Industry's first flexible IoT-supporting beacon that needs no battery replacement

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Figure 1: How the power-control operation works

Fujitsu Laboratories announced the development of a thin, light-weight beacon, weighing 3 grams with a thickness of 2.5 millimeters, that does not require battery replacement or other maintenance and is flexible enough for installation on round objects, corners, and curves. Previously, beacons that did not require battery replacement needed power-supply components, such as power-management ICs and secondary batteries, as control circuits to ensure adequate power on activation. These components, which are relatively thick and occupy a large area, make the beacons themselves rigid and large, limiting locations to which they can be attached.

Fujitsu has developed power-control technology that temporarily deactivates the power monitor, which makes it possible to activate the beacon with the power from a solar cell. The need for conventional power-supply components is thus obviated, enabling beacons made of

slimmer and smaller components to be operated. By mounting these components on thin, elastic silicone sheets, the beacon is thin and flexible, which allows it to conform to the shape of the object to which it is attached.

Thin and flexible beacons using this technology enable greater freedom when attaching them to items, such as to the space between fluorescent bulbs in a ceiling, or to the surface of an LED light. Moreover, because the beacons can be installed without the need for battery replacements, there is a drastic reduction in the time and effort needed for installation and operation, enabling beacons to be used in such applications as guiding people indoors or underground, and real-time device management.

Background

There is growing interest in low-power beacons that use the Bluetooth Low Energy communications standard as a technology supporting Internet-of-Things (IoT) systems, which connect a wide variety of different devices and sensors in networks. Compact beacons, often running on coin-cell batteries, can easily communicate with smartphones so they are starting to be installed in underground areas or indoors for field trials of IoT systems, which obtain location information on people and things. To expand the use of beacons, it is important that they do not require battery replacement to be labor saving, for them to be slim and compact so as not to be unsightly, and that they are able to take different shapes so that they can be installed anywhere. Therefore, there is a need for beacons that are safe, in terms of not breaking even if they fall, that are compact, thin, and flexible enough to conform to a variety of shapes, and that do not need battery replacements.

Technological Issues

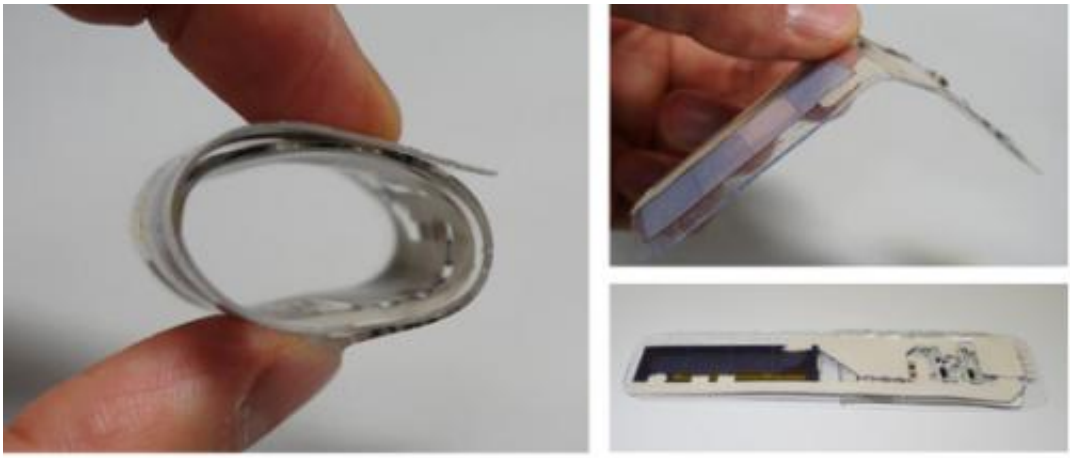

Figure 2: The newly developed thin beacon, which needs no battery replacement

Wireless-communications modules typically consume a relatively high amount of power in the time between powering on and activating communications. When using solar cells with low power-generation capacity, energy is stored temporarily in a storage element. For this reason, the modules have needed power-control systems that monitor whether enough power has been stored for activation, and, when a sufficient amount has been accumulated, use the energy to transition to communications mode. Achieving this has typically required the use of a power-management IC equipped with power-monitoring circuitry, and relatively large storage elements such as a secondary battery. The large amount of power needed for the power monitor's transition has also depended on the storage-element's capacity. Because the thickness and dimensions of components such as the power-management IC and the secondary battery determine the overall size of beacons, the shape was difficult to change.

About the Technology

Fujitsu has developed power-control technology that handles power monitoring while using little power, obviating the need for power-management ICs, secondary batteries, and other energy-storage elements. When used for a beacon, this technology allows for power control using an assembly of compact, slim components. When mounted on thin elastic sheets along with a solar cell, this results in beacons that do not need battery replacements, and that remain thin and flexible, allowing them to be bent during installation.

This power-control technology, which handles power monitoring while using little power itself, has the following features. Wireless-communications modules require a relatively great deal of power right before they begin communicating. Fujitsu has developed a power-control technology that temporarily deactivates the power monitor after it recognizes that the required amount of energy has been accumulated (Figure 1). Because this reduces the power consumed for the power-monitoring transition just before starting communications, it becomes possible to supply the power needed to activate the wireless-communications module using a small storage element connected to a solar cell.

This storage element is only one-ninth the size of those used with previous technologies, and secondary batteries or other relatively large storage elements are unnecessary (Figure 1b). Reducing the power consumed just before starting communications also has the effect of reducing voltage fluctuations when power is being used, obviating the need for a power-management IC.

A switch or other compact components can be used to temporarily deactivate the power monitor just before starting communications, and because power-management ICs, secondary batteries, and other bulky energy-storage elements can be eliminated, components require roughly one-sixth the space of previous technologies. Moreover, because there

are so few parts, they can be mounted on a thin sheet along with a thin film solar cell, resulting in a package that remains thin and flexible.

Results

Mounting this power-control technology to a thin, elastic silicone substrate developed by Fujitsu Advanced Technologies Limited for application to beacons results in a package that is a mere 2.5 millimeters thick and weighs only 3 grams (Figure 2). This sheet tolerates both bending and stretching, so it can be wrapped around corners and can even be equipped to devices to be attached to clothing or to objects to be worn on the wrist.

By using beacons developed with this technology, it is no longer necessary to replace batteries every six months to one year when linking the beacon to smartphones or tablets in order to detect the location of people indoors or underground, or to manage in real time the location of devices. Also, because these beacons are slim and flexible, they can be installed in places that would have previously been problematic , such as in the space between fluorescent bulbs in a ceiling, or on the surface of bulbs.

Fujitsu is currently conducting field testing to establish the beacon's reliability and continuous operation, and is aiming for practical implementation in fiscal 2016. The technology has the potential to expand opportunities for using the IoT to connect information about people and objects.

Provided by Fujitsu

supporting-beacon-battery.html