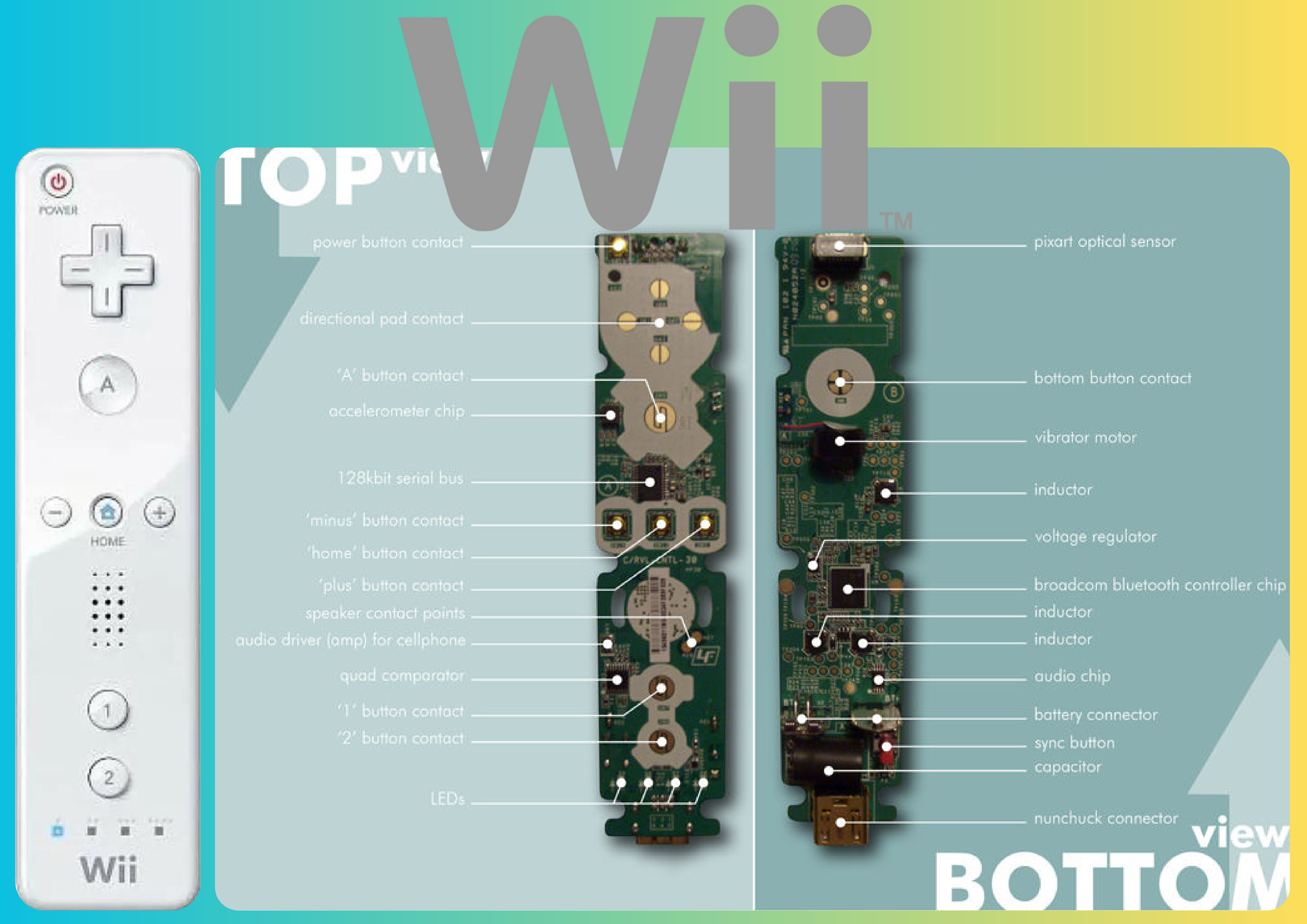
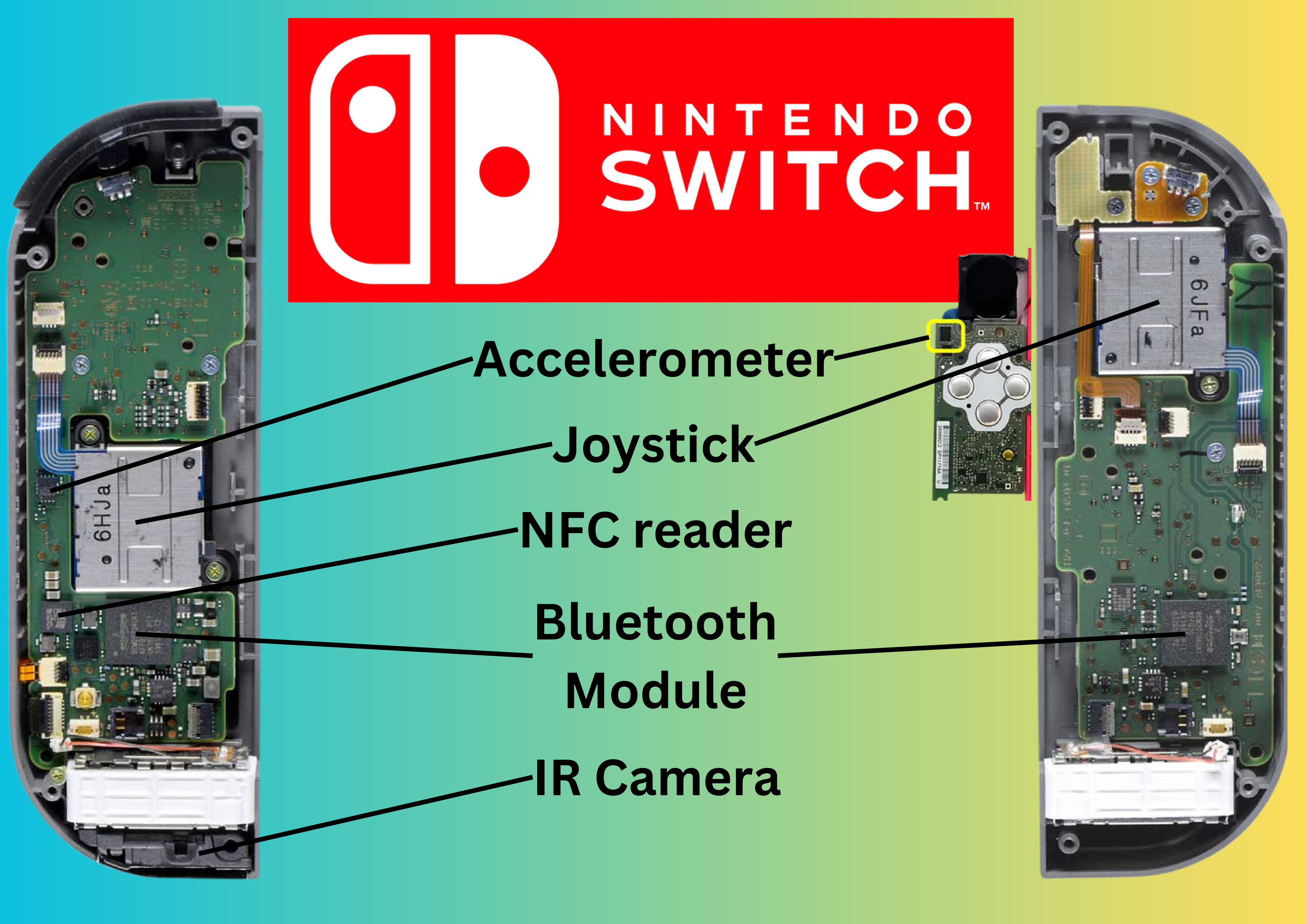

Wii™
POWER
A
HOME
1
2
Wii
TOP view
power button contact
directional pad contact
'A' button contact
accelerometer chip
128kbit serial bus
'minus' button contact
'home' button contact
'plus' button contact
speaker contact points
audio driver (amp) for cellphone
quad comparator
'1' button contact
'2' button contact
LEDs
pixart optical sensor
bottom button contact
vibrator motor
inductor
voltage regulator
broadcom bluetooth controller chip
inductor
inductor
audio chip
battery connector
sync button
capacitor
nunchuck connector
BOTTOM view

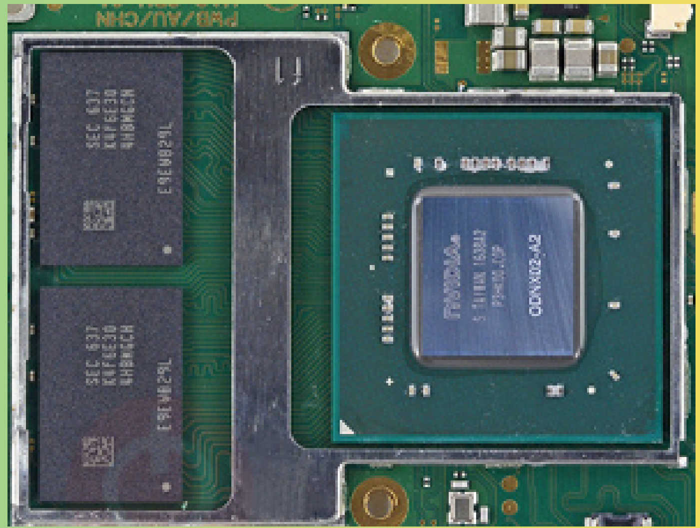

NINTENDO
SWITCH
Accelerometer
Joystick
NFC reader
Bluetooth
Module
IR Camera
6HJa
6JFa

CPU & GPU

Wii

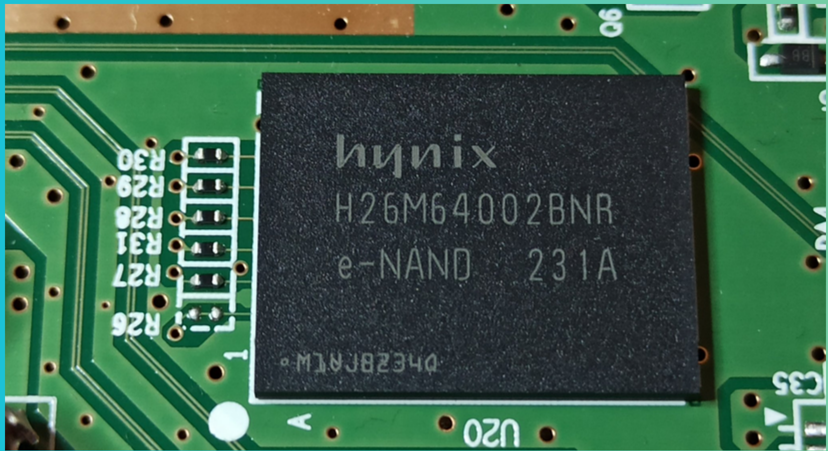
- Introduced in 2006, revolutionized gaming with motion-controlled gameplay.
- Custom-designed Broadway CPU clocked at 729 MHz based on PowerPC architecture.
- Broadway CPU prioritized simplicity and efficiency with a single-core design.
- Paired with the Broadway CPU, the Hollywood GPU rendered vibrant visuals at 480p resolution.
- Hollywood GPU optimized for parallel computing, enhancing the immersive gaming experience.
- Not as powerful as contemporary consoles but excelled in motion-controlled gaming.

NINTENDO SWITCH



- Introduced in 2017, offering a seamless transition between home console and handheld gaming.
- Features a custom NVIDIA Tegra X1 system-on-chip (SoC) integrating CPU and GPU.
- Tegra X1 SoC combines a quad-core ARM Cortex-A57 CPU and a Maxwell-based GPU.
- CPU handles multitasking and complex computations while GPU excels in rendering graphics.
- Achieves a balance between processing power and energy efficiency.
- Capable of handling graphically intensive games in both handheld and docked mode.

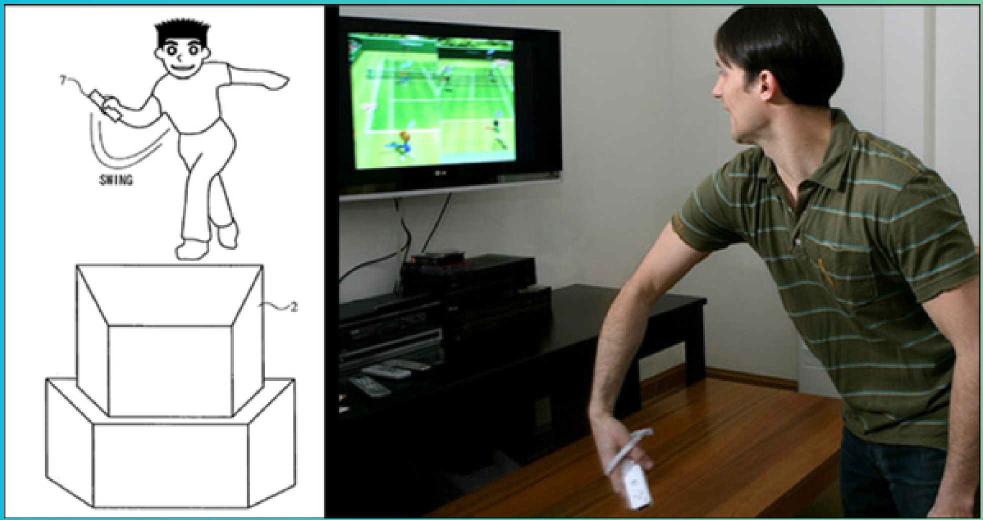
Storage

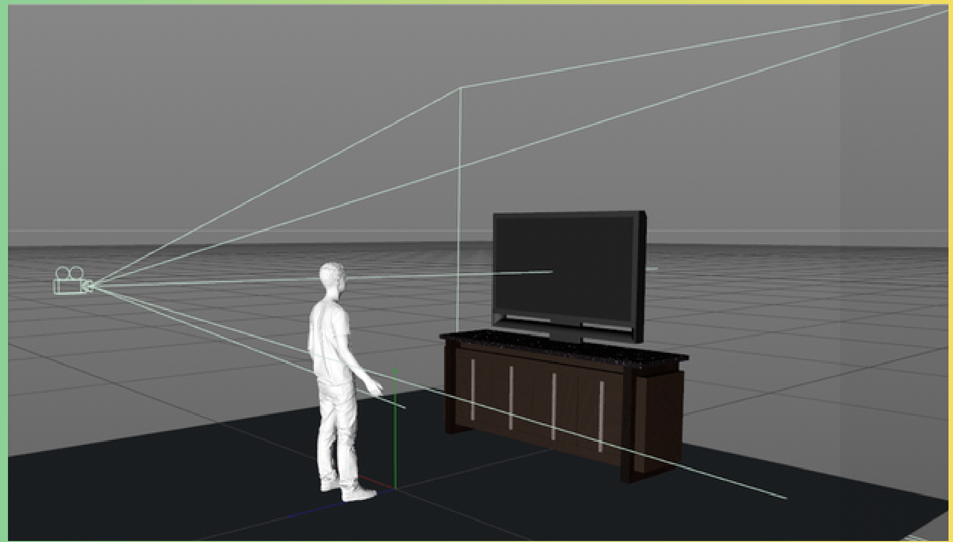


- Has 512MB of internal memory
- Extra storage is limited to an SD card of up to 2GB of storage
- Has 88MB of RAM, with 66MB dedicated to games

- Has 32GB of internal memory
- Can be expanded with a microsd of up to 2TB of storage
- Has 4GB of RAM

MOTION CONTROL



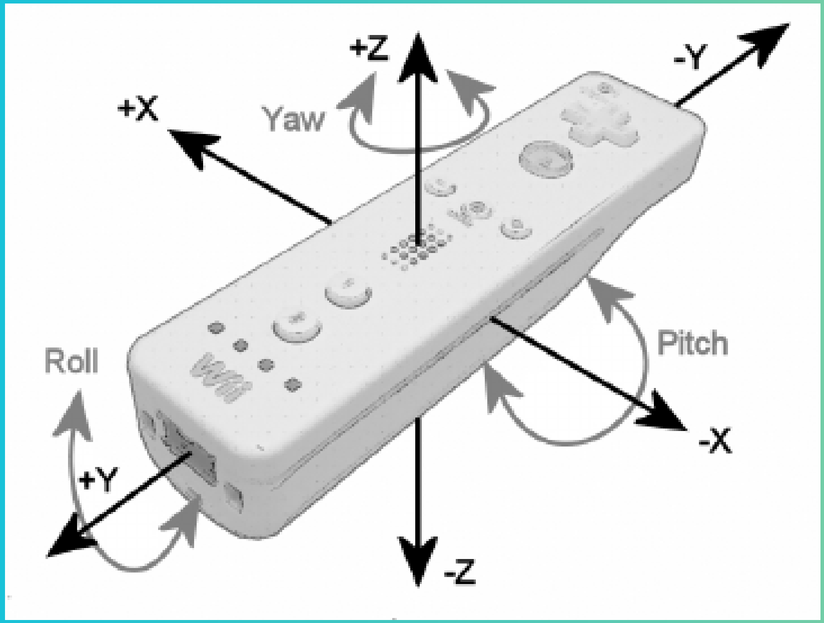


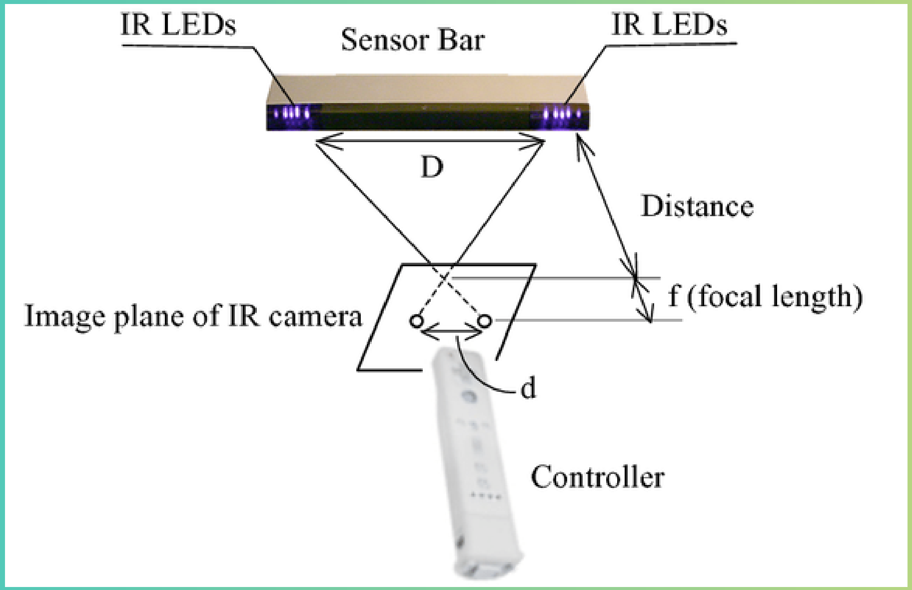
Motion control in gaming refers to the use of physical movements or gestures to interact with and control gameplay elements. The concept allows players to immerse themselves in games by translating real-world movements into in-game actions.

Unlike traditional button-based controls, motion control offers a more intuitive and interactive way to interact with gameplay elements, allowing players to perform actions by simply moving their bodies or gestures. Motion control systems utilize a variety of technologies to track movements accurately, providing precise input for controlling games.

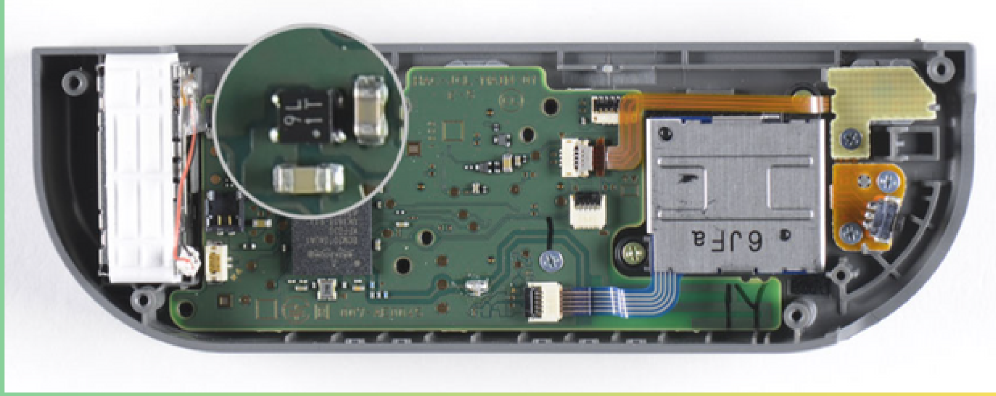
Nintendo made it possible for players to have access to motion controls in games by providing input controllers where people can hold and swing. Both the Wii Remote and the Joy Controllers communicate to the console through bluetooth to send the input in order for the console to process.

Motion Control in Nintendo Wii

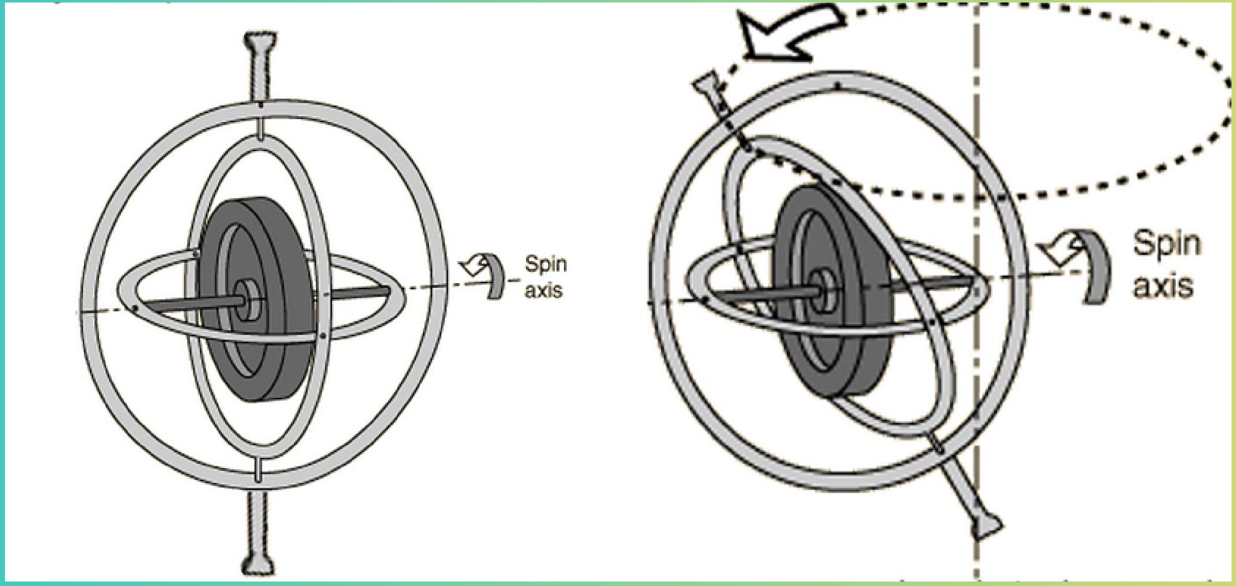




Motion Control in Nintendo Switch



Switch's gyroscope and accelerometer to detect motion



Wii

1. Hardware Evolution:
Introduced motion control with Wii Remote and Sensor Bar combination.

2. Sensor Technology:
Relied on accelerometers and infrared sensors, with the sensor bar emitting infrared light.

3. Accuracy and Precision:
Initial motion control relied on Wii Remote and Sensor Bar, with additional precision offered by Wii MotionPlus.

4. Functionality:
Motion control primarily focused on pointing, cursor movement, and gesture recognition.

5. External Components:
Required the Sensor Bar for certain functions like pointing and cursor control.

6. Integration and Communication:
Integration between Wii Remote and Sensor Bar for motion control.

7. Technological Advancements:
Introduced motion control to mainstream gaming, paving the way for immersive gameplay experiences.

8. Physics Principles:
Relied on accelerometers primarily for motion control enhancements, especially in the Wii Remote, with the Wii MotionPlus accessory providing additional capabilities.

9. Flexibility and Freedom:
Limited flexibility due to reliance on external components like the Sensor Bar.

10. Experience:
Revolutionized gaming with innovative motion control, offering unique and immersive gameplay experiences.

NINTENDO SWITCH

1. Hardware Evolution:
Utilizes Joy-Con controllers with integrated gyroscopes, accelerometers, and infrared sensors.

2. Sensor Technology:
Utilizes gyroscopes, accelerometers, and infrared sensors built directly into the Joy-Con controllers.

3. Accuracy and Precision:
Joy-Con controllers offer advanced motion-sensing technology with gyroscopes and infrared sensors, providing finer-grained data for more precise tracking.

4. Functionality:
Offers expanded functionality with gyroscopes enabling rotational movements and infrared sensors facilitating object detection and gesture recognition.

5. External Components:
Joy-Con controllers integrate all necessary sensors internally, eliminating the need for external components like the Sensor Bar.

6. Integration and Communication:
Unified platform with system-on-chip architecture integrating CPU, GPU, and motion control components, facilitating seamless communication between hardware components.

7. Technological Advancements:
Represents a technological evolution with advanced sensor technology and seamless integration, offering enhanced gameplay experiences.

8. Physics Principles:
Utilizes microelectromechanical systems (MEMS) gyroscopes for motion sensing, operating based on changes in capacitance or resistance, representing a modern technological approach rooted in the principles of angular momentum conservation, akin to traditional gyroscopes.

9. Flexibility and Freedom:
Offers flexibility and freedom of movement with internal sensors, allowing players to interact with games in various ways without external constraints.

10. Experience:
Builds upon the foundation laid by the Wii, providing more advanced motion control technology and further enhancing the overall gaming experience.

MOTION CONTROL & COMPUTER ARCHITECTURE

ALU

When motion control happens, the Arithmetic and Logic Unit (ALU) plays a crucial role in processing the data generated by the motion sensors and translating it into meaningful actions within the gaming environment.

1. Data Interpretation: Motion sensors like accelerometers and gyroscopes detect changes in orientation, acceleration, and rotation, generating raw analog signals.

2. Data Processing: The digital data from motion sensors is sent to the console's CPU. Here, the ALU interprets the data:
   - Acceleration Data: Calculates the rate of change in acceleration to determine motion direction and intensity
   - Rotation Data: Processes gyroscope data to detect rotational movements like tilting or twisting.
   - Combined Data: Combines accelerometer and gyroscope data to derive complex motion patterns, like gestures.

3. Game Logic Execution: After processing, the ALU updates the game state, executing logic algorithms:
   - Example: Tilting the controller left triggers the ALU to move the character left in-game
   - Example: Swinging the controller initiates actions like swinging a virtual sword.

4. Feedback Generation: The ALU may provide feedback to users based on their motions:
   - Example: Correct motions trigger haptic feedback for tactile confirmation.

In a general sense, motion control involves sensors detecting user movements, CPUs processing this data via the ALU to interpret actions, updating the game state accordingly, and providing feedback to enhance user experience.

Input/Output (I/O) Systems

I/O systems facilitate communication between the gaming console and motion control input devices, such as accelerometers, gyroscopes, and infrared sensors. These systems manage the transmission of raw sensor data from the input devices to the CPU for processing and interpretation. Additionally, they handle the feedback signals sent from the console to the input devices, such as haptic feedback or visual cues.

Then (Wii): The Wii utilized an infrared sensor bar as part of its I/O system to track the position of the Wii Remote. Players would point the Wii Remote at the sensor bar, which emitted infrared light, allowing the console to calculate the remote's position and orientation in 3D space.

Now (Switch): The Switch employs more advanced I/O systems, including Bluetooth connectivity and integrated sensor fusion algorithms. The Joy-Con controllers feature built-in accelerometers and gyroscopes, enabling precise motion tracking without the need for external sensor bars. Additionally, the Switch's I/O system supports various feedback mechanisms, such as HD Rumble, which provides tactile feedback to players during motion-controlled interactions.

Memory Hierarchy

Memory hierarchy plays a crucial role in motion control applications by storing and managing motion-related data, such as sensor inputs, processing algorithms, and game logic. Efficient memory organization is essential for reducing latency and ensuring smooth real-time processing of motion inputs.

Then (Wii): The Wii's memory hierarchy consisted of a combination of main memory (RAM) and onboard storage (Flash memory). The console utilized memory caching techniques to store frequently accessed motion control data, such as calibration parameters and motion tracking algorithms, in fast-access cache memory.

Now (Switch): The Switch features a more advanced memory architecture compared to the Wii, with larger RAM capacity and faster memory access speeds. The console employs dynamic memory management techniques to allocate memory resources dynamically based on the demands of motion control processing and other system tasks. Additionally, the Switch's memory hierarchy is optimized for handling motion-related data streams efficiently, enabling seamless integration of motion control functionalities into gameplay experiences.