MINI PROJECT

1) With the advent of LLM and LVMs the development of wearable AI devices is on the rise. List down a few currently existing smart glasses or wearable AI products. Write down your thoughts on them as well as suggest some improvements

The integration of Large Language Models (LLMs) and advanced AI technologies has significantly propelled the development of wearable AI devices, particularly smart glasses. Here are some notable examples:

1. Meta's Ray-Ban Meta Smart Glasses

Meta, in collaboration with Ray-Ban, has developed smart glasses that have gained substantial market traction, with over 1 million units sold in 2024. These glasses feature built-in cameras and have recently been upgraded with AI capabilities, including real-time visual processing and live translation features. The "Live AI" functionality allows the glasses to process visual, auditory, and text inputs, providing users with real-time assistance and information.

Thoughts and Improvements: The integration of AI enhances user interaction, making the glasses more intuitive. However, concerns about privacy due to the always-on camera and microphone persist. Implementing more robust privacy controls, such as physical shutters for cameras and clear indicators when recording, could alleviate user concerns.

2. Solos AirGo Vision Smart Glasses

Solos has introduced the AirGo Vision smart glasses, which integrate OpenAI's GPT-4.0 AI model. These glasses are equipped with front cameras and offer real-time visual recognition, allowing users to ask questions about their surroundings and receive immediate responses. The design includes swappable frames, enabling users to remove the camera for enhanced privacy when not needed.

Thoughts and Improvements: The modular design prioritizes user privacy, addressing a common concern with wearable tech. However, the absence of video recording capabilities might limit functionality for some users. Future iterations could explore secure video recording options with stringent privacy controls to broaden appeal.

3. Amazfit Helio Smart Ring

Expanding beyond eyewear, the Amazfit Helio Smart Ring offers health tracking features, including sleep monitoring, stress level assessment, and AI coaching. Despite its comprehensive feature set, the device faces challenges with battery life, often requiring a charge every three days, and limited sizing options.

Thoughts and Improvements: The compact form factor is commendable for users seeking unobtrusive wearables. Improving battery efficiency and offering a wider range of sizes would enhance user satisfaction and accessibility.

4. Apple Watch Series 10

The Apple Watch Series 10 stands out as a leading smartwatch, offering comprehensive health and fitness tracking, a bright always-on display, and seamless integration with the iPhone. It provides users with a range of AI-driven features, including personalized health insights and proactive activity suggestions.

Thoughts and Improvements: While the Apple Watch excels in functionality and design, expanding its compatibility beyond the Apple ecosystem could attract a broader user base. Additionally, enhancing battery life to reduce the frequency of charging would improve the overall user experience.

5. Meta's Investment in VR and AR Technologies

Meta's substantial investment in virtual and augmented reality technologies underscores the company's commitment to advancing wearable AI devices. With cumulative investments projected to exceed $100 billion, Meta aims to develop products like the Ray-Ban Meta smart glasses and Quest VR headsets, envisioning them as future computing platforms that could potentially replace smartphones.

Thoughts and Improvements: While Meta's ambitious vision is driving innovation in the wearable AI space, the company faces challenges related to user adoption and market competition. Focusing on user-centric design, affordability, and addressing privacy concerns will be crucial for widespread acceptance.

In summary, the wearable AI market is rapidly evolving, with significant advancements in smart glasses and other devices. Balancing innovative features with user privacy, battery efficiency, and broader compatibility will be key to the sustained growth and acceptance of these technologies.

2) Suppose you are given the task of making an AI-powered smart device. Suggest a device which you as a user would like to use daily. Suggest all the features which the device should have. (Go all out and be as creative as you can!). Write in brief the working of the device

1.Smart Bracelet

A smart bracelet designed to enhance daily life with practical, beginner-friendly AI features. The goal is to focus on simplicity and ease of use while still offering real-time, personalized assistance.

Core Features

1. AI-Powered Activity Tracker
Track daily steps, heart rate, calories, and sleep patterns.
AI Suggestions: Based on daily activity, AI provides gentle reminders or motivation like “You’ve been sitting too long, take a quick walk!” or “Your sleep quality improved today.”

2. Voice Assistant Integration
Basic Voice Commands: Use voice commands to set reminders, check the weather, or play music.
Text-to-Speech Notifications: Receive message alerts or calendar events as voice notifications on the bracelet.

3. Stress & Mood Monitoring
Basic Stress Alerts: Measures stress levels using skin conductivity sensors. When stress is detected, it suggests activities like "Take 5 deep breaths."
Mood-based Music Recommendations: If feeling stressed, the AI suggests calm music or sounds.

4. Smart Notifications
Call/Text Alerts: Vibrates or shows a small LED notification for calls, texts, or emails.
Personalized Reminders: Sends reminders to drink water, take medicine, or attend meetings.

5. Bluetooth Connectivity with Phone
Syncs with the phone to display notifications, calls, and app reminders.
Controls basic phone functions such as answering calls or switching music.

6. Basic Smart Home Control

Can control simple devices like smart lights or a smart speaker through voice or a button on the bracelet.

How It Works

1. Wearing the Device: Put on the bracelet comfortably—designed to be lightweight, breathable, and unobtrusive.

2. Voice Interaction: Speak simple commands like "What's the weather today?" or "Set a reminder for 3 PM."

3. Stress Detection: The bracelet subtly alerts you when your stress levels are high and suggests relaxation techniques.

4. Daily Activity Tracking: View your steps and calories burned through a simple app interface on your phone.

5. Notifications: Get basic notifications for calls, messages, and calendar events.

6. Control Smart Devices: Use the bracelet to toggle smart lights or ask it to play music, creating a seamless home automation experience.

Why This Device?

Simple to Use: Perfect for beginners, no complex setup or learning curve.

Affordable and Practical: A smart assistant in a bracelet format that handles your daily life tasks.

Health and Productivity Focus: Motivates you to stay active and manage stress.

2.AI MART SPECTACLES

A lightweight, AI-powered smart spectacle designed for daily use, offering hands-free assistance, health tracking, and smart notifications without being overly complex or expensive.

Core Features

1. AI Voice Assistant

Built-in voice assistant (works via Bluetooth connection to your phone).

Simple voice commands like “Read my messages,” “Remind me at 3 PM,” or “What’s the weather?”

AI summarizes emails & texts and reads them aloud via bone conduction audio.

2. Smart Notifications & Quick Info

Displays small text alerts (e.g., calls, messages, reminders) inside the lens in a minimalist way (not distracting).

Caller ID display + ability to accept/reject calls via touch on the frame.

Shows simple overlays for directions (turn-by-turn navigation).

3. Vision Assistance & AI Recognition

Text-to-Speech Reading: Reads printed text (menus, signs, books, labels) aloud for convenience.

Object Recognition: Can identify everyday objects (e.g., “This is a bottle of Pepsi” or “That’s a Labrador dog”).

Live Translation: AI translates foreign language texts into your native language instantly.

4. Health & Eye Strain Monitoring

Tracks screen time and alerts you when you’ve been staring at screens for too long.

Smart Brightness Adjustment: Adjusts tint based on lighting conditions (reduces glare outdoors).

Detects blinking patterns to remind you if your eyes are getting too dry.

5. Basic Gesture & Touch Control

Swipe on the frame to navigate notifications or adjust volume.

Double-tap to activate AI instead of always listening.

Tilt head slightly for hands-free interaction (e.g., nod to accept a call).

6. Lightweight & Stylish Design

Looks just like normal glasses (no bulky camera modules).

Available in prescription or sunglasses versions.

Designed to be affordable and easy to use, unlike high-end AR glasses.

How It Works

1. Wear like normal glasses – lightweight, no complicated setup.

2. Use AI with voice or touch – simple interactions like "What's my schedule today?"

3. Receive smart notifications – text, call, and navigation pop-ups inside the lens.

4. Read signs & texts instantly – point at a menu or book, and AI reads it aloud.

5. Enhance eye comfort – auto-adjust brightness and alert you when you need a break.

Why This Device?

Simple and practical – no AR gimmicks, just helpful AI features.

Affordable alternative to high-end smart glasses like Ray-Ban Meta.

Daily usability – integrates AI into normal-looking glasses without distractions.

3) You are tasked to make AI-powered smart spectacles with a camera, mic, and two open-ear speakers. The spectacles should be able to connect to the phone via Bluetooth and with the press of a button send audio (from the mic) and camera data to the phone.

AI-Powered Smart Spectacles - Hardware Selection & Design

We need to build AI-powered smart spectacles with a camera, mic, open-ear speakers, Bluetooth connectivity, and a button for data transmission. The system must be power-efficient, compact, and lightweight to suit a wearable device.

a) We want to capture an image and transfer via Bluetooth. The image must be atleast HD, and needs to be encoded before sending (Why?). Recommend a suitable MCU for the spectacles. Keep in mind the constraints of a wearable device such as less heat, small size, battery consumption.

MCU Selection & Image Encoding

Why Encode the Image Before Sending?

Raw images are large (HD resolution can be 1–3MB per image).

Bluetooth has limited bandwidth, so we need compression before transmission.

Encoding formats like JPEG or H.264 reduce size while maintaining quality.

Reduces latency in sending data to the phone.

Recommended MCU: STM32H7B3I (STM32H7 Series)

Why this MCU?

High-performance (480 MHz Cortex-M7)

Hardware JPEG codec for fast image encoding

Built-in MIPI-CSI interface for camera

Low power consumption (optimized for wearables)

Flexible power modes to manage battery life

b) Considering the data we need to transfer (camera data and audio) to an Android/Apple device, recommend which Bluetooth modes (BR, EDR, BLE etc), and thus which bluetooth chip should be used.

Bluetooth Mode & Chip Selection

Bluetooth Modes for Audio + Image Data Transfer

Classic Bluetooth (BR/EDR) → Best for continuous audio streaming.

Bluetooth Low Energy (BLE) → Best for low-power control signals.

Bluetooth 5.2 (LE Audio + Isochronous Channels) → Ideal for high-quality stereo audio with low power.

Recommended Bluetooth Chip: Nordic nRF5340

Why?

Dual-core ARM Cortex-M33 (one for Bluetooth, one for AI tasks).

Bluetooth 5.2 support (LE Audio, Isochronous Channels for synchronized audio).

Low-power BLE + Classic Bluetooth support.

Audio Codec support for clear voice transmission.

c)List down all the hardware components you selected in the above questions (plus others like mic, speakers, BMS etc) which you'll need for the above device and make a detailed BOM.

component	Specification	Reason for selection
MCU	STM32H7B3I (Cortex-M7,480MHz)	High-speed processing, Hardware JPEG encoding
Bluetooth SoC	Nordic nRF5340 (Bluetooth 5.2)	High-quality audio+low power
Camera Module	Sony IMX219 (8MP,MIPI-CSI)	Compact low-power, HD camera
Microphone	Knowles SPH0645LM4H (Digital MEMS)	Low-power High-senstivity
Speakers	Bone conduction Transducers	Open-ear design for safety
Battery	Li-Po 3.7v 500mAh	Lightweight, Rechargable
Battery Management System(BMS)	TIBQ24230 (PMIC for wearables)	Smart charging &power regulation
Storage(FLASH)	Winbond W25Q128 (128mb NOR Flash)	Stores temporary image/audio data
Power Regulator	Texas Instruments TPS62743	Efficient low-power voltage Regulation
Button	Tactile push Button	Used for capturing image/audio
PCB	Custom flexible PCB	Wearable form factor
Antenna	Integrated PCB Antenna	Bluetooth Connectivity

d) Make a rough schematic to show all the components are connected to each other