COMMUNICATION SYSTEM INCORPORATED IN AN INGESTIBLE PRODUCT

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] This application is a continuation-in-part application of U.S. Application No. 13/180,507 filed July 11, 2011 and entitled "Communication System Incorporated in an Ingestible Product," published on January 5, 2012 as U.S. Publication No. 2012/0004527A1, which application is a continuation of U.S. Publication PCT/US20100081894A1 filed on Sept 21, 2009 (U.S. Patent Application No. 12/564,017, now US Patent 7,978,064) and entitled "Communication System with Partial Power Source", which is a continuation-in-part application of U.S. Patent Application No. 11/912,475 filed June 23, 2008, published on November 20, 2008 as U.S. Publication No. 2008/0284599A1: which application is a 371 application of PCT Application Serial No. PCT/US06/16370 filed April 28, 2006, published on January 17, 2008 as WO2006/116718A3; which application pursuant to 35 U.S.C. § 119 (e), claims priority to the filing dates of: United States Provisional Patent Application Serial No. 60/676,145 filed April 28, 2005; United States Provisional Patent Application Serial No. 60/694,078 filed June 24, 2005; United States Provisional Patent Application Serial No. 60/713,680 filed September 1, 2005 and United States Provisional Patent Application Serial No. 60/790,335 filed April 7, 2006; the disclosures of which are herein incorporated by reference.

[002] This application is related to the following US Applications filed on July 11, 2011, the disclosures of which are incorporate herein by reference: US Application Serial No. 13/180,516, filed July 11, 2011 and entitled COMMUNICATION SYSTEM WITH REMOTE ACTIVATION, published on January 12, 2012 as U.S. Publication No. 2012/0007734A1; US Application Serial No. 13/180,525 filed on July 11, 2011 and entitled COMMUNICATION SYSTEM WITH ENHANCED PARTIAL POWER AND METHOD OF MANUFACTURING SAME, published on May 10, 2012 as U.S. Publication No. US2012/0116188A1; US Application Serial No. 13/180,498, filed July 11, 2011 and entitled COMMUNICATION SYSTEM

WITH MULTIPLE TYPES OF POWER, published on January 5, 2012 as U.S. Publication No. 2012/0004520A1; US Application Serial No. US Application Serial No. 13/180,538, filed July 11, 2011 and entitled COMMUNICATION SYSTEM USING POLYPHARMACY CO-PACKAGED MEDICATION DOSING UNIT, published on February 2, 2012 as U.S. Publication No. 2012/0024889A1; US Application

Serial No. 13/180,539, filed July 11, 2011 and entitled COMMUNICATION SYSTEM USING AN IMPLANTABLE DEVICE, published on January 5, 2012 as U.S. Publication No. 2012/0004527A1.

FIELD

[003] The present invention is related to communication systems for detection of an event. More specifically, the present disclosure includes a system that includes a device for association with ingestible ingredients or products.

INTRODUCTION

[004] Ingestible devices that include electronic circuitry have been proposed for use in a variety of different medical applications, including both diagnostic and therapeutic applications. These devices typically require an internal power supply for operation. Examples of such ingestible devices are ingestible electronic capsules which collect data as they pass through the body, and transmit the data to an external receiver system. An example of this type of electronic capsule is an in-vivo video camera. The swallowable capsule includes a camera system and an optical system for imaging an area of interest onto the camera system. The transmitter transmits the video output of the camera system and the reception system receives the transmitted video output. Other examples include an ingestible imaging device, which has an internal and self-contained power source, which obtains images from within body lumens or cavities. The electronic circuit components of the device are enclosed by an inert indigestible housing (e.g. glass housing) that passes through the body internally. Other examples include an ingestible data recorder capsule medical device. The electronic circuits of the disclosed device (e.g. sensor, recorder, battery etc.) are housed in a capsule made of inert materials.

[005] In other examples, fragile radio frequency identification (RFID) tags are used in drug ingestion monitoring applications. In order for the RFID tags to be operational, each requires an internal power supply. The RFID tags are antenna structures that are configured to transmit a radio-frequency signal through the body.

[006] The problem these existing devices pose is that the power source is internal to device and such power sources are costly to produce and potentially harmful to

and the support of the ingestible circuitry are ingestible, and in certain instances digestible or partially digestible.

[008a] According to an aspect of the invention, a signal producing food product comprising: a digestible material; a plurality of communication devices associated with the digestible material, wherein each communication device comprises: a first material physically associated with a support structure; and a second material physically associated with the support structure at a location different from the first material, wherein the first material and the second material are electrically isolated from each other and are selected such that they form a voltage potential difference when in contact with a conductive fluid to provide power to activate the communication device, wherein the support structure includes a control module electrically coupled to the first material and the second material and configured to control conductance between the first material and the second material to modulate a current flow extending through the conductive fluid between the first material and the second material and thereby generate a detectable encoded current signature; wherein at least one first communication device of the plurality of communication devices is located within a first coating wherein the first coating is configured to dissolve in a user's stomach to thereby activate the at least one first communication device in the user's stomach and withstand mastication pressure to prevent the activation of the at least one first communication device as the user chews the signal producing food product, and wherein at least one second communication device of the plurality of communication devices is coated with a second coating configured to break as the user chews the signal producing food product to thereby activate the at least one second communication device in the user's mouth.

BRIEF DESCRIPTION OF THE FIGURES

[009] Fig. 1 shows an event indicator system in communication with an implanted device in according to the teaching of the present invention.

[010] Fig. 2A shows the pharmaceutical product of Fig. 1 with the event indicator system on the exterior of the pharmaceutical product.

[011] Fig. 2B shows the pharmaceutical product of Fig. 1 with the event indicator system positioned inside the pharmaceutical product.

[012] Fig. 3 is a block diagram representation of one aspect of the event indicator system with dissimilar metals positioned on opposite ends.

[013] Fig. 4 is a block diagram representation of another aspect of the event indicator system with dissimilar metals positioned on the same end and separated by a non-conducting material.

[014] Fig. 5 shows ionic transfer or the current path through a conducting fluid when the event indicator system of Fig. 3 is in contact with conducting liquid and in an active state.

[015] Fig. 5A shows an exploded view of the surface of dissimilar materials of Fig. 5.

[016] Fig. 5B shows the event indicator system of Fig. 5 with a pH sensor unit.

[017] Fig. 6 is a block diagram illustration of one aspect of the control device used in the system of Figs. 3 and 4.

[018] FIG. 7 is a functional block diagram of a demodulation circuit that performs coherent demodulation that may be present in a receiver, according to one aspect.

[019] FIG. 8 illustrates a functional block diagram for a beacon module within a receiver, according to one aspect.

[020] FIG. 9 is a block diagram of the different functional modules that may be present in a receiver, according to one aspect.

[021] FIG. 10 is a block diagram of a receiver, according to one aspect.

[066] In accordance with the various aspects of the present invention, the system of the present invention can be inside specific food products (e.g. a granola bar), with one of the data encoded and communicated by the system being the caloric content of the food or other relevant dietary information, e.g. fiber sugar content, fat type and content etc. This may help people on a diet monitor their daily intakes, get incentives for staying on-diet, etc. Also, the system is co-ingested with food, using on-board sensing to measure food release into the stomach, e.g. fat content. Various aspects may include an instrumented cup that detects when the system of the present invention has been dropped into the cup and whether the user or person took a drink (similar, for example, to the inhaler product described in PCT Application Ser. No. PCT/US11/31986, filed April 11, 2011, and published on January 19, 2012 as WO2011/130183A3, the entire disclosure of which is incorporated herein by reference), and how much they drank. An advantage of this aspect of the present invention is that it may be useful for people who take regular supplements in the form of a powder or other, which is mixed with water before drinking.

[067] In accordance with other aspects of the present invention, chemical markers can incorporate certain marker species into the food (e.g. salt, iow-or-high pH, protein, and lipid). When ingested, a marker species is released into stomach environment. With the sensing capability, the system of the present invention can detect chemical-binding receptors on the surface or by coating on the system that reacts with a chemically-active coating (e.g. a coating such as a specific-ion-conducting glass membrane that allows only the desired marker species to penetrate), in various aspects, the ingestible device is co-ingested with the food, and may be used, among other things, to measure/detect the presence of the "marker species". The system that is ingestible and masticable can contain a detector capable of measuring endocanabinoids, as described for example, in the publication by DiPatrizio et al. entitled, "Endocannabinoid signal in the gut controls dietary fat intake", for example reference, the entire disclose of which is incorporated herein by reference). When the signal is detected - e,.g., a sign that high fat food intake has occurred - the user or patient is instructed via phone message or other communication to take a prescription (also RIS-enabled) to disrupt the endocannabinoid signal, thus reducing the craving for more high fat foods.