

System of RFID Devices Programmed with Data Embedded in Movie Images

Field of Invention

Work on RFID systems began in early 1970s. In 1972, Kriofsky and Kaplan filed a patent application (U.S. Patent no. 3859624, in 1975) for an “inductively coupled transmitter-responder arrangement”. This system used separate coils for receiving power and transmitting the return signal.

In 1979, Beigel filed a new patent application (U.S. Patent no. 4333072, in 1982) for an “identification device” that combined the two antennas; many consider his application to be the landmark RFID application because it emphasized the potentially small size of RFID devices.

In 2004, NFC Forum (www.nfc-forum.org) was formed by industry players to advance the use of Near Field Communication (NFC) technology by developing specifications, ensuring interoperability among devices and services, and educating the market about the NFC technology. NFC communication is enabled by bringing two NFC compatible devices within a few centimeters (proximity) of one another.

In the reader-mode NFC communication, NFC reader can read the RFID tag which carries static data content in it. RFID tag is usually placed underneath a static sign (e.g.: poster, advertisement) and is programmed with fixed data associated with the static sign's intended message. One of the most common types of content is the internet URL, which directs the user to a specific internet website.

By referring to the various documents, reports, and specifications of NFC Forum, up to the date of the writing of this document, there is no indication about any discussion or effort to program the RFID tag dynamically using embedded data in a movie (motion picture).

Summary

Radio Frequency Identification (RFID) system typically includes RFID tag and RFID reader (the former is also known as label or inlay, and the latter is also known as RFID reader/writer or RFID interrogator). RFID system can be used in many ways for locating and identifying objects to which the tags are attached.

An RFID tag typically includes an antenna system, a power management section, a radio section, and frequently a logical section, a memory, or both. If power management section includes a power storage device, the RFID tag is known as active tag. If the RFID tag is powered solely by the RF signal it receives, it is called passive tag.

The RFID tag containing the information associated with an object is normally placed beneath or onto the object itself. When RFID tag is stationary, the technical challenge appears when the object is not physical or is transient, or changing over time. One particular situation is, when the object is in the form of digital image displayed on an electronic display, such as on computer display, television screen, and advertisement electronic display. The transient object appears only at certain point of time and at certain position on the electronic screen. Also, different transient objects displayed at different positions and different points of time may be associated with different messages for the human viewer.

This document presents the solution where the information for the RFID tag is encoded into the digital image. There are various well known ways for embedding and retrieving such information from the digital image. While technically any particular methods can be used, the preference should fall to the method which allows faster image pattern detection and faster information retrieval to allow processing in real-time. In the implementation, a dedicated device can be used to detect the encoded information in the digital image frame by frame, then to retrieve the embedded information and use the information to program the associated RFID tag.

This Summary is provided to introduce a selection of simplified concepts further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

Description of the Drawings

FIGURE 1: RFID Tag. The typical RFID tag consists of an antenna and an integrated circuit (IC).

FIGURE 2: System utilization. This shows the use case of this invention. When the viewer sees the visual sign, the viewer uses RFID reader device to capture the information from the RFID tag in the same position as the visual sign.

FIGURE 3: System design. This figure shows the implementation of the three functional components in the electronic circuit: information detector, data extractor, and RFID device programmer.

FIGURE 4: Sequence of image frames in a movie.

FIGURE 5: The visual sign is surrounded by more than one RFID devices.

FIGURE 6: Physical arrangement of RFID device panel, which can be planar or curvature.

Detail Description

Various embodiments of the present invention will be described in detail with reference to the drawings, where some numerical references represent parts and assemblies throughout the several views. Reference to various embodiments does not limit the scope of the invention, which is limited only by the scope of the claims attached hereto. Additionally, any examples set forth in this specification are not intended to be limiting and merely set forth some of the many possible embodiments for the claimed invention.

Throughout the specification and claims, the following terms take at least the meanings explicitly associated herein, unless the context clearly dictates otherwise. The meanings identified below are not intended to limit the terms, but merely provide illustrative examples for the terms.

- The meaning of "a," "an," and "the" includes plural reference.
- The meaning of "in" includes "in" and "on."
- The term "connected" means a direct electrical connection between the items connected, without any intermediate devices.
- The term "movie" or "video" means a sequence of images displayed consecutively in a series of time duration.
- The term "coupled" means either a direct electrical connection between the items connected or an indirect connection through one or more passive or active intermediary devices.
- The term "circuit" means either a single component or a multiplicity of components, either active and/or passive, that are coupled together to provide a desired function.
- The term "signal" means at least one current, voltage, charge, temperature, data, or other measurable quantity.
- The term "RFID reader" refers to any device which is capable of reading the information from RFID tag.
- The term "RFID device" refers to both RFID tag and RFID reader.

FIG. 1 is a diagram of RFID tag 110, which can be implemented as an active or a passive tag. When implemented as an active tag, tag 110 receives power via VCC and GND lines. Tag 110 is programmed by the RFID tag programmer via DATA line.

Tag 110 is formed on a substantially planar inlay 120, which can be made in many ways known in the art. Tag 110 includes antenna segment 122 which is attached on inlay 120, and is shown here forming a rectangular coil, but many other embodiments using any number of antenna segments is possible. Tag 110 also includes integrated circuit 121 which is connected with antenna segment 122 and is attached on inlay 120.

FIG.2 describes system utilization, where one or more individual RFID tags 220 are arranged on a panel 221. Panel 221 is placed behind the electronic display 210, which can be used as a display for the visual sign 211. Visual sign 211 informs the user to place the RFID reader 230 within proximity distance (approximately 0-10 cm) from the visual sign 211. RFID reader 230 captures the information from one or more individual RFID tag 220 which position is close to the visual sign 211 being approached by the RFID reader 230.

FIG 3 describes system design. One or more individual RFID tag 321 is arranged on a panel 320, which is placed behind the electronic display 310. Each RFID tag is connected with RFID device programmer 303.

Information detector 301 scans every single frame of all images displayed on electronic display 310 to look for the embedded information. When the block of embedded information is found, information detector 301 passes the block of information to data extractor 302 which retrieves the information such as screen coordinate (X,Y), data to be programmed to the associated RFID tag, and time duration t. Data extractor 302 shall validate the retrieved information, and then pass the validated information to RFID device programmer 303. Upon receiving the validated information, the RFID device programmer 303 shall program the RFID tag 321 which position is close to the coordinate (X,Y). RFID tag programmer 303 will then reset RFID tag 321 after time duration t has elapsed.

FIG 4 describes the implementation in the movie. A set of data consists of coordinate (X,Y), data to be programmed to RFID tag, and time duration t, are encoded into frame N of a movie. This set of information is called embedded information 401. The method used to encode the embedded data into the image can be any method known in prior art, as long as the resulted image pattern can be detected and captured by information detector 301 in an efficient way.

The frames which come after embedded information 401 frame are the frames which make up the visual sign 402. Visual sign 402 is a series of images which is design to suggest user to place RFID reader close to it. FIG 4 shows one possible arrangement in which the visual sign shows an animated circle which changes its shape from small to large, then large to small, repetitively until time duration t has elapsed. However, other type of animation is possible as long as the animation can serve its purpose, i.e.: as long as it is effective to suggest users to place their RFID reader close to it.

FIG 5 shows the situation where there are more than one RFID tags 503 which are surrounding the visual sign. One possible implementation is to program only one RFID tag which is closest to the visual sign. The distance is measured from the central point of RFID tag 501 to the central point of the visual sign 502. Other possible implementation is to program 2 to all surrounding RFID tags with the same information related with the visual sign.

FIG 6 shows that the physical shape of RFID tag panel shall follow the physical shape of the electronic display, whether it is planar or non-planar.

In this description, numerous details have been set forth in order to provide a thorough understanding of the system. In other instances, well-known features have not been described in detail so as not to obscure the description of the system unnecessarily. A person skilled in the art will be able to practice the present invention in view of this description, which is to be taken as a whole. The specific embodiments as disclosed and illustrated herein are not to be considered in a limiting sense. Indeed, it should be readily apparent to those skilled in the art that what is described herein may be modified in numerous ways. Such ways can include equivalents to what is described herein.

The following claims define certain combinations and sub-combinations of elements, features, steps, and/or functions, which are regarded as novel and non-obvious. Additional claims for other combinations and sub-combinations may be presented in this or a related document.

Claims

1. A system where RFID device can be programmed dynamically with the information embedded in digital image. The system includes the following functions:
 - Information detector, which look for embedded data in information stream of images/video/movie. When the embedded data is detected, it will pass the embedded data to the data extractor.
 - Data extractor, which function is to extract specific information from the embedded data. It will pass the specific information to the RFID device programmer.
 - RFID device programmer, which programs the RFID device at specific position and specific time according to the specific information passed by the data extractor.
2. The information detector of the system described in point 1 check every image frame of a movie or non-movie information stream to find a specific symbol which identifies the embedded data. When such symbol is found, the associated information is retrieved and passed to the data extractor.
3. The movie scanned by the information detector described in point 1 displays visual sign during which the associated RFID device should be activated by the RFID device programmer. The visual sign is an animation or static symbol which is part of the movie. The visual sign informs viewer to hold viewer's RFID reader close to the visual sign, thus allowing viewer's RFID reader to read the information from the underlying RFID device.
4. The information retrieved by information detector as described in point 2 contains at least three information:
 - Data to be programmed to RFID device,
 - The position of the RFID device to be programmed, and
 - The active time/duration of the programmed RFID device.
5. The system indicated in point 1 includes one or more RFID devices mounted on a panel so as to cover a part or all areas of the screen which displays the movie. The mounted RFID devices are linked with RFID device programmer via cable or wireless.
6. The panel as described in point 6 can be placed in front or behind the screen. The shape of the panel follows the shape of the screen, which can be either flat or curvature.
7. The RFID device programmer described in point 1 contains a timer.
8. The RFID device programmer described in point 1 programs one or more RFID devices closest to the position indicated in the embedded data, as indicated in point 4. The RFID device can be in the form of RFID tag or RFID reader.
9. The RFID device programmer described in point 1 resets or clears the programmed data in the RFID device after active duration as specified in point 4 is elapsed.