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# Motion sensing comes to mobile phones

The technology made popular by Nintendo's Wii game controller is adding new utility--and excitement--to the cell phone. Photos: Motion-sensing phones



Marguerite Reardon  June 11, 2007 6:02 a.m. PT



**The same technology used in Nintendo's popular Wii video game console that lets you bowl strikes and hit tennis volleys like you're Venus Williams is also making its way into mobile handsets.**

Responding to a flick of the wrist or sweep of the arm, tiny sensors called accelerometers, which measure linear acceleration in the [Wiimote](#) game controller, translate motion into action on the screen. When the technology is added to a cell phone, the handset's utility changes in several intriguing ways. It can, for example, function as a motion-sensing mouse that lets you browse the mobile Internet by tilting the device left, right, up or down. It even can allow you to monitor a fitness workout by measuring the number of steps you take, your speed and the calories burned.

Experts say this is just the beginning. As accelerometers advanced from one-axis to two-axis to three-axis measurement capabilities, their accuracy has improved dramatically. And some companies, such as the 3-year-old start-up Invensense, are taking the technology a step further by combining three-axis accelerometers with gyroscopes, which measure rotation speed, to create even-more accurate sensors that could be used to improve photo stabilization and [location and navigation services](#).

Analog Devices, one of the largest manufacturers of accelerometers, has already supplied more than 300 million of the devices to consumer electronics makers over the past decade, but Christophe Lemaire, the company's marketing manager, said the market is set to explode as more of these components make their way into cell phones.

"My sense is we are on the edge of seeing an explosion of more and

(microelectromechanical) accelerometers," he said. "We are already working with all the tier one phone manufacturers as well with other third-party application developers to fuel this explosion."

Accelerometers--especially those based on MEM systems, which combine electrical and mechanical components--have been used for years in airbag deployment in automobiles. For those applications the accelerometers are used to detect the rapid negative acceleration of the vehicle to determine when a collision has occurred and its severity.

But in the last few years the technology has also been incorporated into personal electronic devices, such as mobile phones, digital cameras, media players and handheld gaming devices. Several handset manufacturers including, Nokia, Samsung Electronics, LG Electronics, and even newcomer Apple have used accelerometer technology to provide some kind of motion-sensing capability in a handful of handset models.

#### **Not in the U.S.--yet**

Most of these phones have been available only in South Korea or Japan, where cutting-edge cell phone features typically originate. In the U.S., Apple's iPhone will be one of the first phones to use accelerometer technology.

The iPhone, set to debut in June on AT&T's wireless network, detects when the device is rotated, so it can tell whether to display what's on the screen in portrait (vertical) or landscape (horizontal) format. That allows the user to determine which format is best for viewing whatever is on the screen, be it a Web page, video or photo. The phone also can detect when it's being lifted to the ear, and responds by immediately turning off the display light to save power and preventing changes to the display image due to inadvertent contact with the touch-sensitive screen. The system restores screen power when the iPhone is moved away from the ear.

Lemaire said applications such as the ones employed by the iPhone are likely to become popular. He predicts handset makers will include accelerometers to detect if a phone is resting facedown, so that it can turn off the ringer or power down the display to conserve battery power. Accelerometers also could be used to shut off power on phones that have been left idle.

Those are a few basic applications for accelerometers. They can also be used to help people operate their phones without using a keypad. The Samsung SCH-S310, introduced in Asia in 2005, uses a three-axis accelerometer that allows a user to dial the phone by "writing" numbers in the air.

The Sharp V603SH, sold by Vodafone in Japan since 2005, also uses three-axis accelerometers to allow users to scroll through menus by moving the handset up, down, left or right. Users can also use the motion-sensing technology to turn their phone into a controller for

mobile games, including one that allows users to swing the handset like a golf club and hit golf balls on a virtual driving range.

While many of the cool new applications can be done using three-axis accelerometers, experts agree that combining that technology on a single chip with a gyroscope, which can be used to measure rotational speed, could provide even finer sensory control.

#### **An opening for gyroscopes?**

Gyroscopes are important for providing stabilization, said Steve Nasiri, CEO of Invensense. Like accelerometers, gyroscopes have been used for years in the automotive industry, where they are used to help stabilize cars so they don't roll over. Gyroscopes are also used in devices that require accurate balance sensing, such as the Segway.

Invensense is already supplying digital-camera companies with its tiny, MEM-based gyroscopes to help stabilize cameras and improve picture quality, especially on higher-megapixel cameras. This application alone could provide a huge opportunity to companies like Invensense, which is trying to combine gyroscopes with accelerometers.

"The mobile handset market is the ultimate market to be in," Nasiri said. "With 700 million camera phones sold each year and over 50 percent of them with 3 megapixels or more, there is a real need for this technology."

In addition to image stabilization, gyroscopes used in combination with three-axis accelerometers could also help deliver more-accurate location and navigational services. Today, GPS receivers use internal compasses to help get a fix on which direction the phone is pointing. So if you are using a navigation service to get directions to the closest Starbucks, the phone will know if you are facing north, south, east or west. But the compasses work better when the devices are held perfectly horizontal--a position that can be difficult to maintain. A combination accelerometer and gyroscope could help stabilize the device to get a better read.

While Lemaire of Analog Devices agrees that integrating gyroscopes into a chipset that also has an accelerometer could improve accuracy, he also said that much of the improved functionality can be achieved with three-axis accelerometers alone, especially since gyroscopes are expensive, consume a lot of power and add bulkiness to devices.

"Gyroscopes provide greater range of motion, that's true," he said. "But the jury is still out on whether you can make a suitable gyroscope/accelerometer chip. Handset makers are looking for cheaper, lower-power and smaller components. That is their priority rather than adding more functionality, especially when it only adds marginal value."

But Invensense says it is developing a combined three-axis accelerometer and gyroscope that will meet price, power consumption and size constraints appropriate for mobile devices. Commercial products are at least a year away, but the company is already talking to

announced Qualcomm had taken a strategic investment in the company for an undisclosed amount, lending more credibility to the firm's strategy.

Whether handset makers use three-axis accelerometer chips only or a combination chip that has both an accelerometer and gyroscope, experts agree that the best way to ensure the technology is adopted and the market takes off is to enable applications that help mobile operators generate revenue.

"I don't think that handset makers will integrate a \$2 sensor simply to allow people to scroll through screens better," said Marlene Bourne, president and principal analyst for Bourne Research. "But using it to improve picture quality, so that I actually want to send pictures I've taken on my phone to friends and family, which generates traffic on a carrier's network, might be worth it."



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