PROJECT ALFRED

Video link >> https://drive.google.com/file/d/1x8-SH1bQSQqpr5VGzT-r3vs4VMLAK1Cz

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REQUIREMENTS >>

1. 3D Printing Requirements

1.1 Hardware

- **3D Printers**:

1.2 Filaments

- **Primary Filament**: PETG for its balance of strength and flexibility
    - Colors: Natural, Black, White (for aesthetic parts)
- **Secondary Filament**: TPU for flexible joints and protective covers
- **Special Parts**: Nylon for high-stress components

2. Cost of Hardware

- **3D Printers**: already available
- **Filament Cost**:
    - PETG: 1099/kg
    - TPU: 2248/kg
    - Nylon: 2249/kg

3. Electronics

3.1 Components

- **Microcontrollers**: Raspberry Pi 4
- **Motors**: Servo motors

- **Sensors**: detailed research has to be done
- **Power Supply**: wattage to be researched
- **Wiring and Connectors**: Standard connectors, wires, and harnesses

3.2 Assembly Process

- **Microcontroller Setup**: Install and configure the operating system and control software
- **Motor Assembly**: Attach servo motors to printed parts, ensuring proper alignment
- **Sensor Integration**: Install sensors and connect them to the microcontroller
- **Wiring**: Ensure all components are properly wired and insulated

4. Supported Movement Capabilities

- **Articulated Joints**: Head, arms, legs, torso
- **Capabilities**:
  - Grasping objects
  - Head rotation and tilt
  - Arm and hand movements

5. Cost-Efficient Development Strategies

- **Modular Design**: Build and test individual modules before full assembly
- **Open-Source Resources**: Utilize open-source designs and software to reduce development costs
- **3D Print Prototypes**: Print and test smaller-scale prototypes to refine design and functionality

6. Implementation Plan

High-Level Step-by-Step Plan

1. **Planning and Design**
   - Finalize design specifications and requirements
   - Assign roles and responsibilities
2. **Procurement of Materials**
3. **3D Printing Phase**
   - Print all required parts using PETG and TPU
   - Perform quality checks on printed parts
4. **Electronics Assembly**
   - Assemble microcontrollers, motors, and sensors
   - Test electronic components individually
5. **Mechanical Assembly**

- ○ Assemble printed parts and integrate electronic components
        - ○ Conduct initial functional tests
   6. **Software Integration**
        - ○ Develop and upload control software
        - ○ Test movements and refine control algorithms
   7. **Testing and Debugging**
        - ○ Conduct extensive testing in simulated environments
        - ○ Refine design based on test results
   8. **Final Assembly and Validation**
        - ○ Assemble the final humanoid robot
        - ○ Perform comprehensive validation tests

- ● **Team**: 4-6 engineers
- ● **Milestones**:
     - ○ Design Approval
     - ○ Procurement Completion
     - ○ 3D Printing Completion
     - ○ Electronics and Mechanical Assembly Completion
     - ○ Software Integration and Testing Completion
     - ○ Final Validation

This TRD outlines a clear and structured approach to building a humanoid robot, ensuring that all technical requirements are met while keeping costs and development time under control.