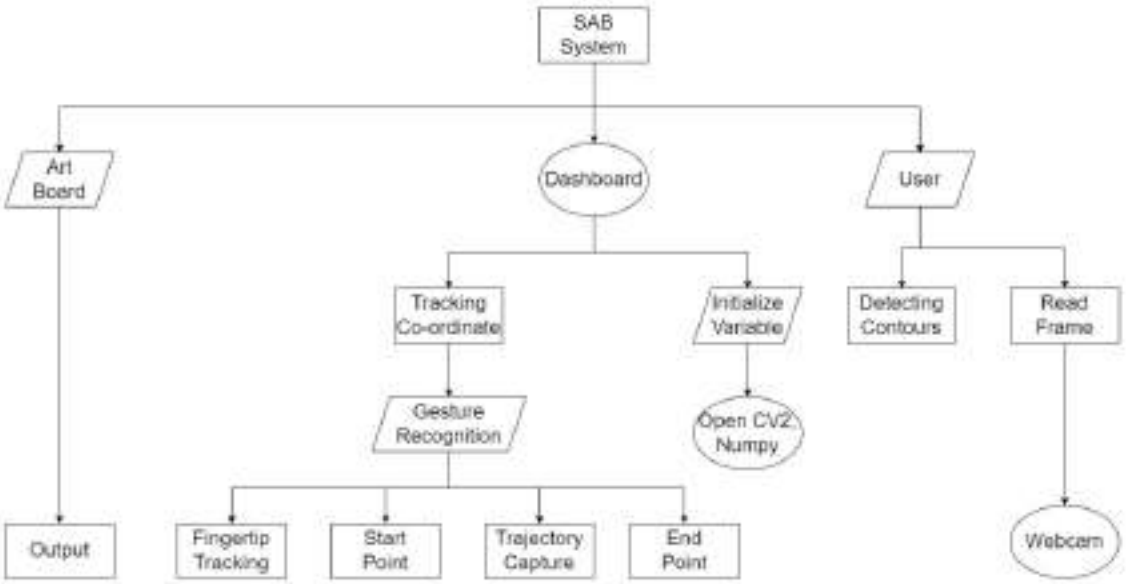

Figure 4.2.5: WBS Chart for Smart Art Board

Chapter 5

Report on Present Investigation

5.1 Methodology

Below Fig.5.2.1 describes our "Smart Art Board for Creators and Enthusiasts" project, which enables us to produce artwork using hand gestures on a smart board, is based on Python and their library. We can draw by waving our hands in the air since the system will use the webcam to track our hand gestures. We used the time, Mediapipe, Open CV2, and Numpy libraries. The PyChram IDE was used to construct this project. We'll employ the Python-based Open CV2 library. Multiple Kaggle datasets will be gathered and used as necessary. Rapid developments in artificial intelligence have significant effects on both the economy and society at large.

5.2 Proposed System

The suggested system for "Smart Art Board Using AI" is shown in the below Fig. 5.2.1. The user interface that is made available to the user is how the system interacts, allowing the camera to recognise the user's actions. The gesture recognition process begins when the camera records the trajectory of the user's hand and monitors the fingertip points in accordance to identify the gesture the user made to carry out a particular function.

5.2.1 Block diagram of the System

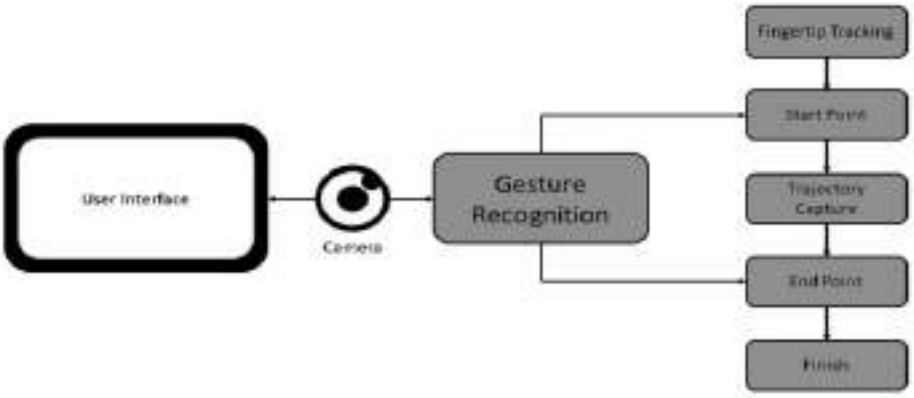

Figure 5.2.1: Architecture/Block Diagram for Smart Art Board

5.3 Implementation

Below fig.5.3.1 explains the workflow of the with the use of the OpenCV2 library, the device's camera can recognize hand motions. On the art board scale in the application's UI, different motions will be assigned to various functions. The educator might print the screen using the camera tool. If class time was running out, the teacher may print the screen to note where each student is in the assignment and then resume work where they left off the next day.

5.3.1 Flow Chart

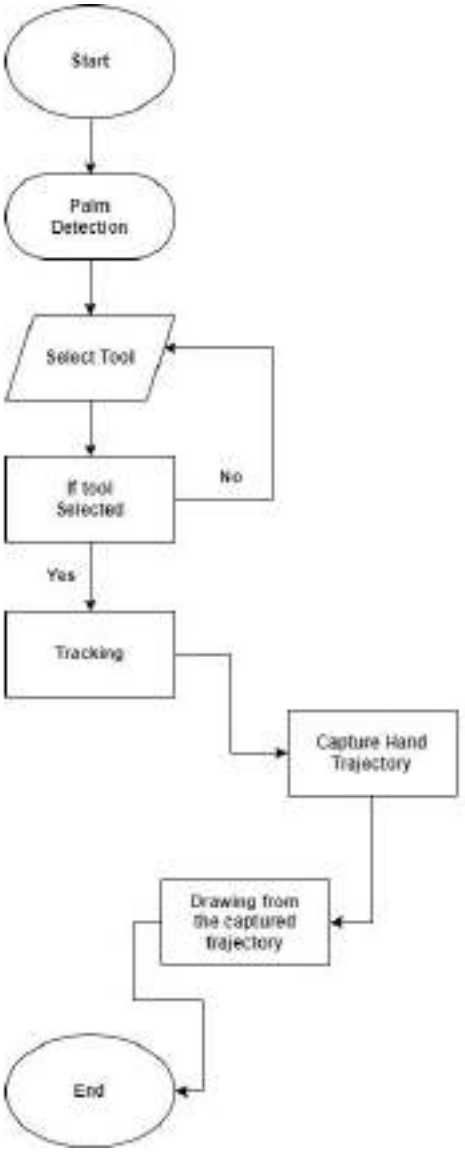

Fig 5.3.1 Flow Chart for Smart Art Board

5.3.2 Pseudo Code

```
import cv2
import mediapipe as mp
import time

cap = cv2.VideoCapture(0)

mpHands = mp.solutions.hands
hands = mpHands.Hands()
mpDraw = mp.solutions.drawing_utils

pTime = 0
cTime = 0

while True:
    success, img = cap.read()
    imgRGB = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
    results = hands.process(imgRGB)
    # print(results.multi_hand_landmarks)

    if results.multi_hand_landmarks:
        for handLms in results.multi_hand_landmarks:
            for id, lm in enumerate(handLms.landmark):
                # print(id, lm)
                h, w, c = img.shape
                cx, cy = int(lm.x * w), int(lm.y * h)
                print(id, cx, cy)
                # if id == 4:
                cv2.circle(img, (cx, cy), 15, (255, 0, 255), cv2.FILLED)

            mpDraw.draw_landmarks(img, handLms, mpHands.HAND_CONNECTIONS)

    cTime = time.time()
    fps = 1 / (cTime - pTime)
    pTime = cTime

    cv2.putText(img, str(int(fps)), (10, 70), cv2.FONT_HERSHEY_PLAIN, 3,
                (255, 0, 255), 3)

    cv2.imshow("Image", img)
    cv2.waitKey(1)
```

5.3.3 Screenshot of Output

Following are some of the screenshots:

Fig.5.3 (a) shows trajectory points are displayed and recognised..

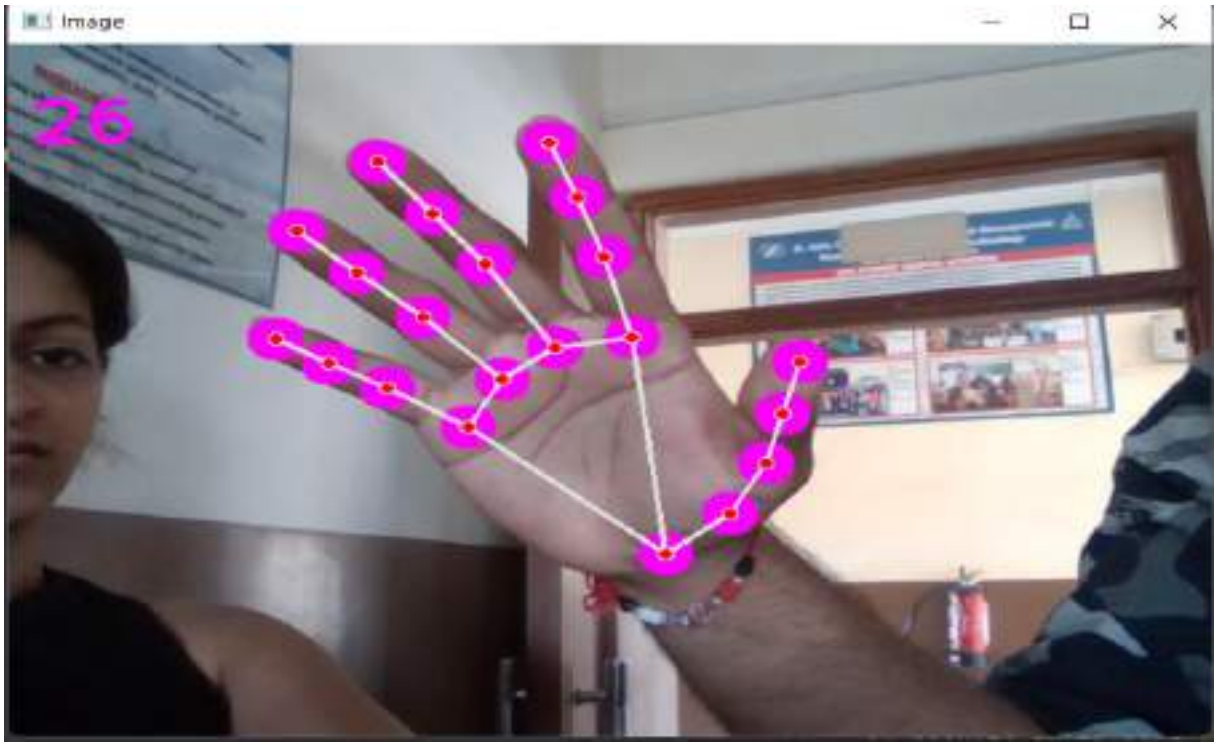

Fig.5.3 (a): Hand Gesture

Fig.5.3(b) shows multiple gestures as complex as soon above can be recognised too.

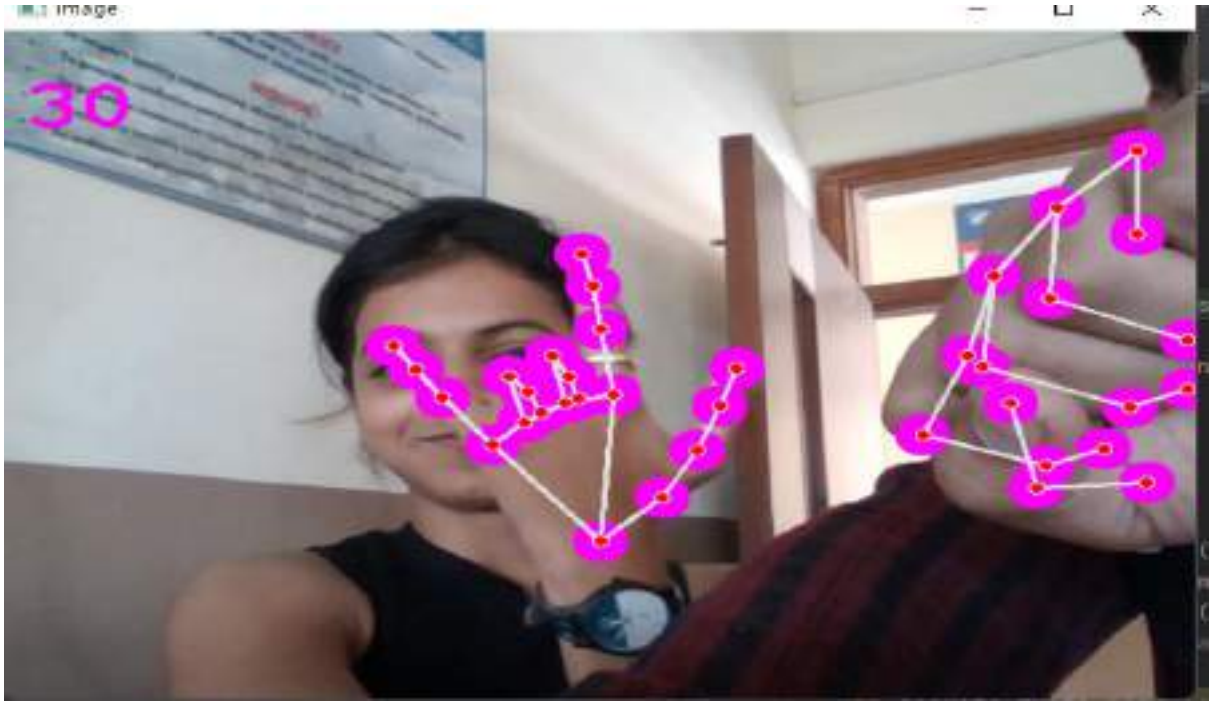

Fig.5.3(b): Gesture Tracking

Fig.5.3 (c) shows single point trajectory points is used to acquired different shape in the system.

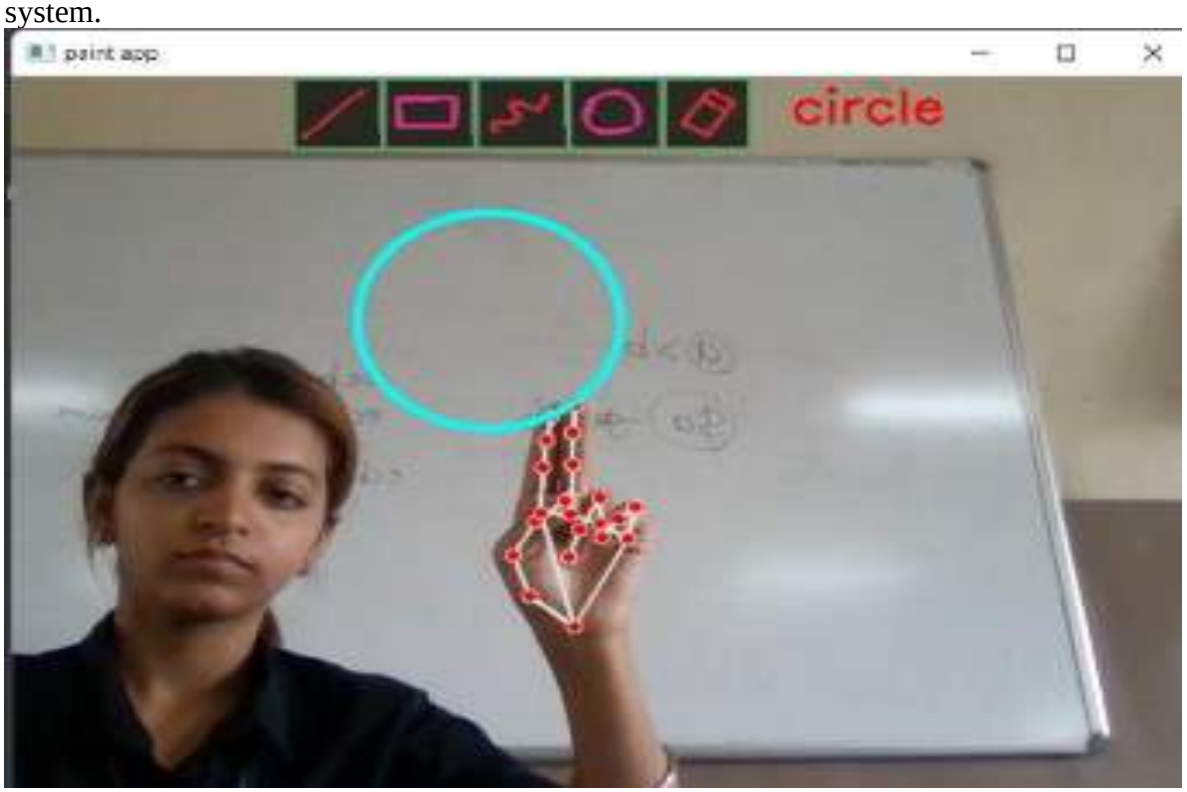

Fig.5.3 (c): Object selection

Fig.5.3 (d) shows the two point trajectory points used to draw the final outcome using the UI.

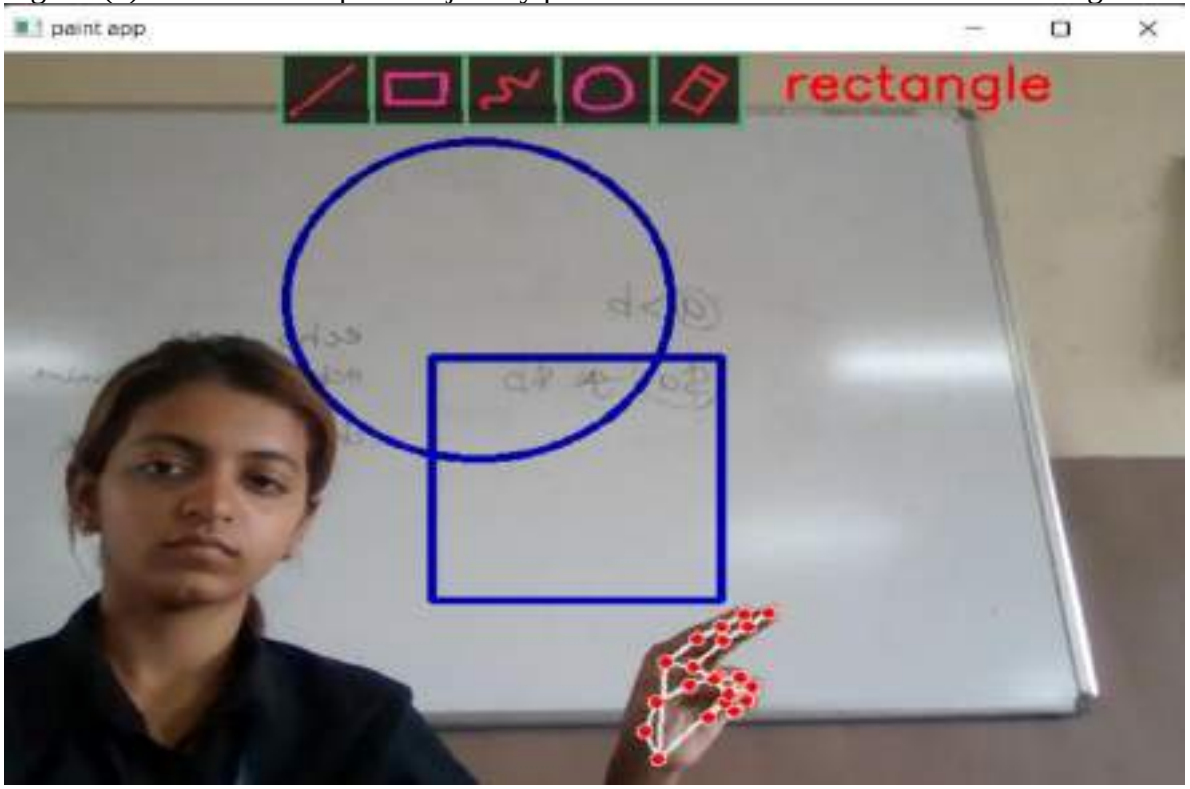

Fig.5.3 (d): Object outcome

Chapter 6

Results and Discussion

Our "Smart Art Board for Creators and Enthusiasts" project is built on Python and their library, which allows us to create artwork using hand gestures on a smart board. The system will use the webcam to track our hand gestures so we may sketch by waving our hands in the air. Numpy, Open CV2, Mediapipe, and time libraries were employed. This project was created in the PyChram IDE.

We successfully implemented the project i.e., Hand gestures or and tracking are recognised by the trajectory points specified and they are Human hand trajectories have been recorded and analyzed in an experimental supervisory control interface. There are multitudinous gatherings and websites that intend to help preceptors by giving Smart Board studies and exercises. There are multitudinous ways that a Smart Board can be employed as a part of a classroom.

Chapter 7

Conclusion

With the literature review and the research gaps we have proposed a system in which The Smart Board can admit and can be recognised by the application. Application will allow you to write and move things around without actually touching the screen. Mediapipe library is use to mark the trajectory points of the hands. Initially the project is an art board which is controlled through hand gestures in air using AI and ML. Multiple other libraries are used to calculate the time of the time frames of the trajectory points. The production and qualities of a wide range of goods and services could be directly impacted by these advancements, with significant effects on competition, employment, and productivity. However, as significant as these effects are expected to be, artificial intelligence also has the power to alter the invention process itself, with implications that could be just as significant and that could eventually eclipse the direct influence.

Additional tools such as a rubber, filler, brush, and so on will be included. We'll use more colors. More geometrical shapes, such as lines, circles, rectangles, and squares, will be included. A virtual keyboard and additional AI technologies will also be included. We intend to build it as a fully interactive artificial intelligence system in the vein of Google Meet and others.

References

[1] Xabdul Halim Abdullah, Mahani Mokhtar, Zakiah Mohamad Ashari, Norazrena "Does The Use Of Smart Board Increase Students' Higher Order Thinking Skills (Hots)?" (2020).

[2] Stefan A. D. Popenici And Sharon Kerr, "Exploring The Impact Of Artificial Intelligence On Teaching And Learning In Higher Education".(2020)

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[5] Noor Qassim Muhammad, Dr.Bushra Saadoon Mohammed Alnoori."The Effect Of Smart Board On Students' Engagement And Achievement "(2019).

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[7] Iain M. Cockburn Rebecca Henderson Scott Stern. "The Effect Of Smart Board On Students" Engagement And Achievement" (2006).

[8] Mingyong Cheng. "The Creativity Of Artificial Intelligence In Art" (2021).

[9] Yelin Kim, Tolga Soyata And Reza Feyzi Behnagh. "Towards Emotionally Aware Ai Smart Classroom: Current Issues And Directions For Engineering And Education" (2017)

Appendix

Technologies Used

- **Python:** A computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a general-purpose language, meaning it can be used to create a variety of different programs and isn't specialized for any specific problems. Python programming is powering the global job market because the benefits of Python are clear. Python is one of the top three programming languages in the world**.**
- **OpenCV2:** An opensource computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Huge open-source library for computer vision, machine learning, and image processing. OpenCV supports a wide variety of programming languages like Python, C++, Java, etc. It can process images and videos to identify objects, faces, or even the handwriting of a human.
- **NumPy:** NumPy stands for Numerical Python and it is a core scientific computing library in Python. It provides efficient multi-dimensional array objects and various operations to work with these array objects. Python library used for working with arrays. It also has functions for working in domain of linear algebra, fourier transform, and matrices. NumPy was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely.
- **Mediapipe lib:** A cross-platform library developed by Google that provides amazing ready-to-use ML solutions for computer vision tasks. OpenCV library in python is a computer vision library that is widely used for image analysis, image processing, detection, recognition, etc.
- **Time lib:** It provides many ways of representing time in code, such as objects, numbers, and strings. It also provides functionality other than representing time, like waiting during code execution and measuring the efficiency of your code.

Publication

[1] Shreya J. Thakur, Keyur B. Prajapati, Chaitanya S. Sharma, Priyanka U. Kamble. “Smart Art Board using AI.” International Journal of Novel Research and Development, April 2023.

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