K21RG

INT 404

<u>Final Submission Report</u>
<u>Seminar Topic No. : 19</u>

Artificial Intelligence in Robotics

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Submitted to,

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Details Of Group Members :

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Contribution : Documentation & Researching Part

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Contribution : Implementation & Coding Part

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Contribution : Overview & Testing Part

Contribution Of Contributors :

Each group member has done some work on this project and contributed their time in completion of the project.

Contribution of contributors are as follows :-

At first, when this project work was given to us, we came together to discuss on this topic that how we are going to complete this project work together. After discussing all this, we decided to divide our work in following parts.

Planning :

We discussed specifically how we are going to meet the requirements of the project. This is the stage where we planned exactly what needs to be done, how it needs to be done, and who should do what.

- ✓ Documentation & Researching :- Sudhanshu Raj Tiwari
- ✓ Implementation & Coding :- Ganpati Nath
- ✓ Overview & Testing :- Sagar Kumar

Documentation & Researching :

Research is a process of systematic inquiry that entails collection of data, analysis and interpretation of that data/information, in accordance with suitable methodologies which are related. And data collection is a systematic process of gathering observations or measurements. We searched and gathered all the information, logics and data regarding the project topic. Searching about the topic and collecting data and information allowed us to gain first-hand knowledge and original insights into our research problems.

 This part is completed by Sudhanshu Raj Tiwari and being shared and discussed among us.

Implementation & Coding :

Project implementation is the phase where visions and plans become reality. This is the logical conclusion, after evaluating, deciding, visioning, planning, we apply all the things together to achieve an output. In this part, all the implementation of the functions and execution of programs and working of all that are done here.

This part was completed by Ganpati Nath as he has done the implementation work in the project.

Overview & Testing :

Testing is the process of evaluating a system or its components with the intent to find whether it satisfies the specified requirements or not. We do test in order to identify any gaps, errors, or missing requirements in contrary to the actual requirements. And project overview is also necessary because it gives a detailed description of a project's goals and objectives, the steps to achieve these goals, and the expected outcomes. The project overview enables us to outline the project schedule, requirements, necessary resources, and status.

This part was done by Sagar Kumar as he tested and overviewed the project.

Artificial Intelligence

In

Robotics

Abstract :

Artificial Intelligence (AI) has revolutionized the field of robotics by providing the ability to develop more advanced and intelligent robots. The integration of AI in robotics has led to the development of robots that can perform complex tasks that were once considered impossible.

One of the key advantages of AI in robotics is that it enables robots to adapt to new and unexpected situations. Traditional robots are programmed to perform specific tasks, and any deviation from the task can cause the robot to malfunction. AI-based robots, on the other hand, can learn from their environment and adjust their behavior accordingly. This makes them more flexible and adaptable in various environments.

Another advantage of AI in robotics is that it allows robots to perform tasks that are too dangerous for humans. For example, robots equipped with AI can be used in disaster zones to search for survivors and provide aid. They can also be used in hazardous industrial environments to perform tasks that would put human workers at risk.

In addition, AI in robotics has led to significant advancements in the field of healthcare. Robots equipped with AI can be used to perform complex surgeries, such as those involving delicate organs or tissues. They can also be used to provide care for elderly patients, helping them with daily tasks such as bathing and dressing.

AI in robotics also has significant implications for the future of work. As robots become more intelligent and capable, they have the potential to replace human workers in certain industries. However, they also have the potential to create new jobs in areas such as robot maintenance and programming.

Despite the many benefits of AI in robotics, there are also concerns about the potential negative consequences. For example, some experts worry about the possibility of robots becoming too intelligent and autonomous, leading to a loss of control over their behavior. There are also concerns about the impact of robots on employment and the economy.

Overall, the integration of AI in robotics has led to significant advancements in the field, with the potential to transform a wide range of industries. While there are certainly challenges to be addressed, the benefits of AI in robotics are clear, and will likely continue to drive innovation in the field for years to come.

Introduction :

Artificial Intelligence (AI) is a rapidly growing field that has made significant advancements in recent years, particularly in the field of robotics. The integration of AI in robotics has transformed the way robots are designed and operated, leading to the development of robots that can perform increasingly complex tasks.

AI has the potential to enhance the capabilities of robots in numerous ways. For example, traditional robots are programmed to perform specific tasks, and any deviation from the task can cause the robot to malfunction. AI-based robots, on the other hand, can learn from their environment and adjust their behavior accordingly. This makes them more flexible and adaptable in various environments.

Applications on AI in Robotics

Artificial Intelligence (AI) is transforming the field of robotics, leading to the development of smart and intelligent robots that can perform tasks without human intervention. These robots are equipped with sensors, cameras, and other hardware components that allow them to perceive and analyze their environment. In this article, we will discuss five applications of AI in robotics and explain each application in detail.

➢ **Autonomous Navigation**

One of the most important applications of AI in robotics is autonomous navigation. Autonomous navigation involves developing robots that can move around and interact with their environment without human intervention. This technology has a wide range of applications in industries such as manufacturing, logistics, and healthcare.

To enable autonomous navigation, robots are equipped with sensors and cameras that allow them to perceive their environment. These sensors capture data such as images, sounds, and other sensory inputs. This data is then analyzed by AI algorithms that allow the robot to make decisions about its movements and interactions with the environment.

For example, self-driving cars use AI algorithms to analyze data from cameras and sensors to navigate roads and avoid obstacles. Similarly, robots in manufacturing plants use AI algorithms to navigate around obstacles and move materials from one location to another.

➢ <u>**Object Recognition**</u>

Another application of AI in robotics is object recognition. Object recognition involves developing robots that can identify and classify objects in their environment. This technology has a wide range of applications in industries such as manufacturing, retail, and healthcare.

To enable object recognition, robots are equipped with cameras and sensors that allow them to capture images of objects in their environment. These images are then analyzed by AI algorithms that can identify and classify objects based on their shape, color, and other characteristics.

For example, robots in warehouses use object recognition algorithms to identify and locate specific items on shelves. Similarly, robots in hospitals use object recognition algorithms to identify medical instruments and equipment.

<u>**Ex : AIHanddectector**</u>
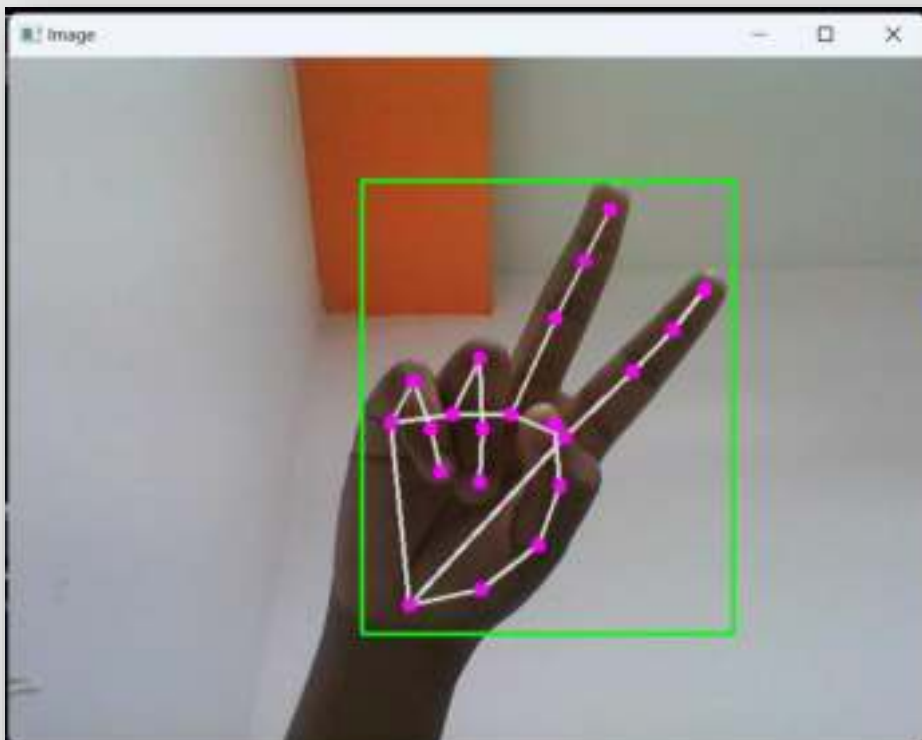
Sourcecode :

```python
import cv2

from cvzone.HandTrackingModule import HandDetector

cap = cv2.VideoCapture(0)
cap.set(3, 1280)
cap.set(4, 720)

detector = HandDetector(detectionCon=0.8)

while True:
    success, img = cap.read()

    img = detector.findHands(img)
    lmList, bboxInfo = detector.findPosition(img)

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

➢ <u>**Speech and Language Recognition**</u>

Speech and language recognition is another important application of AI in robotics. Speech and language recognition involves developing robots that can understand and respond to human speech. This technology has a wide range of applications in industries such as customer service, healthcare, and education.

To enable speech and language recognition, robots are equipped with microphones and software that can capture and analyze human speech. This software uses AI algorithms to recognize words and phrases, and then respond appropriately.

For example, customer service robots can use speech and language recognition to understand customer inquiries and provide appropriate responses. Similarly, robots in healthcare settings can use speech and language recognition to communicate with patients and provide instructions.

➢ <u>**Predictive Maintenance**</u>

Predictive maintenance is another important application of AI in robotics. Predictive maintenance involves developing robots that can predict when maintenance is needed and schedule maintenance before a problem occurs. This technology has a wide range of applications in industries such as manufacturing and energy.

To enable predictive maintenance, robots are equipped with sensors and software that can detect changes in performance or potential problems. This data is then analyzed by AI algorithms that can predict when maintenance is needed and schedule maintenance accordingly.

For example, robots in manufacturing plants can use predictive maintenance algorithms to detect when a machine is beginning to show signs of wear and schedule maintenance before a breakdown occurs. Similarly, robots in energy plants can use predictive maintenance algorithms to detect potential problems with equipment and schedule maintenance before a failure occurs.

➢ <u>**Collaborative Robots**</u>

Collaborative robots, also known as cobots, are robots that work alongside humans to perform tasks. This technology has a wide range of applications in industries such as manufacturing, healthcare, and agriculture.

To enable collaborative robots, robots are equipped with sensors and software that can detect the presence of humans and adjust their behavior accordingly. These robots are designed to work safely alongside humans, performing tasks that are difficult or dangerous for humans to perform alone.

For example, collaborative robots in manufacturing plants can work alongside humans to perform tasks such as
For example, customer service robots can use speech and language recognition to understand customer inquiries and provide appropriate responses. Similarly, robots in healthcare settings can use speech and language recognition to communicate with patients and provide instructions.

AIVirtualKeyboard
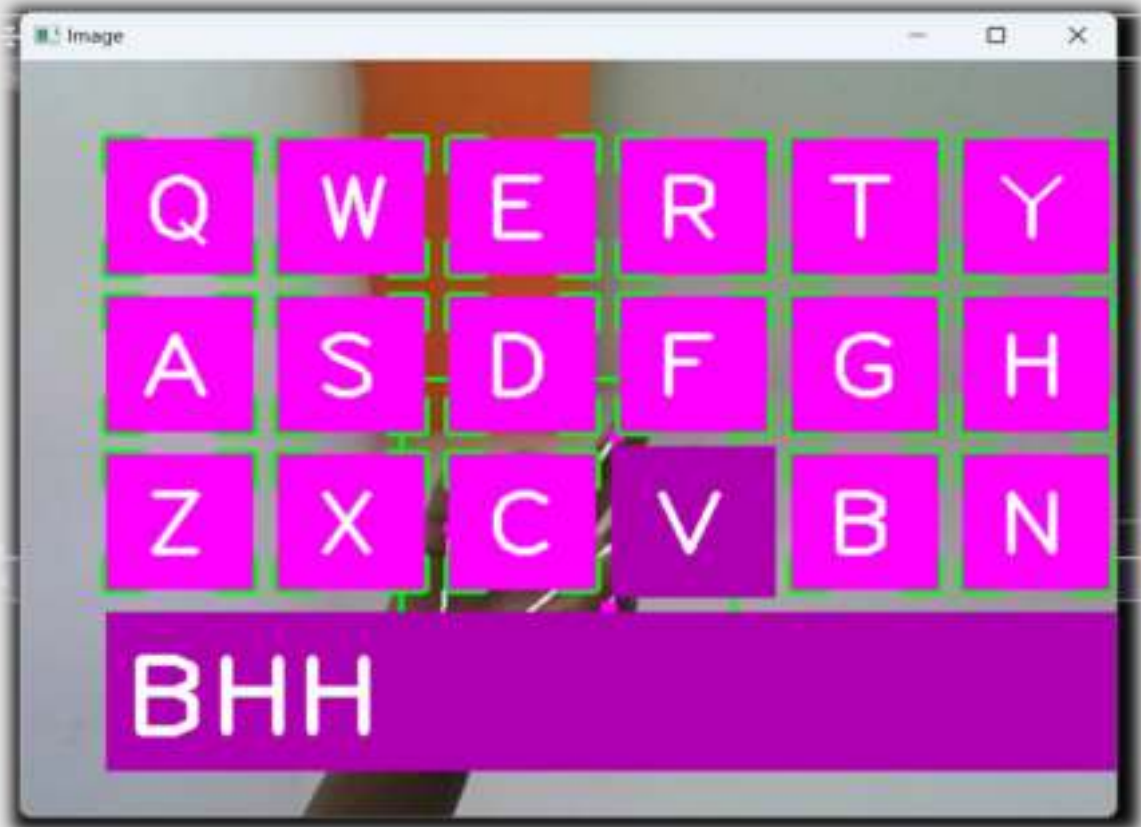

```python
import cv2
from cvzone.HandTrackingModule import HandDetector
from time import sleep
import numpy as np
import cvzone
from pynput.keyboard import Controller


cap = cv2.VideoCapture(0)
cap.set(3, 1280)
cap.set(4, 720)


detector = HandDetector(detectionCon=0.8)
keys = [["Q", "W", "E", "R", "T", "Y", "U", "I", "O", "P"],
        ["A", "S", "D", "F", "G", "H", "J", "K", "L", ";"],
        ["Z", "X", "C", "V", "B", "N", "M", ",", ".", "/"]]
```

```python
finalText = ""

keyboard = Controller()

def drawAll(img, buttonList):
    for button in buttonList:
        x, y = button.pos
        w, h = button.size
        cvzone.cornerRect(img, (button.pos[0], button.pos[1], button.size[0], button.size[1]),
                        20, rt=0)
        cv2.rectangle(img, button.pos, (x + w, y + h), (255, 0, 255), cv2.FILLED)
        cv2.putText(img, button.text, (x + 20, y + 65),
                cv2.FONT_HERSHEY_PLAIN, 4, (255, 255, 255), 4)
    return img

class Button():
    def __init__(self, pos, text, size=[85, 85]):
        self.pos = pos
        self.size = size
        self.text = text

buttonList = []
for i in range(len(keys)):
    for j, key in enumerate(keys[i]):
        buttonList.append(Button([100 * j + 50, 100 * i + 50], key))

while True:
    success, img = cap.read()
    img = detector.findHands(img)
    lmList, bboxInfo = detector.findPosition(img)
    img = drawAll(img, buttonList)
```

```python
 if lmList:
      for button in buttonList:
         x, y = button.pos
         w, h = button.size

         if x < lmList[8][0] < x + w and y < lmList[8][1] < y + h:
            cv2.rectangle(img, (x - 5, y - 5), (x + w + 5, y + h + 5),
(175, 0, 175), cv2.FILLED)
            cv2.putText(img, button.text, (x + 20, y + 65),
                    cv2.FONT_HERSHEY_PLAIN, 4, (255, 255, 255),
4)
            l, _, _ = detector.findDistance(8, 12, img, draw=False)
            print(l)

            ## when clicked
            if l < 30:
               keyboard.press(button.text)
               cv2.rectangle(img, button.pos, (x + w, y + h), (0, 255,
0), cv2.FILLED)
               cv2.putText(img, button.text, (x + 20, y + 65),
                      cv2.FONT_HERSHEY_PLAIN, 4, (255, 255, 255),
4)
               finalText += button.text
               sleep(0.15)

   cv2.rectangle(img, (50, 350), (700, 450), (175, 0, 175),
cv2.FILLED)
   cv2.putText(img, finalText, (60, 430),
         cv2.FONT_HERSHEY_PLAIN, 5, (255, 255, 255), 5)

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

Impact of AI in robotics :

Artificial Intelligence (AI) has revolutionized the field of robotics in recent years, enabling machines to perform tasks that were once considered impossible. With AI, robots can now learn, adapt, and even make decisions on their own, greatly expanding their capabilities and potential applications. In this article, we will explore the impact of AI in robotics and how it is shaping the future of automation.

One of the most significant impacts of AI in robotics is the ability to learn from experience. Through machine learning, robots can analyze large amounts of data and use this information to improve their performance. This has led to the development of robots that can learn new tasks quickly and adapt to changing environments, making them highly versatile and efficient.

Another major impact of AI in robotics is the ability to make decisions autonomously. With AI, robots can analyze their surroundings and determine the best course of action without human intervention. This is particularly useful in situations where human decision-making may be too slow or impractical, such as in manufacturing plants or hazardous environments.

AI has also enabled robots to interact with humans more effectively. Through natural language processing and other AI technologies, robots can understand and respond to human commands and queries, making them easier to operate and more user-friendly. This has led to the development of robots that can assist humans in a wide range of tasks, from household chores to medical procedures.

In addition, AI has enabled robots to perform complex tasks that were previously beyond their capabilities. For example, AI-powered robots can now recognize and respond to human emotions, making them useful in fields such as healthcare and education. They can also perform intricate movements and manipulations, making them ideal for tasks that require high levels of precision, such as surgery and manufacturing.

The impact of AI in robotics is not limited to industrial and commercial applications. It is also making a significant impact in the field of space exploration. With the help of AI-powered robots, scientists can explore and study distant planets and moons, collecting valuable data and samples that would be impossible to obtain otherwise. This has the potential to greatly expand our understanding of the universe and advance our knowledge of space science.

Despite these many benefits, there are also concerns about the impact of AI in robotics. One of the main concerns is the potential loss of jobs, as robots become increasingly capable of performing tasks that were previously done by humans. This has led to calls for policies and regulations to ensure that the benefits of AI are shared fairly among all members of society.

Future Scope and Conclusion of AI in Robotics :

The future scope of AI in robotics is vast and promising, and it is likely to shape the future of robotics in significant ways. AI has already begun to transform the field of robotics, enabling the development of intelligent robots that can operate autonomously, interact with humans in natural ways, and perform complex tasks. In this context, the possibilities are endless, and the future looks bright for the integration of AI and robotics.

One of the significant impacts of AI on robotics is the development of autonomous robots that can work independently without human intervention. Such robots can be used in many industries, such as manufacturing, logistics, healthcare, and agriculture. They can help increase efficiency, reduce costs, and improve safety in many different contexts. Autonomous robots can use sensors, cameras, and machine learning algorithms to navigate their environment, perform tasks, and learn from their experiences.

Another significant impact of AI in robotics is human-robot interaction. As robots become more intelligent and autonomous, it will become increasingly important to ensure that humans can communicate and interact with them effectively. AI can be used to develop natural language processing and speech recognition algorithms that enable robots to understand and respond to human speech. AI can also be used to develop computer vision and gesture recognition algorithms that enable robots to recognize and respond to human gestures and facial expressions.

AI can also be used to optimize the performance and efficiency of robots. Machine learning algorithms can be used to optimize robot movements and actions, enabling them to perform tasks more quickly and accurately. AI can also be used to analyze data from sensors and other sources to identify patterns and make predictions about future events, enabling robots to anticipate problems and take corrective actions before they occur.

Furthermore, AI can enable robots to learn and adapt to new situations and environments. Reinforcement learning algorithms can be used to teach robots to perform complex tasks by rewarding them for successful actions and punishing them for unsuccessful ones. As robots learn, they can become more flexible and adaptable, enabling them to perform a wide range of tasks in a variety of environments.

In conclusion, the future of AI in robotics is exciting and promising. As AI and robotics continue to evolve and improve, we can expect to see even more advanced and capable robots that can perform complex tasks and adapt to new situations and environments. While there are challenges and limitations to the development and deployment of AI in robotics, these challenges can be addressed through ongoing research and development and collaboration between experts in AI, robotics, and related fields. Overall, the integration of AI and robotics is likely to be a key driver of innovation and progress in the years to come.

<u>References</u> :

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