Vidya Jyothi Institute of Technology

(Autonomous)

Aziz Nagar, Hyderabad -500075

A Project Report

on

DESIGN AND FABRICATION OF AI ROBOT

Submitted for partial fulfillment of the requirements for the award of the degree

Of

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

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CERTIFICATE

This is to certify that the project work entitled " DESIGN AND FABRICATION OF AI ROBOT " is a bonafide work carried out by Mr.CH SUDHEER KUMAR (21915A0204) Mr. K RAKESH (21915A0213) Mr.M RAMAKRISHNA (21915A0218) Ms.U SRILAXMI (21915A0225) in partial fulfillment of the requirements for the award of degree of BACHELOR OF TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING to be awarded by the JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, Hyderabad.

The content in this report has not been submitted to any other university or institute for the award of any degree or diploma.

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DECLARATION

This is to certify that the work reported in the present project entitled **" DESIGN AND FABRICATION OF AI ROBOT "** is a record of work done by us in the Department of Electrical and Electronics Engineering, Vidya Jyothi Institute of Technology (Autonomous), Jawaharlal Nehru Technological University, Hyderabad. The reports are based on the project work done entirely by us and not copied from any other source.

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ABSTRACT

The primary objective of developing ai robots is to enable them to interact with the world in a manner similar to humans. This involves not only replicating human physical appearance but also incorporating advanced sensors, sophisticated control systems, and artificial intelligence algorithms to perform tasks, move gracefully, and even communicate with humans.

The abstract features of a AI robot typically include a human-like appearance, with a head, torso, arms, and legs, often equipped with sensors such as cameras, microphones, and touch sensors to perceive the environment and interact with it. Actuators such as motors and joints enable these robots to move and perform tasks with a wide range of dexterity and mobility. AI robots are often controlled by advanced AI algorithms and computer systems, allowing them to make decisions, recognize objects and people, and adapt to changing situations.

Applications of AI robots are diverse and can include tasks in industries such as healthcare, manufacturing, entertainment, research, and education.

Overall, AI robots represent a cutting-edge field of robotics that seeks to bridge the gap between machines and humans, offering the potential to revolutionize industries and enhance our daily lives through their versatility and adaptability.

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CHAPTER-1

1.1 Introduction

A AI robot is a type of robot designed to resemble the human body in terms of its physical structure and appearance. These robots are often equipped with features such as a head, torso, arms, and legs, which mimic the human form. The primary goal of AI robotics is to create machines that can perform tasks in a manner similar to how a human would, both in terms of physical movement and interaction with the environment.

AI robots are complex anthropomorphic artificial machines. The growing interest in AI robots accompanied by the latest and ever-increasing technological advancements in the field of robotics, locomotion, and AI, achieved by engineers, has speeded up their development over the past decade. Moreover, because of their human-like shape, these robots can use the same equipment and environment as humans, hence, making them more compatible to be used as a building platform for the physical implementation of the Digital Twin.

Today's AI robots come in different shapes and sizes and are extensively being used for research and space exploration, personal assistance and care-giving, education and entertainment, search and rescue operations, manufacturing and maintenance, public relations, and most importantly healthcare sector.

A AI robot is a robot resembling the human body in shape. The design may be for functional purposes, such as interacting with human tools and environments, for experimental purposes, such as the study of bipedal locomotion, or for other purposes. In general, AI robots have a torso, a head, two arms, and two legs, though some AI robots may replicate only part of the body, for example, from the waist up. Some AI robots also have heads designed to replicate human facial features such as eyes and mouths. Androids are AI robots built to aesthetically resemble humans

Characteristics of AIs – Self-maintenance, Autonomous learning, Avoiding harmful situations to people, property, and itself , Safe interacting with human beings and the environment , Legged locomotion

Role Of AI Robots In Society

AI robots are playing an increasing role in society, and their impact will only continue to grow. These machines can interact with people and learn quickly, making them valuable to many industries. Here are some ways AI robots are being used in society today

AI robots in healthcare can help patients by performing tasks such as picking up objects or assisting with basic medical procedures. This technology has the potential to improve patient care and reduce costs significantly.

AI robots in manufacturing: They can help workers by performing tasks such as moving heavy objects or handling dangerous chemicals. This technology can save companies money and improve workplace safety.

AI robots in the military can help soldiers carry out dangerous tasks such as navigating rugged terrain or attacking enemy targets. This technology has the potential to save lives and improve combat efficiency.

CHAPTER-2

3D PRINTING

2.1 3D Printer

A 3D printer is a type of computer-controlled machine that creates three-dimensional objects by adding material layer by layer. This technology is known as additive manufacturing.

Design: The process begins with creating a 3D model of the object you want to print. This can be done using computer-aided design (CAD) software or by downloading pre-made 3D models from online repositories

Slicing: The 3D model is then sliced into thin horizontal layers using slicing software. This software generates a set of instructions (G-code) that tells the 3D printer how to build the object layer by layer.

Printing: The 3D printer reads the G-code instructions and starts the printing process. It typically uses one of several additive manufacturing technologies, such as Fused Deposition Modelling (FDM), Stereo lithography (SLA), Selective Laser Sintering (SLS), or others.

In FDM printers, a plastic filament is heated and extruded through a nozzle, creating each layer by depositing material on top of the previous one.

In SLA printers, a liquid photo polymer resin is cured layer by layer using a UV laser.

In SLS printers, a laser selectively sinters or fuses powdered material (usually plastic or metal) to create each layer.

Cooling and Solidifying: After each layer is deposited or cured, it may need to cool or solidify before the next layer is added. This step depends on the specific technology used

Completion: The 3D printer continues building layer by layer until the entire object is created. The time it takes to complete a print job depends on the complexity and size of the object.

3D printers are used in a wide range of industries and applications, including manufacturing, aerospace, healthcare (for producing prosthetics and medical devices), automotive, architecture, education, and hobbyist projects. They have become more accessible and affordable in recent years, allowing individuals and small businesses to harness the power of 3D printing for various creative and practical purposes.

Three-dimensional (3D) printing is an additive manufacturing process that creates a physical object from a digital design. The process works by laying down thin layers of material in the form of liquid or powdered plastic, metal or cement, and then fusing the layers together.

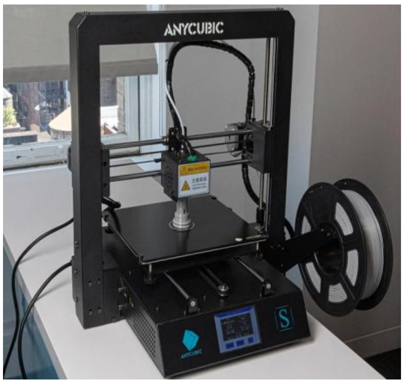


Fig 2.1 (3D PRINTER)

2.2 PRINTING FILAMENT

3D printing filament is created using a process of heating, extruding and cooling plastic to transform nurdles into the finished product. However, unlike a 3D printer, the filament is pulled rather than pushed through the nozzle to create the filament. The diameter of the filament is defined by the process that takes place after the plastic has been heated rather than the diameter of the ext ruder nozzle. A different force and speed is applied to the filament as it is pulled out of the ext ruder to define the width of the filament, most commonly 0.5 mm or 1 mm diameter

3D printer filament is the raw material used in Fused Deposition Modeling (FDM) and similar 3D printing technologies. It is a thermoplastic material that is extruded through a heated nozzle to create the layers of a 3D-printed object. Filament comes in various types, materials, and colors, allowing you to choose the best filament for your specific 3D printing needs

CHAPTER-3

COMPONENTS DETAILS

MG995 Servo Motor

MG995 servo motor is a popular servo motor mainly used in robotics and drones applications. MG995 provides precise rotation over 180 º ranges and comes with metal geared, and shock proof double ball bearing design, so suited for designing robotic arm in which wear and tear of motor is high.

While the MG995 servo motor can still serve its purpose in various applications, it is important to consider the potential limitations of plastic gears in terms of longevity, durability, and resistance to heavy loads. Plastic gears may wear down more quickly under extensive use or high-stress conditions compared to their metal counterparts.

MG995 Features and Electrical characteristics:

- Operating voltage range is 4.8 V to 7.2 V
- Current draw at idle is 10mA
- No load operating current draw is 170mA
- Current at maximum load is 1200mA
- Dimension: 40.7×19.7×42.9mm
- Stall torque: 9.4kg/cm (4.8v); 11kg/cm (6v)
- Operating speed: 0.2 s/60º (4.8 V), 0.16 s/60º (6 V)
- Rotational degree: 180º
- Dead band width: 5 µs
- Metal geared servo for more life
- Stable and shock proof double ball bearing design
- Constant torque throughout the servo travel range
- Dimension: 40.7×19.7×42.9mm
- Stall torque: 9.4kg/cm (4.8v); 11kg/cm (6v)
- Operating speed: 0.2 s/60º (4.8 V), 0.16 s/60º (6 V)
- Rotational degree: 180º
- Dead band width: 5 µs

Fig 3.1 (MG995 SERVO MOTOR)

The servo is suited for designing robotic arm in which wear and tear of motor is high. Being metal geared, the servo has long life and can be installed on system like robotic arm were motor work is huge.

The servo is also suited to be used in drones and toy planes. Having a satisfying torque which is enough to overcome air resistance and control wings of plane, the servo is preferred in toy planes and drones which need precision control no matter the condition

Microphone

A microphone is a small input device that is used for multiple reasons like to record, communicate, or for voice recognition into a system. Connecting a microphone with a Raspberry Pi can allow users to create a wide range of projects like speech recognition projects, AI projects, Voice assistance applications

Fig 3.2 (MICROPHONE)

In robotic applications, dynamic microphones are often preferred when ruggedness, low power consumption, and resistance to environmental factors are crucial. They are commonly used for sound localization in robotics and can withstand challenging conditions

Condenser microphones, on the other hand, are chosen when high audio quality, sensitivity, and small form factors are required. They are suitable for applications like human-robot interaction, voice commands, and applications where capturing subtle acoustic cues is important.

Ultimately, the choice between dynamic and condenser microphones in robotics will depend on the specific needs of the robot and the intended tasks it is designed to perform.

Audio Amplifier

Audio amplifiers are commonly used in robotics for various purposes related to sound processing and communication. These amplifiers help robots process and produce audio signals more effectively

Class D Amplifier: The PAM8403 is a Class D audio amplifier. Class D amplifiers are known for their high efficiency and low power consumption, making them suitable for battery-powered devices and compact applications.

Stereo Output: The module typically provides a stereo audio output, meaning it can amplify audio signals for both the left and right channels. This makes it suitable for applications where stereo sound is desired.

Amplification Power: The PAM8403 is available in various power output configurations, such as 3W+3W or 5W+5W, depending on the specific module version and design.

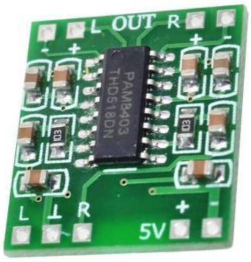


Fig 3.3 (AUDIO AMPLIFIER)

Voice Recognition and Speech Synthesis: In human-robot interaction, voice recognition and speech synthesis are crucial. Audio amplifiers are used to boost the output of microphones and speakers, allowing the robot to understand spoken commands and respond with synthesized speech.

Ultrasonic Sensing: Some robots use ultrasonic sensors to detect obstacles or measure distances. Audio amplifiers can boost the ultrasonic signals generated and received by these sensors for better accuracy.

Lithium-ion Battery

A 12V 20Ah lithium-ion battery can be a suitable power source for many robotics applications. It provides a decent amount of energy in a relatively compact and lightweight package, making it a popular choice for robotics.

Voltage Compatibility: Ensure that the 12V output voltage matches the voltage requirements of your robot's motors, controllers, and other electronic components. Many robotic systems operate at 12V, but it's essential to confirm this.

Fig 3.4 (LITHIUM ION BATTERY)

Maintenance: Lithium-ion batteries require minimal maintenance compared to some other types of batteries, like lead-acid. However, they should be stored with some charge (around 50%) if not in use for an extended period to prevent deep discharge.
When using a 12V 20Ah lithium-ion battery in a robotics project, it's important to consider factors such as voltage regulation, charging and discharging profiles, and safety precautions to ensure the battery's reliable and safe operation..

Pi Camera

The Pi camera module, often used with Raspberry Pi boards, is a versatile camera module that can be beneficial in various robotics applications. It allows you to capture high-quality images and videos, making it a valuable component for robots that require visual perception, navigation, and object recognition.

Fig 3.5 (PI CAMERA)

Vision-Based Navigation: Robots can use the Pi camera to capture images or video frames and process them for navigation purposes. This can involve obstacle avoidance, path planning, and SLAM (Simultaneous Localization and Mapping) tasks, enabling the robot to move autonomously in its environment.

Object Detection and Recognition: The Pi camera can be used in conjunction with computer vision libraries like Open CV to detect and recognize objects in the robot's surroundings. This is particularly useful for tasks such as picking and placing objects or identifying specific items.

Gesture Control: Robots can be programmed to recognize hand gestures or body movements captured by the camera, allowing users to control the robot's actions through gestures.

DUAL STEREO SPEAKER

Dual stereo speakers in robotics are commonly used to provide audio output for various purposes, such as human-robot interaction, audio feedback, navigation cues, and communication. Stereo speakers are capable of producing spatial sound, which can be valuable in scenarios where directional audio is important

Fig 3.6 (DUAL STEREO SPEAKER)

Enhanced Audio Quality: Dual stereo speakers provide better audio quality compared to a single speaker. They can reproduce stereo audio tracks, making it easier to convey spatial information and create a more immersive audio experience.

Human-Robot Interaction: In social or service robotics, stereo speakers can provide a more natural and engaging interaction experience. The robot can simulate speech from a specific direction or engage in conversations that sound more realistic.

When implementing dual stereo speakers in a robotic system,the audio processing algorithms used, and the synchronization with other sensory inputs and actuators. Additionally, the choice of speakers and amplification circuits should be based on the specific requirements of the application like power consumption, size constraints, and desired audio quality

Ultrasonic Sensor

Ultrasonic sensors are commonly used in robotics for various purposes, including distance measurement, object detection, obstacle avoidance, and navigation. These sensors use sound waves to determine the distance between the sensor and an object, making them valuable tools for enabling robots to interact with their environment

Fig 3.7 (ULTRA SONIC SENSOR)

Distance Measurement: Ultrasonic sensors measure the time it takes for sound waves to travel to an object and bounce back to the sensor. By knowing the speed of sound in the medium (usually air) and the time it takes for the sound to return, the sensor can calculate the distance to the object.

Object Detection: Ultrasonic sensors can detect the presence or absence of objects within a specific range. This is useful for sorting systems, conveyor belts, and quality control applications.

Gesture Recognition: Some robots use ultrasonic sensors to recognize hand gestures or movements made by humans or other robots. This can be employed for interaction and control.

Capacitive Touch Sensor

Capacitive touch sensors are widely used in robotics to enable touch-sensitive interfaces and human-robot interaction. These sensors detect changes in capacitance when a conductive object (such as a human finger) approaches or touches the sensor's surface. Capacitive touch sensors offer several advantages in robotics applications

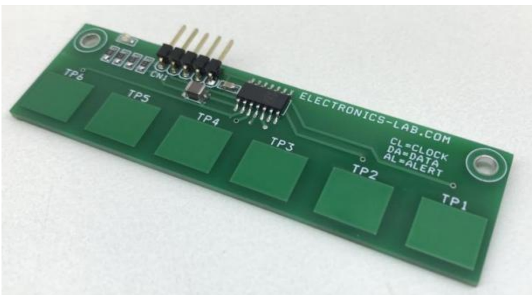


Fig 3.8 (CAPACTIVE TOUCH SENSOR)

User Interface: Capacitive touch sensors are often used as user interfaces on robot control panels or interfaces. Users can interact with the robot by touching specific areas on the sensor, triggering various actions or commands.

Gesture Recognition: Advanced Capacitive touch sensors can detect not only touch but also gestures, such as swipes, pinches, or multi-touch actions. This allows for more complex and intuitive human-robot interactions.

Obstacle Detection: Capacitive sensors can be used as proximity sensors to detect the presence of objects or obstacles. For example, a robot can use Capacitive touch sensors to avoid collisions with nearby objects or individuals.

Raspberry Pi 4

The Raspberry Pi 4 (R Pi 4) is a versatile and powerful single-board computer that has found extensive use in robotics applications. Its compact size, low cost, and community support make it an attractive choice for hobbyists, students, and professionals working on various robotic projects.

Control and Processing: The R Pi 4 serves as the central processing unit for many robots. It can run a variety of operating systems, including Raspberry Pi OS (formerly Arabian), Ubuntu, and others, which enables it to perform tasks like sensor data processing, motor control, and decision-making

Camera Vision: The R Pi 4's camera module and USB camera support are often used for computer vision tasks in robotics. Robots can capture images and videos, perform object recognition, image processing, and even use cameras for navigation and mapping

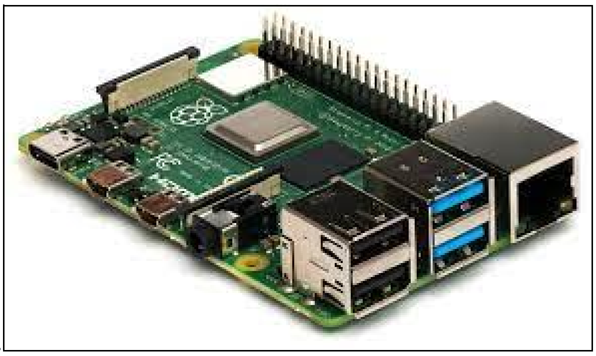


Fig 3.9 (RASPBERRY PI4)

Robot Operating System (ROS): ROS, a popular robotics middleware framework, is compatible with the R Pi 4. It provides tools and libraries for developing complex robot control systems, making it easier to build and program robots.
Io T Integration: Raspberry Pi 4's Wi-Fi and Ethernet capabilities
make it suitable for IoT (Internet of Things) integration in robotics. Robots can communicate with cloud services, receive remote commands, and send data for analysis.

Arduino Mega

The Arduino Mega is a micro-controller board that is often used in robotics due to its versatility, ample I/O pins, and compatibility with a wide range of sensors and actuators. It's part of the Arduino family and is known for its enhanced capabilities compared to the standard Arduino boards. Here's how the Arduino Mega is used in robotics:
Control Hub: The Arduino Mega can serve as the central control hub for a robot. It can process sensor data, control motors, servos, and other actuators, and make real-time decisions based on the robot's programming

Fig 3.10 (ARDUINO MEGA)

Motor Control: The board has multiple PWM (Pulse Width Modulation) pins, making it suitable for controlling DC motors, stepper motors, and servo motors used in robot motion and manipulation
Machine Learning: While the Arduino Mega has limited computational power compared to more advanced platforms, it can still be used for simple machine learning tasks like pattern recognition or gesture detection.

IoT (Internet of Things) Integration: The Arduino Mega can be used to connect robots to IoT platforms, enabling data collection, remote monitoring, and control of robots over the internet.
Human-Robot Interaction: With the addition of user interface components like buttons, touch screens, or Capacitive touch sensors, the Arduino Mega can facilitate human-robot interaction in applications such as tele presence robots or interactive exhibits.

DC 775 Motor

The DC 775 motor is a powerful and versatile motor that can be used in a wide range of robotics applications. These motors are known for their high torque output and reliability, making them suitable for tasks that require precise control of movement and force
Wheel Propulsion: DC 775 motors are often used as drive motors for robot wheels. Their high torque allows robots to move efficiently, even in challenging terrains. They are commonly employed in mobile robots, including wheeled robots, tracked robots, and robotic vehicles

Fig 3.11 (DC 775 MOTOR)

Motor Control: Use appropriate motor drivers or controllers to control the speed and direction of DC 775 motors. PWM (Pulse Width Modulation) is commonly used for motor speed control.
Manipulation: In robotic arms and manipulators, DC 775 motors can provide the necessary torque to lift, move, and manipulate objects. They are suitable for applications like pick-and-place, industrial automation, and material handling.
Conveyor Systems: Conveyor belts or roller systems in industrial robots often use DC 775 motors to control the movement of objects along an assembly line or conveyor.

CHAPTER-4

4.1 Block Diagram

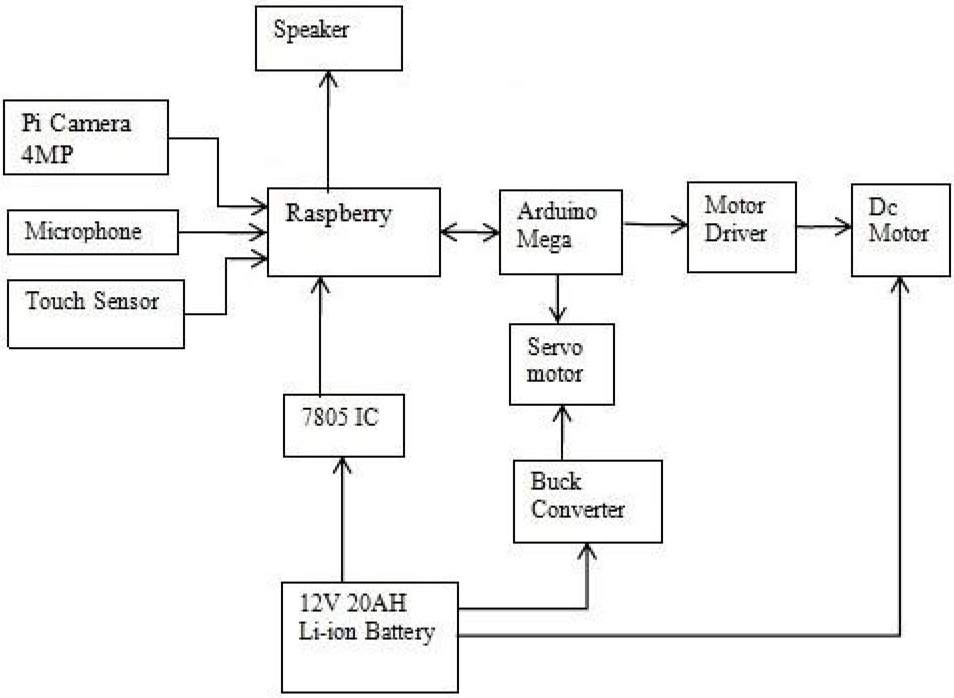


FIG 4.1 (BLOCK DAIGRAM)

4.2 Working:

Creating a robot with inputs from a Raspberry Pi camera, microphone, and touch sensors, and outputs to servo motors, DC motors for movement, and audio from a speaker involves integrating various hardware components and programming the Raspberry Pi to process the inputs and control the outputs.

4.2.1 Hardware Components:

Raspberry Pi: This serves as the brain of the robot, handling all input and output operations.

Pi Camera: The Pi Camera captures video and images for vision-based tasks.

Microphone: The microphone records audio input for sound-based interactions.

Touch Sensors: These sensors detect physical touch or contact with objects.

Servo Motors: Servo motors are used for precise and controlled movements, such as for camera panning or robot arm articulation.

DC Motors: DC motors drive the robot's movement, typically by controlling the speed and direction of the wheels.

Speaker: The speaker is used to produce audio output.

4.2.2 Software and Programming:

Operating System: Installed a suitable operating system (e.g., Raspberry Pi OS) on the Raspberry Pi.

Programming: Written Python programming language code to control the various components and handle inputs and outputs.

Camera Input:

Used libraries like Open CV to process video feeds from the Pi Camera.Robot can perform tasks like object detection, image recognition, or tracking based on the camera input.

Microphone Input:

Used a library like PyAudio to capture and process audio input.

Implement speech recognition or sound detection algorithms if needed.

Touch Sensors:

Connected the touch sensors to GPIO pins on the Raspberry Pi.

Written code to monitor the GPIO pins for touch events.

Servo Motor Control:

Connect the servo motors to GPIO pins or a PWM (Pulse Width Modulation) controller.

Use libraries like RPi. GPIO or the Adafruit PWM Servo Driver to control the servo motors. Adjust the servo angles based on camera or sensor input.

DC Motor Control:

Connected the DC motors to motor driver boards for movement of robot

Speaker Output:

Connect the speaker to the Raspberry Pi's audio output.

Used libraries like pygame or simple audio to play audio files or generate speech output.

User Interface :

Create a user interface for remote control or monitoring of the robot through a web interface or mobile app.

Power Supply: The robot has an adequate power supply to run all components.(Li-ion Battery)

4.3 AI integration:

The core idea of artificial intelligence systems integration is making individual software components, such as speech synthesizers, interoperable with other components, such as common sense knowledgebases, in order to create larger, broader and more capable A.I. systems. The main methods that have been proposed for integration are message routing, or communication protocols that the software components use to communicate with each other, often through a middleware blackboard system.

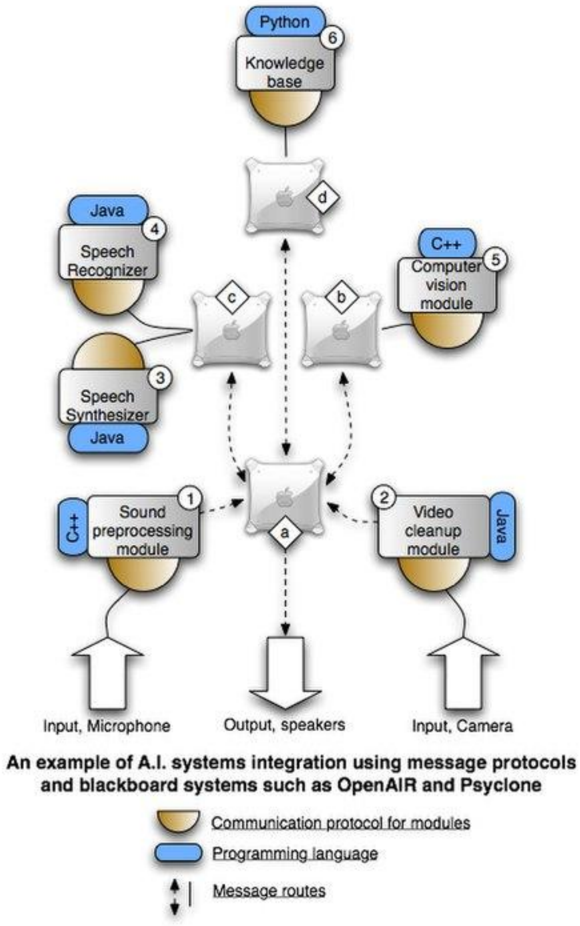
Most artificial intelligence systems involve some sort of integrated technologies, for example, the integration of speech synthesis technologies with that of speech recognition. However, in recent years, there has been an increasing discussion on the importance of systems integration as a field in its own right. Proponents of this approach are researchers such as Marvin Minsky, Aaron Sloman, Deb Roy, Kristinn R. Thórisson and Michael A. Arbib. A reason for the recent attention A.I. integration is attracting is that there have already been created a number of (relatively) simple A.I. systems for specific problem domains (such as computer vision, speech synthesis, etc.), and that integrating what's already available is a more logical approach to broader A.I. than building monolithic systems from scratch.

Integration focus:

The focus on systems' integration, especially with regard to modular approaches, derive from the fact that most intelligences of significant scales are composed of a multitude of processes and/or utilize multi-modal input and output. For example, a humanoid-type of intelligence would preferably have to be able to talk using speech synthesis, hear using speech recognition, understand using a logical (or some other undefined) mechanism, and so forth. In order to produce artificially intelligent software of broader intelligence, integration of these modalities is necessary.

Challenges and solutions:

An example of how multiple modules written in miscellaneous programming languages can be utilized on multiple computers in A.I. systems integration
Collaboration is an integral part of software development as evidenced by the size of software companies and the size of their software departments. Among the tools to ease software collaboration are various procedures and standards that developers can follow to ensure quality, reliability and that their software is compatible with software created by others (such as W3C standards for webpage development). However, collaboration in fields of A.I. has been lacking, for the most part not seen outside the respected schools, departments or research institutes (and sometimes not within them either). This presents practitioners of A.I. systems integration with a substantial problem and often causes A.I. researchers to have to 're-invent the wheel' each time they want a specific functionality to work with their software. Even more damaging is the "not invented here" syndrome, which manifests itself in a strong reluctance of A.I. researchers to build on the work of others.



An example of A.I. systems integration using message protocols and blackboard systems such as OpenAIR and Psyclone

The outcome of this in A.I. is a large set of "solution islands": A.I. research has produced numerous isolated software components and mechanisms that deal with various parts of intelligence separately. To take some examples:

Speech synthesis
FreeTTS from CMU
Speech recognition
Sphinx from CMU
Logical reasoning
OpenCyc from Cycorp
Open Mind Common Sense Net from MIT
With the increased popularity of the free software movement, a lot of the software being created, including A.I. systems, is available for public exploit. The next natural step is to merge these individual software components into coherent, intelligent systems of a broader nature. As a multitude of components (that often serve the same purpose) have already been created by the community, the most accessible way of integration is giving each of these components an easy way to communicate with each other. By doing so, each component by itself becomes a module, which can then be tried in various settings and configurations of larger architectures. Some challenging and limitations of using A.I. software is the uncontrolled fatal errors. For example, serious and fatal errors have been discovered in very precise fields such as human oncology, as in an article published in the journal Oral Oncology Reports entitled “When AI goes wrong: Fatal errors in oncological

research reviewing assistance".[1] The article pointed out a grave error in artificial intelligence based on GBT in the field of biophysics.

Many online communities for A.I. developers exist where tutorials, examples, and forums aim at helping both beginners and experts build intelligent systems. However, few communities have succeeded in making a certain standard, or a code of conduct popular to allow the large collection of miscellaneous systems to be integrated with any ease.

Methodologies:

Constructionist design methodology
The constructionist design methodology (CDM, or 'Constructionist A.I.') is a formal methodology proposed in 2004, for use in the development of cognitive robotics, communicative humanoids and broad AI systems. The creation of such systems requires the integration of a large number of functionalities that must be carefully coordinated to achieve coherent system behavior. CDM is based on iterative design steps that lead to the creation of a network of named interacting modules, communicating via explicitly typed streams and discrete messages. The OpenAIR message protocol (see below) was inspired by the CDM and has frequently been used to aid in the development of intelligent systems using CDM.

Integrating AI on a Raspberry Pi can be done using various frameworks like TensorFlow Lite, OpenCV, or even custom Python scripts. Here's a basic example using TensorFlow Lite for image classification:

1. *Install TensorFlow Lite:*

```
pip install tflite-runtime
```

2. *Get a TensorFlow Lite Model:*
You can either train your own model or download a pre-trained one. For example, you can get a pre-trained image classification model from TensorFlow's model zoo.

3. *Code Example:*
Here's a simple Python script to load the model and perform image classification:

```
python
import tensorflow as tf
import numpy as np
from PIL import Image

# Load the TFLite model and allocate tensors.
interpreter = tf.lite.Interpreter(model_path="model.tflite")
interpreter.allocate_tensors()

# Get input and output tensors.
input_details = interpreter.get_input_details()
output_details = interpreter.get_output_details()
```

```
# Load an image.
img = Image.open('image.jpg').resize((input_details[0]['shape'][1], input_details[0]['shape'][2]))
input_data = np.expand_dims(img, axis=0)

# Normalize input data (if needed).
input_mean = 127.5
input_std = 127.5
input_data = (np.float32(input_data) - input_mean) / input_std

# Set the input tensor.
interpreter.set_tensor(input_details[0]['index'], input_data)

# Run inference.
interpreter.invoke()

# Get the output tensor.
output_data = interpreter.get_tensor(output_details[0]['index'])

# Process the output (e.g., print class labels).
print(output_data)
```

4. *Run the Code:*
   Save the script as classify.py and run it on your Raspberry Pi. Make sure to replace "model.tflite" with the path to your TensorFlow Lite model and "image.jpg" with the path to the image you want to classify.

Remember to adjust the code according to your specific AI task and model architecture. Additionally, consider optimizing your model and code for performance on the Raspberry Pi's hardware.

4.4 LlamaIndex:

LlamaIndex is a data framework for LLM-based applications which benefit from context augmentation. Such LLM systems have been termed as RAG systems, standing for "Retrieval-Augemented Generation". LlamaIndex provides the essential abstractions to more easily ingest, structure, and access private or domain-specific data in order to inject these safely and reliably into LLMs for more accurate text generation. It's available in Python (these docs) and Typescript.
LLMs offer a natural language interface between humans and data. Widely available models come pre-trained on huge amounts of publicly available data like Wikipedia, mailing lists, textbooks, source code and more.

However, while LLMs are trained on a great deal of data, they are not trained on your data, which may be private or specific to the problem you're trying to solve. It's behind APIs, in SQL databases, or trapped in PDFs and slide decks.

You may choose to fine-tune a LLM with your data, but:

Training a LLM is expensive.
Due to the cost to train, it's hard to update a LLM with latest information.
Observability is lacking. When you ask a LLM a question, it's not obvious how the LLM arrived at its answer.
Instead of fine-tuning, one can a context augmentation pattern called Retrieval-Augmented Generation (RAG) to obtain more accurate text generation relevant to your specific data. RAG involves the following high level steps:

Retrieve information from your data sources first,
Add it to your question as context, and
Ask the LLM to answer based on the enriched prompt.
In doing so, RAG overcomes all three weaknesses of the fine-tuning approach:

There's no training involved, so it's cheap.
Data is fetched only when you ask for them, so it's always up to date.
LlamaIndex can show you the retrieved documents, so it's more trustworthy.
Why Context Augmentation?#
LLMs offer a natural language interface between humans and data. Widely available models come pre-trained on huge amounts of publicly available data like Wikipedia, mailing lists, textbooks, source code and more.

However, while LLMs are trained on a great deal of data, they are not trained on your data, which may be private or specific to the problem you're trying to solve. It's behind APIs, in SQL databases, or trapped in PDFs and slide decks.

You may choose to fine-tune a LLM with your data, but:

Training a LLM is expensive.
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Instead of fine-tuning, one can a context augmentation pattern called Retrieval-Augmented Generation (RAG) to obtain more accurate text generation relevant to your specific data. RAG involves the following high level steps:

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There's no training involved, so it's cheap.
Data is fetched only when you ask for them, so it's always up to date.
LlamaIndex can show you the retrieved documents, so it's more trustworthy.
Why LlamaIndex for Context Augmentation?#
Firstly, LlamaIndex imposes no restriction on how you use LLMs. You can still use LLMs as auto-complete, chatbots, semi-autonomous agents, and more (see Use Cases on the left). It only makes LLMs more relevant to you.

LlamaIndex provides the following tools to help you quickly standup production-ready RAG systems:

Data connectors ingest your existing data from their native source and format. These could be APIs, PDFs, SQL, and (much) more.
Data indexes structure your data in intermediate representations that are easy and performant for LLMs to consume.
Engines provide natural language access to your data. For example:

Query engines are powerful retrieval interfaces for knowledge-augmented output.

Chat engines are conversational interfaces for multi-message, "back and forth" interactions with your data.

Data agents are LLM-powered knowledge workers augmented by tools, from simple helper functions to API integrations and more.

Application integrations tie LlamaIndex back into the rest of your ecosystem. This could be LangChain, Flask, Docker, ChatGPT, or… anything else!

4.4 Semantic Search :

Objective of the work:
Build a RAG System:
The goal of the project is to build a robust generative search system capable of effectively and accurately answering questions from various policy documents. LlamaIndex is used to build the generative search application. The document of college is used to do semantic search.

Design Implementation
Part 1 - Overall Product Specifications
Problem Statement - Our goal here is to build a simple RAG application on the College details document.

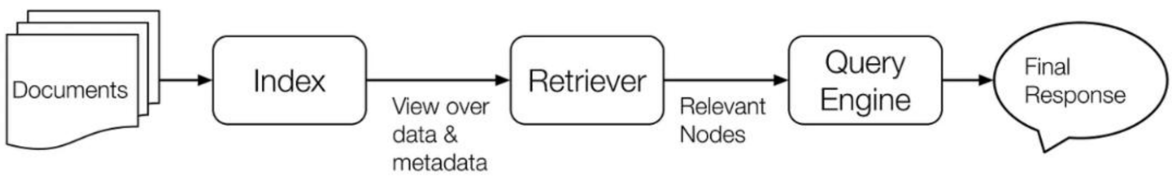
Solution Strategy - Build a POC which should solve the following requirements:

Users would get responses from the Insurance Document.
If they want to refer to the original page from which the bot is responding, the bot should provide a citation as well.
Goal - Solving the above two requirements well in the POC would ensure that the accuracy of the overall model is good and therefore further improvisations and customizations make sense.

Data Used – Document prepared with details of college

Tools used - LlamaIndex has been used due to its powerful query engine, fast data processing using data loaders and directory readers as well as easier and faster implementation using fewer lines of code.
Part 2 - Solution POC

In this section, a POC is built that was proposed in the previous step



Step 3 - Data Loading:
SimpleDirectoryReader was used for data loading as multiple files were stored in google drive in a folder.
Step 4 - Building the query engine:
Llama_Index is used to build the query engine.
Step 5 - Checking responses and response parameters
Step 6 - Creating a response Pipeline
Step 7 - Build a Testing Pipeline
Here we feed a series of questions to the Q/A bot and store the responses along with the feedback on whether it's accurate or not from the user

Challenges
It is observed that the responses were not always correct. Sometimes there were no responses. Hence prompting was done to improve the accuracy of the responses.

Lessons Learned
Semantic search using embeddings, and Retrieval Augmented Generation using Llama_Index is learnt.

CHAPTER-5
5.1 Conclusion

In conclusion, this project involves the development of a versatile robot that incorporates inputs from a Raspberry Pi camera, microphone, and touch sensors, and delivers outputs through servo motors, DC motors for movement, and audio via a speaker. This project is a comprehensive exploration of robotics and programming on the Raspberry Pi platform, offering opportunities for innovation and experimentation in various domains. It can serve as a valuable educational experience and a foundation for more advanced robotic applications. Successful completion of this project would result in a versatile robot capable of performing tasks that involve vision, audio, and physical interaction while providing opportunities for further customization and expansion.

5.2 Future scope

Autonomous Navigation and Mapping:

Implement algorithms for autonomous navigation and mapping using the camera and sensors. Integrate technologies like SLAM (Simultaneous Localization and Mapping) for indoor mapping and localization.

AI and Machine Learning Integration:

Enhance the robot's capabilities by integrating AI and machine learning models for tasks like object recognition, voice command understanding, and decision-making.

Implement deep learning models for more advanced image and speech processing.

Voice Assistant and Natural Language Processing:

Develop the robot into a voice-controlled assistant capable of natural language understanding and responses.Expands its functionality to perform tasks based on voice commands and queries.

Wireless Control and Remote Monitoring:

Enable remote control and monitoring of the robot through wireless communication protocols like Wi-Fi or Bluetooth.

Create a user-friendly mobile app or web interface for remote interaction.

Sensor Expansion:

Add more sensors to the robot for additional capabilities, such as infrared sensors for obstacle avoidance, environmental sensors for data collection, or GPS for outdoor navigation.

Robot Arm and Manipulation:

Incorporate a robot arm or gripper for tasks involving manipulation, such as picking up objects or interacting with the environment.

Human-Robot Interaction (HRI):

Explore human-robot interaction concepts, such as gesture recognition, facial recognition, and emotional analysis, to improve the robot's ability to interact with users.

Multi-Robot Systems:

Create a swarm of robots that can communicate and collaborate on tasks, such as search and rescue missions or distributed environmental monitoring.

Security and Surveillance:

Utilize the robot for security and surveillance applications by equipping it with additional cameras, motion detectors, and alarms.

Education and Research:

Adapt the project for educational purposes, introducing robotics and programming concepts to students.Use the robot as a research platform for exploring topics like human-robot interaction, computer vision, and artificial intelligence.

Customization for Specific Industries:

Tailor the robot's capabilities and sensors to meet specific industry needs, such as healthcare (telemedicine), agriculture (crop monitoring), or logistics (inventory management).

Open-Source Contribution:

Contribute to open-source robotics projects and communities by sharing your code and experiences, fostering collaboration and innovation.

The future scope of this project is vast and can be customized to meet various needs and interests. As technology advances and new hardware and software solutions become available, there will be even more opportunities to enhance and expand the capabilities of your versatile robot.

VJIT DOCUMENT

Secretary and Correspondent

Dr. P. Rajeshwar Reddy is a Member of Legislative Council and a Government Whip of Telangana State. His passion and zeal for education is instrumental in creating Anurag Institutions. He is one of the charismatic leaders in education providing a learning environment for an intellectual, personal and societal transformation.

He obtained his Ph.D in Physics from Osmania University. He also earned the most prestigious award “Dr. Tamahanker Memorial Prize” for the Best Research Paper in the year 1996 by Magnetic Society of India.

Joint Secretary

Mrs. S. Neelima did her B. Tech in Electrical and Electronics Engineering from JNTU, Hyderabad and M. Tech, Power Systems from Osmania University, Hyderabad.

She served as an Engineer in AP Transco department for over two decades. Mrs. Neelima is presently Joint Secretary and takes care of the management of the institution.

Member

Prof.M. Govind Ram Reddy obtained his Doctorate in Chemistry from Osmania University and was associated with the University for more than three decades in various positions like Faculty, Head, Department of Chemistry, and also as Vice Principal and Principal of University College of Science.

More than 60 Papers were published in national and international journals and he guided 16 students to achieve their doctorate degrees. He is member of the VJES

Principal

Professor Eadala Saibaba Reddy, ME. (Hons) Roorkee, PhD (Nottingham, UK), Post Doc. (Halifax, Canada), Post Doc (Birmingham, UK) an eminent Civil Engineer and a Professor of Civil Engineering JNTUHCEH. Dr. Reddy served as Professor in the Civil Department, functioned in many administrative capacities, as Head of the Department, Vice-Principal, Director Academic and Planning, Director Academic Audit Cell, Officer on Special Duty to Vice- Chancellor, Registrar, Rector (Pro-Vice

Chancellor) of JNT University Hyderabad. He has been a member in a number of expert selection committees constituted by Govt. of Andhra Pradesh, UGC, AICTE, Union Public Service Commission, A.P. Public Service Commission, Member of Search Committee for selection of Vice-Chancellor, Member of Board of Governors of Veer Surendra Sai Institute of Medical Science and Research. He is also on many other Academic/ Administrative/ Governing Bodies of various Institutions and Universities. He was Convener for EAMCET for two consecutive years 2007 and 2008.

Dr Reddy a recipient of several Scholarships and Fellowships, including: an UGC Scholarship, Commonwealth Scholarship (UK), Commonwealth Fellowship (U.K.), & Post-Doctoral Fellowship (Canada). A recipient of a number of National and International Awards including: American Society for Testing and Materials (ASTM) Award (USA), for outstanding Research paper for the year 1998, Shamshare Prakash Research Award by University of Roorkee (presently IIT Roorkee) Year 2000, Engineer of the Year Award from Govt. of A.P. and Institution of Engineers (India) for the Year 2009. Best Teacher Award from Govt. of A.P. for the year 2012.

Professor Reddy as a visiting faculty has visited over 20 Foreign Universities, including University of Birmingham, UK, University of New Orleans USA, Kansas State University (USA) and University of Illinois at Chicago (USA). He delivered invited Lectures and Chaired various National and International conferences all over the world. He is a member of over 12 National and International Professional bodies, guided 7 PhD Scholars and several M. Tech. projects, presently Guiding 3 PhD Scholars. He has published over 150 Research papers in National and International journals and Authored four Text Books in Civil and Environmental Engineering.

Dean

Dr. Padmaja obtained her B.Tech. in Chemical Engineering and M.Tech. in Biochemical Engineering from A.U. College of Engineering Andhra University, Visakhapatnam. Subsequently, she received her Ph. D. in Chemical Engineering from College of Technology, Osmania University and Post Graduate Diploma in Patent Law from Nalsar University, Hyderabad. Dr. Padmaja has guided several B.Tech / M.Tech students and published numerous papers in reputed journals/conference proceedings.

Dr. Padmaja is currently working as Dean, Accreditation & Rankings at Vidya Jyothi Institute of Technology, Hyderabad. She has nearly 20 years of Experience in Industry and Academia in the areas of teaching, research and development and consulting. She has been working with Anurag Group of Institutions for the past seven years in various capacities. Prior to joining academics, she worked at Uni-Sankyo Ltd., and Jupiter Bio-sciences Ltd., Hyderabad managing large R&D projects of highly interdisciplinary nature involving Chemical Engineering and Biotechnology. She was responsible of launching of several new products like enzymes, amino acids, nutracueticals and mucopolysaccharides beginning from basic research in the lab to taking all the way to bulk production. She has taken the initiative in setting up and managing several Labs and facilities for research and development, quality control and diagnostics. She has profound knowledge of GLP/GMP processes and ISO standards.

Sr. Administrative Officer

Mr. Venkatachalam has done his M. Sc. (Physics) and M. Phil. He has over 17 years of experience in academics and worked in various senior positions in the teaching and administrative roles in professional colleges. Through his student friendly approach and lively attitude he adds a lot of value to the administrative system.

Academic Coordinator

Mrs. Srilatha is awarded two Gold Medals in Academics by Osmania University. She has 25 years of teaching experience and 12 years as a principal. She is an able administrator and has proficiency in academics and administrative activities and is known for commitment. She has perseverance to regularly interact and motivate the students to achieve their goals.

Name	Qualification	Designation
Prof B S Murthy	Director IIIT, Hyderabad	Chairman
Dr. P. Rajeshwar Reddy	M. Sc, Ph. D., MLC, Govt.Secretary & Correspondent of VJES	Member
Mr Krishna Palla	B.Tech, MPS (USA)	Member
Mrs. S. Neelima	M.Tech., Joint Secretary of VJES	Member
Dr. L Ramakrishna Reddy	President Auropro Soft	Member
Dr. E. Sai Baba Reddy	Principal, VJIT	Member Secretary
Prof Sreeram Venkatesh	Dept of MECH,Principal, University College of Engineering , OU	Member

Name	Qualification	Designation
Dr M T Naik	Professor of ME, JNTUH CEH	Member
Mr R Venkata Chalam	Sr. Adminstrative Officer	Member
Dr. A. Padmaja	M.Tech, Ph.D, Dean Accreditations & RankingsVJIT	Member
Dr. B. Vijaya Kumar	M.Tech, Ph.D Professor in CSE	Member
Mrs G Srilatha	Academic Coordinator	Member
Dr. Balaji Utla	Registrar,Anurag University	Member

Laboratories

The VJIT's laboratories are far more advanced and ever accessible to students .This encourages students to spend more time on practicals. They are guided by experienced teaching and non-teaching staff. Students get easy access to the labs and are free to work on any projects they like in conjunction with the faculty.
We have 11 high-end computer labs with latest configuration and required software with ample UPS support.

Conference Halls

VJIT has three spacious conference halls with the state-of-the-art audio visual equipment. The First Hall has a seating capacity of 500, the second & third with the capacity to accommodate 200. The spaces in the conference halls have been designed with good acoustic systems and ambiance. Conferences, Workshops, Seminars, Tech Fests, Faculty Development Programs and Student Training & Development Programs are organized regularly in these facilities and they have been well appreciated by the visiting dignitaries from premier academic institutions and corporate organizations.

Library & Information Centre

The Vidya Jyothi Institute of Technology (VJIT) Central Library is the soul of the Institution. The Central Library supports the Institution in realizing its primary goal of imparting the quality Technical Education and to promote the research activities. The Central Library acquires, process, preserves and disseminate the information to the user Community for attaining the academic and research goals. The Objective of the Central Library is to empower knowledge. The Central Library provides information services and access to bibliographic as well as full-text digital and printed resources to support the scholarly and informational needs of the Institute community.

Housed in an independent and spacious building, The Central Library has an extensive collection of Books, Scientific and Technical Journals accompanied by a vast collection of Electronic Resources. The central Library comprises of Reference Section, Circulation Section, Journals Section, Newspaper Section, Reprography Section, Discussion Room, SC/ST Book Bank Section and Digital Library. The Library has automated all its activities by Koha Integrated Library Software to provide better, effective and immediate services to user fraternity. Apart from the Central Library, departmental libraries have set up to cater to the needs of the students, faculty and Research Scholars at the departmental level.

Well-equipped with modern facilities with WiFi enabled contains a myriad of resources including CD- ROMs, online databases, audio-video cassettes, books, e-journals, theses, reports, monographs, full-text and bibliographical databases among others.

Sports

Sports play an important role in shaping up the personality and fitness of a person and to give a truly global experience to all the students of VJIT. Sports environments matching global standards are provided at the college.
VJIT College is founded in 1999, since the inception college has been actively involved in sports and has been undisputed champions in Games like Cricket, Volleyball, Kabaddi, Badminton, Basketball, Wrestling, Boxing, Chess and Table Tennis.
College has a very good infrastructure of volleyball courts, basketball court, kabaddi courts, cricket ground and nets, and Table Tennis Hall which accommodates 06 TT tables. Also has a Gym with latest Gym equipment's.
Hall which accommodates a space of more than 10 Carom Boards, and 10 Chess Boards. Massive hall which is dedicated to the sport Wrestling and Boxing where champions are made.
College has a outdoor games facility with games like, Volley ball (2 courts) ,

Throwball (1 court) , Basketball (1 court) Kabaddi 2 (Courts) Kho kho field, Football field, Cricket Ground.

Transport

The college has its own fleet of buses operating from many points in the city of Hyderabad and the suburbs. The starting points and routes of the College Buses: College Bus Timings & Route Details 2024. For more details contact Transport In-Charge Mr. K. Pradeep Reddy, 9866999116.

EEE Team

Head of the Department

Dr. A. Srujana completed her Bachelor's degree from Kakatiya Institute of Technology & Science, Warangal, and M. Tech in Power Electronics from JNTU, Hyderabad. She was awarded Ph.D by JNTUH,Hyderabad for her research in the area of HVDC.She has worked at various capacities in prominent Engineering colleges as Principal, Professor and HOD. She has guided fifteen M. Tech projects & 2 Ph. D students. Her expertise in research is witnessed with her publication of 32 research papers in core technical areas in indexed journals and also in both National and International peer reviewed conferences. She has about 23 years of experience in Academics. Her areas of interests are power Electronics, FACTS, HVDC and POWER SYSTEMS.

Faculty Members

Name	Designation
Dr Vuppalanchu Srujana	HOD
Mr Daravastu Srinivas	Associate Professor
Mrs K Swapna	Assistant Professor
Mr Tummeti Parameshwar	Associate Professor
Mr Hussain Shaik	Associate Professor
Dr Siva Prasad Syamala	Professor
Mr Kammari Sathish Kumar	Associate Professor
Mr M Vijay Kumar	Assistant Professor
Mr Paidipamula Nageswara Rao	Associate Professor
Mrs S Chaitanya	Assistant Professor
Dr Dumpala Bala Gangi Reddy	Professor

Mrs Vemuri Vijaya LakshmI	Associate Professor
Dr C N Ravi	Professor
Mr P Naga Muneendra	Assistant Professor
Mr Raju Lakkabattula	Assistant Professor
Mr Vikram Chandha	Assistant Professor
Mrs P Vaishnavi devi	Assistant Professor
Mr Sudhakar Reddy Bhumireddy	Assistant Professor
Mr Karnam Rajeev	Assistant Professor
Mr Shamanety Suresh	Assistant Professor
Ms Abbe Doddi Bolla Bhavana Reddy	Assistant Professor
Mrs K Haritha	Assistant Professor
Mr Bhaskarla Rajesh	Assistant Professor
Ms R Keerthi	Assistant Professor
Ms M Jhansi Lakshmi	Assistant Professor
Mrs Attaluri Srilatha	Assistant Professor
Mr Audirala Mohan Das	Assistant Professor
Mr Shaik Mohammod Zaffarullah	Associate Professor
Dr S Rajesh Kumar	Associate Professor
Mr NLV Prasada Rao	Associate Professor
Mr M Soujanya	Assistant Professor
Mr Bodhanam V Siva Subrahmanyam	Assistant Professor
Mrs SH B Ireena	Assistant Professor
Dr Mathi Dileep Krishna	Assistant Professor
Mr P Satheesh	Assistant Professor
Mrs Pandikuntla Murali	Assistant Professor
Mrs Vasanthapuram Anuradha	Assistant Professor
Mr Pasumarthi Hemanth Kumar	Assistant Professor
Mr D Srikanth	Assistant Professor
Dr Devagowda Siddegowda	Associate Professor
Ms Machupalli Anitha	Assistant Professor

Block is located near Main Entrance.Mechanical department is in A-Block.

Block is located beside A-Block.Workshop is located in B-Block.

Block is in the middle of S-Block and N-Block.CSE department is located in C-Block.

Block is located in front of E-Block.Civil department and MBA department are located in D-Block.

Block is located at back entrance.ECE department and 1st Year students are located in E-Block.

Block is behind Volleyball court.EEE department is located in N-Block.

Block is beside cafeteria.AI department is located in S-Block.

Head of the Department CSE:

Dr. D.Aruna Kumari, has completed B.Tech in CSE from Shri Vishnu Engineering college , Bhimavaram in the year 2005, M.Tech in CSE from Koneru Lakshmaiah college of Engineering and Ph.D in CSE in the year 2014 from K L University. She received a grant of Rs. 1, 18,61,430/- from DST for Developing 4 villages to enhance their Agricultural Sustainability trough IoT for Social and Economic Empowerment of Scheduled Caste Communities (in Moinabad Mandal, Rangareddy District, Telangana State)" in the year March,2023.

Head of the IT Department :

Srinivasulu completed his Bachelor's degree (Computer Science & Engineering) from Karnataka University, Master's degree from Anna University, Chennai. He is currently pursuing research in the area of Cloud Computing. He has 21 years of Academic, Research and Industry experience. Working as Professor & Head in Department of Information Technology since December 2011, he worked as Senior Assistant Professor in Department of Computer Science & Engineering, PES Institute of Technology, Bangalore and Lecturer in Department of CSE, SRM Engineering College, Chennai. He has around 20 journal articles, national and international conference publications to his credit. He is the member of ACM, ISTE and CSI.

Head of the AI Department:

Dr. A. Obulesh working as Assoc. Prof. at Vidya Jyothi Institute of Technology, in the Dept. of Artificial Intelligence has an incredible experience of 14 years in academics under various capacities. He received his Ph.D. in Computer Science & Engineering from Jawaharlal Nehru Technological University, Kakinada (JNTUK), India. The M.Tech. in CSE from Rajeev Gandhi Memorial College of Engineering and Technology(RGMCET), Nandyal which is affiliated to JNT University, Hyderabad, in 2006.

Head of the ECE Department:

Dr.M. Rajendra Prasad obtained his B. Tech (ECE) from SK University, M.E (Digital System Design) from Osmania University and was awarded Ph.D. in Internet of Things from Osmania University. A versatile academician with extensive experience of 23 years in teaching and research, he has been serving Vidya Jyothi Institute of Technology for the last 18 years.

Head of the CIVIL Department:

Dr. Pallavi Badry completed Bachelor degree in Civil Engineering from Visvesvaraya National Institute of Technology, Nagpur and Ph. D in Geotechnical Earthquake Engineering from IIIT Hyderabad. She has more than 15 years of experience in teaching, research and industry. Her expertise in research benchmarked with around 50 technical papers in indexed journals and in National and International peer-reviewed conferences. She guided 50+ BTech students and 15 Mtech students and 1 PhD student. She has 3 book chapters, 1 book and 1 International patent on her credits.

Head of the MECHANICAL Department:

Dr. G Sreeram Reddy has done his B.Tech (Mech.) from Osmania University, Hyderabad, M. Tech. (Energy Systems) from JNTUH and was awarded a Ph.D. in Mechanical Engineering from JNTUH.His career in academics spans more than 19 years. He has worked with various corporate as Design Engineer, before taking charge as the Head of the Department of Mechanical Engineering. He also contributed his services as the Placement Officer and Student Coordinator at VJIT. He has to his credit 25 peer-reviewed technical papers published in National and International journals. He has applied 4 Patents with Indian Patent Office on numerous technical innovative concepts.