Indian Institute of Information Technology Una Himachal Pradesh

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Review I
Project Phase – I (ECL502)

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1. Title of the Project

MiniMech: Your Compact Companion in Robotics

2. Introduction

Humanoid robots, designed to resemble humans in form and function, have been a subject of fascination and research for decades. These advanced machines are increasingly becoming a part of our daily lives, from industrial automation to personal companionship. This project aims to develop a humanoid robot that can interact with humans in a natural and intuitive manner, showcasing the potential of human-machine collaboration. By combining elements of robotics, artificial intelligence, and human-computer interaction, we seek to create a versatile and adaptable robotic companion.

3. Problem Definition

- **Complex Control Systems:** Coordinating the movements of a humanoid robot requires intricate control algorithms to ensure stability, balance, and natural-looking motions.
- **Sensory Perception:** Enabling robots to perceive their environment accurately through vision,hearing, and touch is essential for effective interaction.
- **Natural Language Processing:** Developing robots capable of understanding and responding to human language in a meaningful way is a significant hurdle.
- **Ethical Considerations:** As humanoid robots become more sophisticated, addressing ethical concerns related to their autonomy, privacy, and potential impact on society is crucial.
- **Cost and Accessibility:** The high cost of humanoid robot development and manufacturing can limit their widespread adoption.
- **Real-World Applications:** Identifying practical and meaningful applications for humanoid robots in various domains, such as healthcare, education, and entertainment, is an ongoing challenge.

4. Objectives

- Design and Construct: Develop a humanoid robot capable of performing basic human-like movements and interactions.
- Implement Sensory Perception**:** Equip the robot with sensors (e.g., cameras, microphones, touch sensors) to perceive its environment and interact with objects and people.
- Develop Natural Language Processing**:** Enable the robot to understand and respond to human language in a natural and meaningful way.
- Integrate Human-Machine Interaction**:** Design a user-friendly interface for humans to interact with the robot and provide feedback.
- Address Ethical Considerations**:** Incorporate ethical principles into the robot's design and operation to ensure responsible and beneficial use.
- Explore Real-World Applications**:** Identify potential applications for the humanoid robot in areas such as healthcare, education, or entertainment.

5. Skillset additionally required to solve/address the problem

- Robotics Engineering: Knowledge of robot design and mechanics.
- Embedded Systems: Experience with microcontrollers (e.g., ATmega2560) and integration of hardware components.
- Electronics: Skills in circuit design, power management, and interfacing sensors and actuators.
- Motor Control: Expertise in controlling servo and micro servo motors for movement and gestures.
- Sensor Integration: Experience with integrating and calibrating sensors for environment interaction.
- Wireless Communication: Knowledge of Wi-Fi and communication protocols for remote control and data exchange.
- Voice Recognition (if applicable): Skills in implementing and programming voice recognition systems.

6. Timeline to achieve the skillset

Skills	Time required to achieve the skillset
Project Planning, Hardware Procurement, and Setup	3-4 weeks
Robotics Connection Fundamentals, Microcontroller Programming, and Electronics	2-3 weeks
Mechanical Design, Fabrication, and Sensor Integration	3-4 weeks
Motor Control, Computer Vision, and Natural Language Processing	3-4 weeks
Human-Computer Interaction, Final Testing, and Documentation	2-3 weeks

7. Block and schematic Diagram

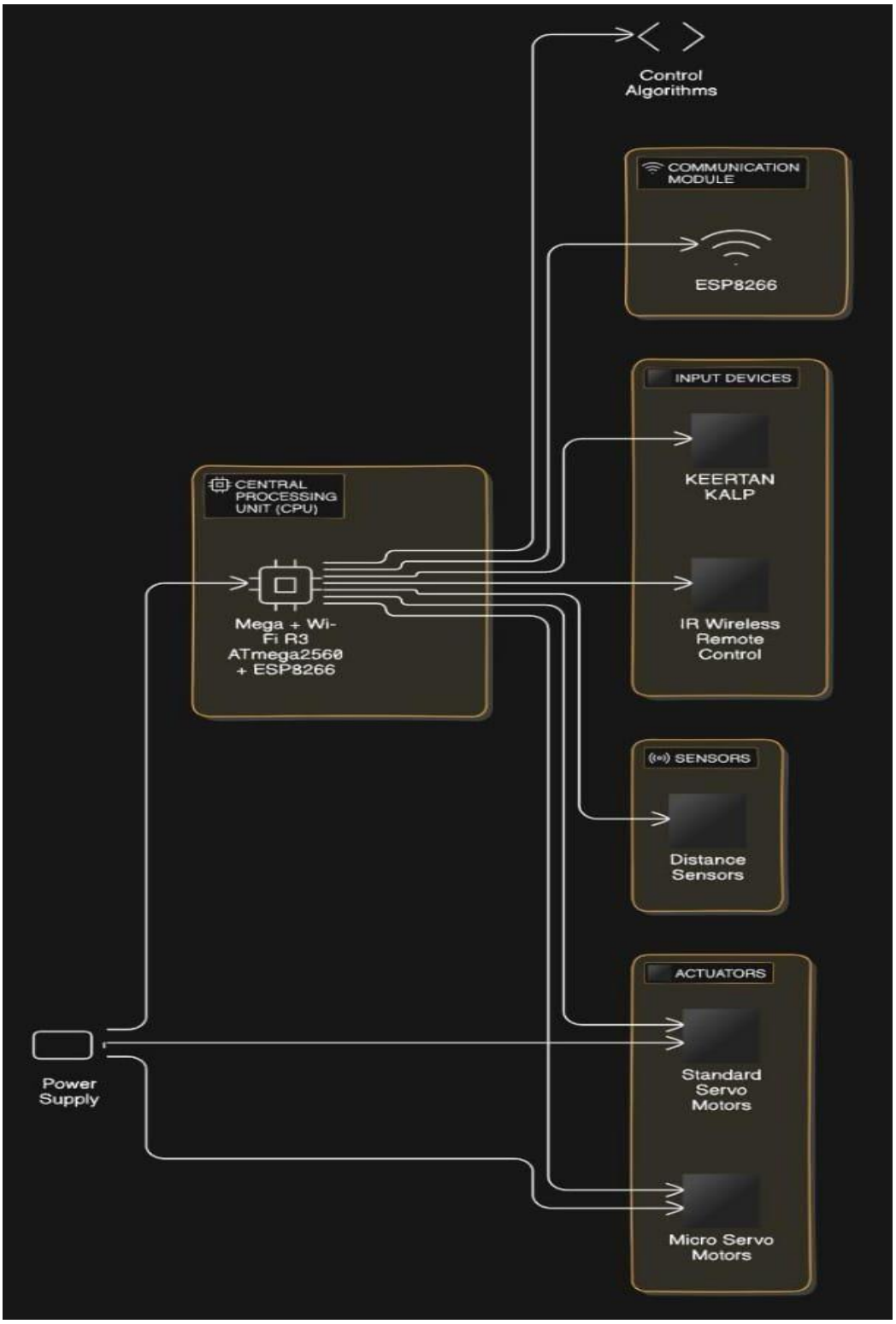

Fig 1: Block diagram of MiniMech

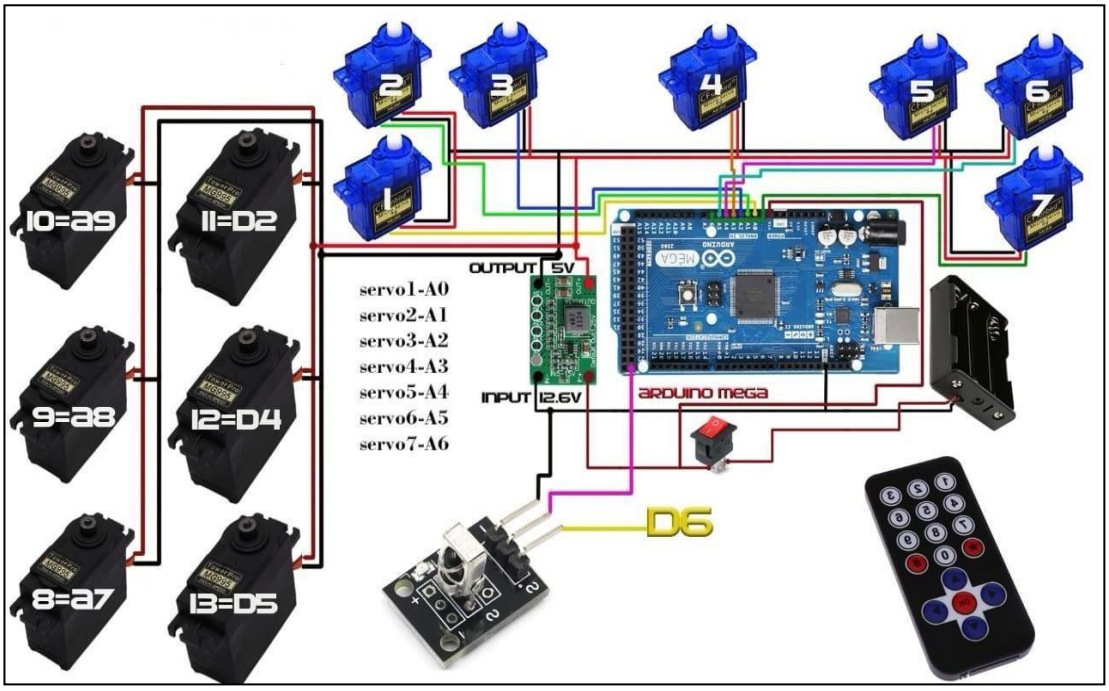

Fig 2: Schematic Diagram of MiniMech

8. Weekly milestones

Week	Major Activities to be Completed
Week 1	Define project scope and objectives.
Week 2	Create detailed project plan and timeline.
Week 3	Purchase and assemble all necessary components (KEERTAN KALP, REES52 MEGA 2560, servo motors, etc.).
Week 4	Set up the development environment and tools.
Week 5	Design and build the robot's physical structure.
Week 6	Prototype the robot’s body and frame using appropriate materials.
Week 7	Integrate sensors and motor controllers with the central processing unit.
Week 8	Test and calibrate sensor inputs and motor outputs.
Week 9	Develop and test basic control algorithms for walking andgestures.
Week 10	Program the microcontroller to handle motor commands and sensor data.
Week 11	Implement control for basic commands.
Week 12	Test remote functionality and refine communication protocols.
Week 13	Research and integrate voice recognition modules.

Week 14	Develop and test voice command functionalities.
Week 15	Combine all components and systems into a cohesive unit.
Week 16	Analyze performance metrics (accuracy, response time, stability).
Week 17	Optimize control algorithms and hardware settings for better performance
Week 18	Perform comprehensive testing of all features and functionalities
Week 19	Prepare final project documentation, including design, programming details, and user manual.
Week 20	Conduct a final review and presentation of the project.

9. Completed Milestones

- Defined project scope and objectives, outlining the goals of developing a humanoid robot capable of interacting with humans in a natural and intuitive manner.
- Created a detailed project plan and timeline, outlining the key activities, deliverables, and deadlines for each phase of the project.
- Purchased and assembled all necessary components, including REES52 MEGA 2560, servo motors, and other required hardware.
- Prototyped and made operational both the upper and lower body parts of the robot.

10. Milestones to be Completed

- **Sensor Integration:** Integrate sensors and motor controllers with the central processing unit.
- **System Calibration:** Test and calibrate sensor inputs and motor outputs.
- **Control Algorithm Development:** Develop and test basic control algorithms for walking and gestures.
- **Software Implementation:** Program the microcontroller to handle motor commands and sensor data.
- **Remote Control and Wireless Functionality:** Implement laptop key control, push button control, and explore wireless control options.

11. Expected Challenges

- **Complex Control Systems:** Coordinating the movements of a humanoid robot requires intricate control algorithms to ensure stability, balance, and natural-looking motions.
- **Sensory Perception:** Enabling robots to perceive their environment accurately through vision, hearing, and touch is essential for effective interaction.
- **Ethical Considerations:** As humanoid robots become more sophisticated, addressing ethical concerns related to their autonomy, privacy, and potential impact on society is crucial.

- **Real-World Applications:** Identifying practical and meaningful applications for humanoid robots in various domains, such as healthcare, education, and entertainment, is an ongoing challenge.

12. References

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Name and Signature of Student **Name and Signature of Supervisor**