HMR Institute of Technology and Management
Plot No. 326, Hamidpur, Delhi-110036.

Synopsis of Major Project

Date:

Major Project Title: Humanoid Robot With Two Active Senses

Name of Guide(s): Mr. Gyanender Kumar

Programme: B.Tech. CSE		Year/Semester: IV year, 8th semester	
S. No.	Enrolment No.	Name	Signature
1.	01413302719	Muhammed Rizwan P. S.	
2.	02813302719	Sonal Balayan	
3.	02413302719	Sahil Rao	
4.	00313302719	Neeraj Bhandari	

Major Project Summary:

Humanoid robots are robots that are designed to resemble humans in appearance and/or behaviour. These robots typically have a head, torso, arms, and legs, and may have features like eyes, a mouth, and fingers. The goal of humanoid robotics is to create robots that can interact with humans in a more natural way, using gestures, speech, and body language. Humanoid robots are being developed for a variety of applications, including entertainment, education, and healthcare. Some examples of humanoid robots include ASIMO, developed by Honda, and Pepper, developed by SoftBank Robotics. ASIMO is capable of running, walking on uneven surfaces, and climbing stairs, while Pepper is designed to interact with humans and provide customer service.

While humanoid robots are still relatively new and there are many technical challenges to overcome, they hold great promise for the future of robotics and the potential for more natural human-robot interaction.

The idea behind this project is to develop a talking, thinking and chatting robot that will take audio(speech, voice or sound), vision and text as inputs; processes these inputs accordingly and then gives an output in the form of audio(speech, voice or sound). Also to note, this project consists of a robotic head which symbolizes a human head and uses eyeball, eyelids and lips to showcase interactive expressions and sync with it's actions.

This project takes advantage of the following API's and python packages:

- OpenAI,
- OpenCV,
- Pandas,
- Numpy,
- easyocr,
- Speech Recognition,
- pyttsx3 and others.

Problem Statement

Today, AI is almost everywhere and when we watch and get inspired by the modern technologies and systems, we can get an idea of the power an AI constitutes and it's

capabilities. Inspired from so many science fiction movies, novels and imagination, there is a quest to develop an artificial brain and to ultimately develop a machine similar to a human in both intelligence and physical capabilities. Such machine are called Humanoid robots or Androids.

The point is not to develop Humanoid's, AGI's or ASI's just to make science fiction come true, but to replace humans on the field. Such humanoids can replace soldiers, scientists who work on hazardous materials, workers at a radio active site, etc. Although this might take up jobs but at the same time it will also produce jobs in creating and maintaining such commercial android systems.

Background of the Problem

There are no limits in a machine. If they are fed with the adequate resources, then machines can keep working flawlessly. This is the basic difference between a machine and a human. Machines don't get bored, tired or frustrated by the work. Machines don't have a wedding to attend. Machines never complain, nor make any mistakes. So these machines can be made intelligent to think like a human one day, and who know what lies in our feature. But the present problem is to make robots for situations where the humans have very less reach (like into the depths of oceans) or works having hazards to the human body. So these robots will be able to compensate for the limitations of the human body and brain.

Objectives:

We plan to develop the whole system but due to limitation of time we are only focusing on the two basic human sense which are sense of audition and sense of vision.

The development objectives includes:

- Sense of audition
- Sense of vision
- Thinking capacity
- Humanoid head with expressive features

Functional Taxonomy

A.   Vision

1. Scene Captioning and Image Captioning
   - Purpose
   - Libraries Used: OpenCV
   - Process
2. Text Extraction or Optical Character Recognition
   - Purpose
   - Libraries Used: OpenCV
   - Process
3. Object Detection
   - Purpose
   - Libraries Used: OpenCV
   - Process

B. Audition

1. Speech to Text
   - Purpose: Hearing the user and converting the audio signals to text.
   - Libraries Used: Speech Recognition
2. Text to Speech
   - Purpose: Converting the texts into audible form and then speaking it out load in human language.
   - Libraries Used: pyttsx3

C. Mechanisms

1. Eyeball Mechanisms
   - Purpose: To control the eyeballs and mimic the natural eyeball movements of a human being.
   - Libraries Used: pyfirmata, time, SERVO
2. Blinking
   - Purpose: To control the eyelids and mimic the natural blinking of a human being.
   - Libraries Used: pyfirmata, time, SERVO
3. Head Control and Rotation
   - Purpose: To function like a neck and facilitate the rotational motion of the head.

- Libraries Used: pyfirmata, time, SERVO
4. Lip Sync
    - Purpose: Mimic the lip movement to sync with the audio output of the robot.
    - Libraries Used: pyfirmata, time, SERVO

D. Interactions

1. Chatting or Conversation
    - Purpose:
    - Libraries Used: OpenAI, pyttsx3, Speech Recognition
2. Behavioural Interaction
    - Purpose
    - Libraries Used: Threading
3. Hardware and Software Integration
    - Purpose
    - Libraries Used: Threading. SERVO

E. Miscellaneous

1. Chatting or Conversation
    - Purpose
    - Libraries Used
    - Process
2. Behavioural Interaction
    - Purpose
    - Libraries Used
    - Process
3. Hardware and Software Integration
    - Purpose
    - Libraries Used
    - Process

Research Paper Topic:

Any one of the topics will be chosen subjective to the progress of the project.

1. Humanoid robots (Androids)
2. Natural Neural Networks
3. Transformers

Base Paper Link:

Under research.

Resource Requirement:

Software

1. **Anaconda** is a distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.), that aims to simplify package management and deployment.

2. **Jupyter Notebook** is the original web application for creating and sharing computational documents.

3. **Visual Studio Code** is a streamlined code editor with support for development operations like debugging, task running, and version control.

4. **PyCharm** is a dedicated Python Integrated Development Environment (IDE) providing a wide range of essential tools for Python developers, tightly integrated to create a convenient environment for productive Python, web, and data science development.

5. **Arduino IDE,** the open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Hardware

1. Arduino Uno/Raspberry Pi
2. Electronic components like Servos, Breadboards, Wires, etc.
3. Tools
4. Laptop/PC

Schedule of Major Project Work Along with Research Paper:

March:

• Goal: Research about modern technologies in chatbots, ChatGPT, transformers and stable diffusion. Develop simple audio and computer vision codes.

• Progress: Completed

April:

• Goal: Research about humanoid robots, especially the eyeball and lib mechanisms to make a model replica of the human head. Learning Arduino IDE and coding. Researching about some basic electronic components and there functions.

• Progress: Ongoing

May:

• Goal: Develop code for the two senses. Collect, use and start creating major project report. Develop Arduino codes and start making a model of humanoid head using electronic components.

• Progress: Ongoing

June:

• Goal: Final development of remaining requirements. Model integration and testing. Functional testing for approval of both senses under various scenarios.

• Progress: Ongoing

Signature of Student(s)   **Signature of Supervisor(s)**

Signature of Major Project Co-ordinator

Co-ordinator Name:

Approval by Board of Faculty

Member(s)	Signature	Remarks (Approved/Not approved)