

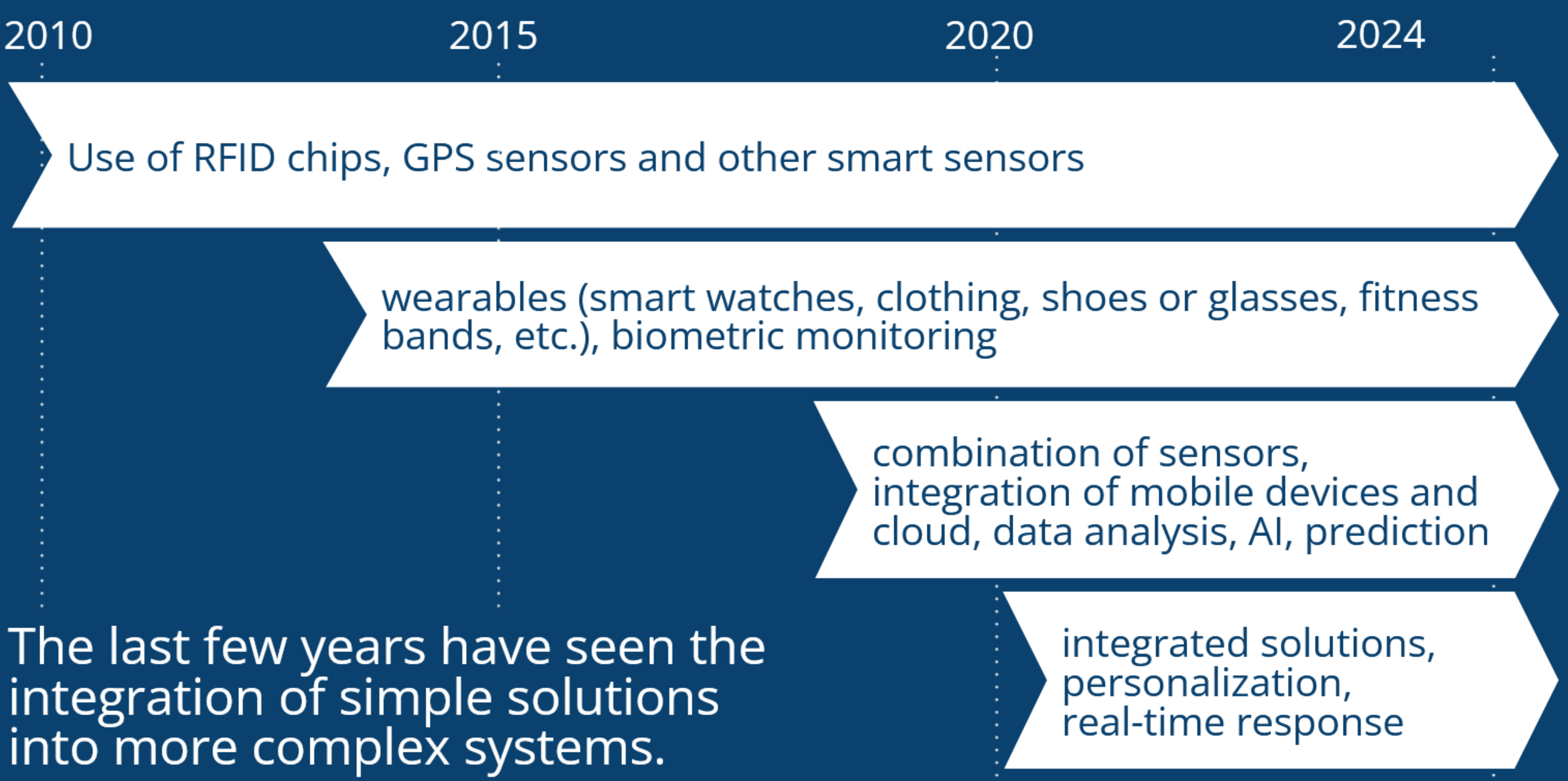
CHIPS IN SPORTS

REVIEW OF SCIENTIFIC PAPERS AND PATENTS

TC Spotlight
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Trends in the use of chips in sports over the last 15 years:



What chips are used in sports?

RFID (Radio Frequency Identification)

time tracking, pass registration, 3D monitoring of the movement of athletes or the ball (puck)

NFC (Near-Field Communication)

fan engagement, contactless payments, contactless data transfer

GPS (Global Positioning System)

monitoring of athlete or ball position, navigation, speed, distance, altitude (limited to outdoor sports), synchronization of timing devices in different locations

specialized sensors (accelerometers, gyroscopes, magnetometers, thermometers, pressure gauges, hygrometers, etc.)

measurement of athlete movement data, measurement of health indicators such as heart rate, blood oxygenation, temperature; measurement of pressure and impact in sports equipment and protective gear, potentially used to determine wear rates and risk of injury

microprocessors (single-chip microcomputers)

processing sensor data, controlling actuators in sports equipment, providing communication between different components; running advanced evaluation algorithms to analyze performance, predict injuries or run simulations; used in wearables or various smart sports equipment; providing power optimization to extend battery life

BLE (Bluetooth Low Energy)

Bidirectional and energy-efficient data transfer between sports equipment, wearables and mobile devices; connects smart sports devices to mobile phones, tablets, computers and the cloud for data analysis and visualization, control and interaction

memory chips (e.g. flash memory, SRAM)

storage and retention of sensor and analysis data (e.g. athlete profiles); firmware and software storage to ensure device operation and algorithm execution

LED devices

providing visual feedback to athletes, illuminating elements or directional signs on sports equipment, interactive displays in stadiums

other technologies

Ion-Selective Electrodes (ISE) real-time sweat analysis for monitoring physiological parameters of athletes
FPGA (Field-Programmable Gate Array) devices for high-speed motion analysis algorithms, image recognition and video processing in various sports disciplines
piezoelectric sensors measuring pressure on equipment or devices; generation of small amounts of electrical energy by mechanical stress to power sensors or chips with very low power consumption
Hall effect sensors detecting the presence or distance of a magnet, detecting rope skips or tracking the movement of a ball or puck; tracking the movement or angle of components of sports equipment
IMU (Inertial Measurement Unit) detailed tracking of athlete motion and posture by combining a gyroscope and accelerometer for competition and rehabilitation; real-time calculation of jump height
UWB (Ultra-Wideband) precision indoor positioning

What sports are the chips used in?

In many sports disciplines, chips are used in **training** (data collection, game or race simulation).

Across sports disciplines, they are often used for physiological monitoring of athletes, injury prevention and other data analysis of sports performance and exercise execution, or for sports fan engagement and sports event management.

Examples of specialized applications in sports disciplines:

running (including marathon, triathlon, etc.) time and position measurement of athletes, starting blocks with pressure sensors

football player movement monitoring, game data analysis for strategy and game scenario development, ball monitoring, trajectory and impact force analysis

tennis chips in rackets for analysis of playing technique, monitoring systems for data analysis of the game, equipment for stroke training support

golf swing and shot analysis, ball tracking, data analysis and feedback systems

basketball monitoring to record baskets made, equipment for interactive shooting and ball handling training

American football player motion monitoring, game data analysis for strategy and game scenario development, ball monitoring, trajectory and impact force analysis, collision prediction, player proximity sensors

volleyball movement monitoring, ball-to-net sensors

climbing heart rate sensor

billiards automatic ball feeding

rugby player motion monitoring and analysis

aerobic motion monitoring and analysis for performance evaluation, personalized training plans

martial arts image analysis for movement assessment and quality of moves

swimming timing, swimmer safety monitoring, smart swimming goggles for real-time data display

hockey game analysis, player and puck motion monitoring, puck speed and impact force, interactive training devices

curling sensors for pressure, throw frequency and temperature in the broom

cycling monitoring of position, rider performance, navigation, smart helmets for collision impact measurement and communication for rider safety

sailing sensors for boat speed, sail angle and wind pressure

table tennis impact sensors in the table and net, monitoring of ball trajectory and player movement, interactive training devices

badminton ball trajectory and impact monitoring, racket sensors to measure swing speed and assess stroke technique

kendo sensors in the pads measuring the force of the strokes to improve technique and prevent injuries

Data sources:

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