

EMBEDDED DIGITAL ID SOLUTIONS FOR TRACKING AND MANAGING RECYCLING

FIELD

[0001] This description relates generally to automated recyclable waste management and, more particularly, to an embedded encoded instructional device which automatically assists a recyclable waste container to a recapitulation process wherein embedded encoded instructions reside on a digital medium storing instruction sets configured to determine the automated systematic directives of a recyclable waste container.

BACKGROUND

[0002] Recycling of recyclable waste is the process of collecting, sorting and processing recycled waste that would otherwise be thrown away as trash and turning the recycled waste into new products using the recycled raw materials. Recycling has many benefits to both the community and the environment. Conventional recycling offers isolated elements used in the recycling process to recycling participants used in a 3 cycle process. First, collecting and processing the recycled waste, then manufacturing with the processed recycled raw material created by the recycled waste and, finally, selling the newly manufactured consumer goods in an open market where the recycled products may be used again.

[0003] In order for a city to have an effective recycling system, adequate services (like separate bins and safe recycling centers) are needed. Some cities just do not have these resources or the government support to have adequate recycling services for willing user/participants. Recycling is playing a role in solving the toxic plastic waste issues that plague our waterways and oceans. Many challenges to recycling can be alleviated if user/participants buy more products that are made from recycled materials. Users need to educate themselves

on what goes into the recycling bin and work harder to make sure that recyclable materials do not end up in a landfill somewhere when they can be reused over and over again.

[0004] Recycling needs to be done efficiently and the current recycling systems being used today show some mixed results, especially as countries continue to export contaminated recyclables to countries that lack adequate infrastructure and proper recycling hardware to efficiently process recycling waste. Recycling raw materials produces its strongest benefits when it displaces the extraction of materials (like ore or oil) at the beginning of the production process. Right now, current augmentation of recycled raw material is used to supplement virgin resources rather than virgin resources being used to supplement recycled raw material. It would be advantageous to reverse this augmentation process such that the recycled raw materials are used more than the virgin resources.

[0005] Recycling is done poorly in different countries mostly because the average public is confused about what and how to recycle. One can look in most recycle bins and see there is other heterogeneous waste thrown in with the wrong genre of waste respective to the waste container. This places too much workload on the collectors who have to manually and painstakingly sort the heterogeneous mix of recyclable waste into a homogeneous recyclable waste for processing. This contamination of mixing recyclable waste leads to increased costs for the sorting and processing plants, the ones who pay for recycled consumer products, and any governments who collect recyclable waste. The user/participants who buy recycled consumer products and most governments are subsidizing both the companies that produce the materials and those that purchase them after recycling. This contributes to problems in the recycling industry.

[0006] Therefore there is a need for a better way to recycle recyclable waste using electronically enhanced hardware that instructs the recycled discarded waste control management hardware to systematically recapitulate said recyclable waste from a recycling

participant which has been discarded at a designated location comprising sufficient cooperative hardware which reads the embedded instructions to efficiently generate automated controls for automated separation of respective homogeneous waste genres.

SUMMARY

[0007] According to an aspect of one or more example embodiments, a container includes: a machine-readable optical label whose optically converted data corresponds to a plurality of flexible recyclable waste containers; and a radio frequency readable and writeable identification device including a memory.

[0008] According to another aspect of one or more example embodiments, a flexible recyclable waste container includes: an embedded read / write element including encoded information configured to guide the flexible recyclable waste container from a waste disposal portal to a controlled path utilizing electronic and mechanical hardware which alters and controls a travel course of the flexible recyclable waste container to respective locations that pertain to processing of homogeneous and heterogeneous waste.

[0009] According to another aspect of one or more example embodiments, a transparent recyclable waste container includes: a read write element; and a machine-readable optical label configured to allow visual external inspection of homogeneous or heterogeneous waste.

BRIEF DESCRIPTION OF DRAWINGS

[0010] The above and other aspects and features will be more apparent from the following description of one or more example embodiments taken in conjunction with the accompanying drawings, in which:

[0011] Figure 1 shows a clear see-through disposable recyclable waste container (22) and a multi-recyclable waste container enclosure (13) according to one or more example embodiments;

[0012] Figure 2 shows a recyclable waste container (22) and a mobile device (45) according to one or more example embodiments;

[0013] Figure 3 shows a mobile device (45), which may upload user information (42) to a network (43) for storage in a database (47), according to one or more example embodiments;

[0014] Figure 4 shows a hopper door assembly or waste portal (29) for discarding a homogeneous recyclable waste container (22), according to one or more example embodiments;

[0015] Figure 5 shows a flow diagram showing sorting of a recyclable waste container (22) according to one or more example embodiments;

[0016] Figure 6 shows a Master Control Panel (101) and a database (103) according to one or more example embodiments;

[0017] Figure 7 shows a mobile device (45) communicating with a wide area network (43), according to one or more example embodiments;

[0018] Figure 8 shows a map (104) corresponding to a database (103A) residing on a Master Control Panel (101) device, which uploads coordinate data position (103B), according to one or more example embodiments;

[0019] Figure 9 shows a plurality of homogeneous waste locations on a map (104), distance data (103C) and weight data (103D); according to one or more example embodiments; and

[0020] Figure 10 shows a flow diagram showing a path of the digitally embedded data homogeneous waste container from User Purchase to End of Cycle.

DETAILED DESCRIPTION

[0021] Hereinafter, one or more example embodiments will be described in detail with reference to the accompanying drawings. The same reference numerals are used for the same components in the drawings, and duplicate descriptions thereof are omitted.

[0022] Figure 1 shows one or more example embodiments comprising a clear see-through disposable recyclable waste container (22), which may be made of a rigid or flexible material. The recyclable waste container (22) may have an embedded readable/writeable digital media device (15), which has been encoded in the memory blocks with specific data pertaining to a Unique Identifier or UID (16). The UID (16) may comprise a Group Association Identifier or GAI, which may be relative to a visual pattern recognition element (11) and a respective waste genre Identifier. Also shown in Figure 1 is a multi-recyclable waste container enclosure (13) which may house a plurality of said recyclable waste containers (22). The multi-recyclable waste container enclosure (13) may contain a visual pattern recognition element (11) which may correspond to all of the plurality of recyclable waste containers (22) within said multi-recyclable waste container enclosure (13).

[0023] According to one or more example embodiments, a MFRC522 integrated reader/writer for contactless communication may be used along with various libraries to write to a digital media storage device which utilizes a modulation and demodulation scheme. The MFRC522 integrates various types of passive contactless communication modes and protocols at 13.56MHz following the ISO14443A standard. The internal transmitter section drives the reader antenna to communicate with the ISO14443A MIFARE digital storage medium. It does this by using a serial dump of the UID and a Proximity Integrated Circuit Card (PICC) type. For instance, according to one or more example embodiments:

```

Serial.print(F("UID:")); //Dump UID into serial
for (byte i = 0; i < mfrc522.uid.size; i++) {
Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? "0" : "");
Serial.print(mfrc522.uid.uidByte[i], HEX);

```

[0024] According to one or more example embodiments, the type of PICC may be checked, and the :: operator may be used to access a const/static member of class or namespace MFRC522. For instance, according to one or more example embodiments:

```

Serial.print(F(" PICC type: ")); // Dump PICC type into serial
MFRC522::PICC_Type piccType = mfrc522.PICC_GetType(mfrc522.uid.sak);
Serial.println(mfrc522.PICC_GetTypeName(piccType));

```

[0025] According to one or more example embodiments, BoxID and Machine-readable optical label are like elements.

[0026] An app interface may receive a request for input of a UID (16), such as a BoxID, whose alphanumeric characters are configured to generate a visual pattern recognition element (11), such as a machine-readable optical label. That is, according to one or more example embodiments, the machine-readable optical label and the BoxID data are one in the same alphanumeric value. Any input by the app interface may automatically write to the first Block of the MIFARE digital storage medium which may be embedded in the recyclable waste container (22). For instance, according to one or more example embodiments:

```

byte buffer[34];
byte block;

```

```

MFRC522::StatusCode status;

byte len;

Serial.setTimeout(60000L); // wait until 20 seconds for input from serial

// Ask for BoxID input

Serial.println(F("Type BOX ID, ending with new line char"));

len = Serial.readBytesUntil('\n', (char *) buffer, 30); // read BoxID from serial

for (byte i = len; i < 30; i++) buffer[i] = ' '; // pad with spaces

block = 1;

status = mfrc522.PCD_Authenticate(MFRC522::PICC_CMD_MF_AUTH_KEY_A,
block, &key, &(mfrc522.uid));

if (status != MFRC522::STATUS_OK) {

    Serial.print(F("PCD_Authenticate() failed: "));

    Serial.println(mfrc522.GetStatusCodeName(status));

    return; }

else Serial.println(F("PCD_Authenticate() success: ")); // Write block

status = mfrc522.MIFARE_Write(block, buffer, 16); if (status !=
MFRC522::STATUS_OK) {

    Serial.print(F("MIFARE_Write() failed: "));

    Serial.println(mfrc522.GetStatusCodeName(status));

    return;

}

else Serial.println(F("MIFARE_Write() success: "));

```

[0027] The app which writes the BoxID associated with a machine-readable optical label may utilize a QR Code class library which converts an alphanumeric code to a visual QR

code. According to one or more example embodiments, the alphanumeric code may begin with the characters “CHG” as a prefix followed by a randomly generated integer using “random” System.Class.Random. For instance, according to one or more example embodiments:

```
Random rnd = new Random();  
var randomnumber = rnd.Next();  
tbGenCode.Text = “CHG” + randomnumber.ToString();
```

[0028] The aforementioned may generate a random integer and set an alphanumeric code in the GenCode Textbox. The request from the MIFARE hardware may serially initialize the alphanumeric BoxID value and insert it into a serial output of the app to the MIFARE hardware to write to the digital media embedded in the recyclable waste container. For instance, according to one or more example embodiments:

```
if (serialPortDTU.IsOpen)  
{  
    serialPort1.WriteLine(“CHG32185984”); //CHG+Random Int  
}
```

[0029] One or more example embodiments may, use the QRCode Class to generate a respective corresponding machine-readable optical label image which may be saved as an Image file and in the database as a varChar(30). When the UID (16) is read, Radio Frequency Identification (RFID) information may be placed serially in a RFID Textbox which may also

be saved at the same time the BoxID is generated and saved. For instance, according to one or more example embodiments:

```

QRCode.QRCodeGenerator QG = new QRCode.QRCodeGenerator();

var          MyData          =          QG.CreateQrCode(tbGenCode.Text,
QRCode.QRCodeGenerator.ECCLLevel.H);

var code = new QRCode.QRCode(MyData);

pbQRCode.Image = code.GetGraphic(5);

The PictureBox (pbQRCode.Image) image may be generated by the QRCode Class
and saved to a remote network storage medium;

        saveFD.FileName = tbGenCode.Text;        saveFD.Filter = "JPEG|*.jpeg"; if
(saveFD.ShowDialog() != DialogResult.Cancel)        {
        string savePath = saveFD.FileName;

        Bitmap bmp = new Bitmap(pbMachine-readable optical label .Image);

        bmp.Save(savePath, ImageFormat.Jpeg);

    }

```

[0030] When the machine-readable optical label is created by the random alphanumeric generator, the alphanumeric data may be serially sent to the MIFARE device and the BoxID may be written to Block 1.

[0031] This write event may automatically generate a second serial request for a selectionID entry by the MIFARE hardware device/. For instance, according to one or more example embodiments:

```

Serial.println(F("Type Selection#, ending with new line char"));

```

```

        len = Serial.readBytesUntil('\n', (char *) buffer, 20); // read waste selection genre from
serial
        for (byte i = len; i < 20; i++) buffer[i] = ' '; // pad with spaces
        block = 5;
        status = mfrc522.PCD_Authenticate(MFRC522::PICC_CMD_MF_AUTH_KEY_A,
block, &key, &(mfrc522.uid));
        if (status != MFRC522::STATUS_OK)
        {

                Serial.print(F("PCD_Authenticate() failed: "));
                Serial.println(mfrc522.GetStatusCodeName(status));
                return;
        }

```

[0032] According to one or more example embodiments, the incoming data may be written from the output of the app interface of the selectionID to the MIFARE hardware which may write the data to the embedded read writeable storage device In or on the recyclable waste container. For instance, according to one or more example embodiments:

```

status = mfrc522.MIFARE_Write(block, buffer, 16);
        if (status != MFRC522::STATUS_OK) {
                Serial.print(F("MIFARE_Write() failed: "));
                Serial.println(mfrc522.GetStatusCodeName(status));
                return
        }

        else Serial.println(F("MIFARE_Write() success: "));

```

[0033] According to one or more example embodiments, the App may respond by sending any of a plurality of selectionID genres which may be stored into the subsequent available block in the storage medium. An example list of possible selectionID genre below:

1. Paper
2. Plastic
3. Metal
4. Glass
5. Organic
6. Electronics
7. General Waste

[0034] Once the BoxID and the SelectionID accompany the RFID, other variant information may be written into other writeable blocks in the embedded storage medium residing on or in the recyclable waste container.

[0035] It is important to note that the visual pattern recognition element (11) may identify the origin of the UID (16). So one visual pattern recognition element (11) can have many UID(s) (16) of various genres (Selection#(16)). For instance, one box with a unique visual pattern recognition element (11) (machine-readable optical label) may contain a plurality of recyclable waste containers each one with a unique RFID. Furthermore, the same BoxID may contain a plurality of different genres, each comprising a unique RFID. For instance, according to one or more example embodiments:

Box with affixed BoxID01 optical tag comprises:

RFIDxxx1, BoxID 01, Paper

RFIDxxx2, BoxID 01, Paper

RFIDxxx3, BoxID01, Paper

- RFIDxxx4, BoxID 01, Paper
- RFIDxxx5, BoxID 01, Paper
- RFIDxxx6, BoxID 01, Plastic
- RFIDxxx7, BoxID 01, Plastic
- RFIDxxx8, BoxID 01, Plastic
- RFIDxxx9, BoxID 01, Plastic
- RFIDxx10, BoxID 01, Plastic
- RFIDxx11, BoxID 01, General Waste
- RFIDxx12, BoxID 01, General Waste
- RFIDxx13, BoxID 01, General Waste
- RFIDxx14, BoxID 01, General Waste
- RFIDxx15, BoxID 01, General Waste

[0036] Where the box has an affixed Optical Tag representing the BoxID01 where the digital storage medium comprises a block of a first RFID, a second BoxID and a third SelectionID. A box may also have only one BoxID and one SelectionID with a plurality of the same genre of recyclable waste containers.

For instance, according to one or more example embodiments, a Box with affixed BoxID02 visual pattern recognition element (11) comprises:

RFIDxxx1	BoxID 02	Paper
RFIDxxx2	BoxID 02	Paper
RFIDxxx3	BoxID02	Paper
RFIDxxx4	BoxID 02 Paper	
RFIDxxx5	BoxID 02. Paper	

RFIDxxx6	BoxID 01	Paper
RFIDxxx7	BoxID 01	Paper
RFIDxxx8	BoxID01	Paper
RFIDxxx9	BoxID 01	Paper
RFIDxxx10	BoxID 01	Paper

[0037] According to the above-described one or more example embodiments, BoxID01 may refer to a multi-recyclable waste enclosure (13) comprising 3 separate genres (selectionID(16)) Paper, Plastic and General Waste, respectively. Each recyclable waste container (22) has a unique UID (16) which represents said recyclable waste container yet the plurality of each individual recyclable waste containers has an embedded BoxID which corresponds to the machine-readable optical label (11) on the multi-recyclable waste enclosure (13).

[0038] Furthermore BoxID02 may refer to a multi-recyclable waste enclosure (13) comprises a single genre of Paper (selectionID(16)) of a plurality of recyclable waste containers (22).

[0039] Figure 2 shows one or more example embodiments comprising a recyclable waste container (22) which has an embedded readable/writeable digital media device (15) and a visual pattern recognition element (11), such as an optical machine-readable optical label, as described with reference to one or more example embodiments shown in Figure 1. The embedded readable/writeable digital media device (15) comprises a Unique Identifier or UID (16) and a Group Association Identifier or GAI, which corresponds to the visual pattern recognition element (11). The visual pattern recognition element (11) may be configured to be optically scanned by a mobile device (45), which may be configured to recognize said visual pattern recognition element (11) and to associate it with a mobile app user information (49).

[0040] The optically recognized machine-readable optical label comprising account information (41) on the Mobile device may correspond to the same visual pattern recognition element (11) which resides on the multi-recyclable waste container enclosure (13). Once said visual pattern recognition element (11) is optically scanned into a user inventory of user information (49), the BoxID and contents of a plurality of recyclable waste containers (22) may be transferred to the user information (49) from the mobile device (45).

[0041] Figure 3 shows one or more example embodiments comprising a mobile device (45) with a machine-readable optical label reader which optically scans a recorded pattern recognition element comprising account information (41) and associates it with mobile app user information (49). The mobile device (45) may upload the user information (42) to a network (43) and the user information (42) may be stored in a database (47).

[0042] For instance, according to one or more example embodiments, this information would appear in a dataset respectively:

ID	User	BoxID	UID	Selection	DateTime	History
01	Joe	CHG1234567	AY3155	Paper	03211923:1403	
			1			
02	Joe	CHG1234567	GY3125	Paper	03211923:1403	
			1			
03	Joe	CHG1234567	7Y3354	Paper	03211923:1403	
			1			
04	Joe	CHG1234567	AFF154	Paper	03211923:1403	
			1			
05	Joe	CHG1234567	AY985F	Paper	03211923:1403	
			1			
06	Joe	CHG1234567	A7L9P7	Plastic	03211923:1403	
			1			
07	Joe	CHG1234567	BV23PP	Plastic	03211923:1403	
			1			
08	Joe	CHG1234567	AY3155	Plastic	03211923:1403	
			1			
09	Joe	CHG1234567	GY3125	Plastic	03211923:1403	
			1			
10	Joe	CHG1234567	7Y3354	Plastic	03211923:1403	
			1			
11	Joe	CHG1234567	AFF154	General	03211923:1403	
			1			
12	Joe	CHG1234567	AY985F	General		
		03211923:1403	1			
13	Joe	CHG1234567	A7L9P7	General		
		03211923:1403	1			
14	Joe	CHG1234567	BV23PP	General		
		03211923:1403	1			
15	Joe	CHG1234567	H9YC87	General		
		03211923:1403	-1			

[0043] In the above dataset, the user corresponding to the user information (49) is Joe who purchased a multi-recyclable container enclosure (13) with an affixed visual pattern recognition element (11) comprising a plurality of recyclable waste containers (22) with embedded readable/writeable digital media devices(15) where said embedded readable/writeable digital media devices comprise at least 3 unique readable data:

1. RFID UID# in Read Only Memory

2. BoxID# corresponding to the visual pattern recognition element (11) Writeable Memory

3. Selection# (paper, plastic, metal, glass, general waste, organic ect;) Writeable Memory

[0044] The user inventory information (49) may be coordinated between the app mobile device (45) and a remote server of a network (43).

[0045] Figure 4 shows one or more example embodiments comprising a hopper door assembly or waste portal (29) with a digital reader (25) which may read a UID (16), such as a wireless embedded encoded digital data radio frequency identifier, from an embedded readable/writeable digital media device (15) comprising information such as a BoxID, a BagID and a SelectionID, in which said BoxID comprises at least a portion of the alphanumeric code uniquely identifiable to give access to the recyclable waste disposal portal by energizing or de-energizing an electronic access device (31) such as an electric strike. Further, the embedded readable/writeable digital media device (15) may comprise information, which may grant access to hopper door portal (32) to discard homogeneous recyclable waste container (22).

[0046] According to one or more example embodiments, the first data to be read is the UID (16). For instance, according to one or more example embodiments:

```
MFRC522::MIFARE_Key key;

for (byte i = 0; i < 6; i++) key.keyByte[i] = 0xFF;

byte block;

byte len;

MFRC522::StatusCode status;

if ( ! mfrc522.PICC_IsNewCardPresent() ) {

return;

}
```

```

        if ( ! mfrc522.PICC_ReadCardSerial() ) {
            return;
        }

```

```

        Serial.println(F("***Bag Detected:***"));
        digitalWrite(ALARM_PIN, HIGH);
        card_swiped = 1;

```

[0047] Once card_swiped = 1, it sets a flag which tells the pin that controls the electric strike access to go high which energizes the strike and allows access to the waste portal. Then, the other blocks are read to determine BoxID and SelectionID. For instance, according to one or more example embodiments:

```

        status = mfrc522.MIFARE_Read(block, buffer2, &len);
        if (status != MFRC522::STATUS_OK) {
            Serial.print(F("Reading failed: "));
            Serial.println(mfrc522.GetStatusCodeName(status));
        }
        return;
    }

    for (uint8_t i = 0; i < 16; i++) {
        Serial.write(buffer2[i] );           //PRINT BOXID
        RS485_BUFF_Send(buffer2[i]);        // Now send BoxID over network
        to Master Panel
    }

```

[0048] The digital reader (25) may read the 3rd block of information SelectionID and send it over the network to the Master Control Panel. For instance, according to one or more example embodiments:

```

        byte buffer1[18];

```

```

        block = 5;

        len = 18;

        status = mfrc522.PCD_Authenticate(MFRC522::PICC_CMD_MF_AUTH_KEY_A,
        block, &key, &(mfrc522.uid)); //line 834 of MFRC522.cpp file

        if (status != MFRC522::STATUS_OK) {

            Serial.print(F("Authentication failed: "));

            Serial.println(mfrc522.GetStatusCodeName(status));

            return;
        }

        status = mfrc522.MIFARE_Read(block, buffer1, &len);

        if (status != MFRC522::STATUS_OK) {

            Serial.print(F("Reading failed: "));

            Serial.println(mfrc522.GetStatusCodeName(status));

            mfrc522.PICC_HaltA();

            mfrc522.PCD_StopCrypto1();

            return;
        }

        for (uint8_t i = 0; i < 16; i++)

        {

            if (buffer1[i] != 32)

            {

                Serial.write(buffer1[i]);                // Print SelectionID

                RS485_BUFF_Send(buffer1[i]);            // Now send SelectionID over network to

                Master Panel

            }

        }

```

[0049] According to one or more example embodiments, the first block of the code in the digital reader (25) UID gains access to the waste portal for disposal of the recyclable waste container (22), then sends the next blocks of information BoxID and SelectionID to the Master Control Panel (101) where the BoxID refers to the origin of the recyclable waste container and the SelectionID refers to the controllers of the diversion process to ensure proper location of the respective recyclable waste container (22) into a respective larger collection element (115A) (see Figure 5).

[0050] The BoxId comprises a prefix of unique characters as identified by the “CHG” in the above BoxID column, which grants access to hopper door portal (32) to discard the homogeneous recyclable waste container (22). These digital data, when recorded, will post their information to a database as described in Figure 5.

[0051] Figure 5 shows a recyclable waste container (22) with embedded digital media (102) which was read into a digital recording, reporting and control hardware such as a digital reader (25) and sending data from said digital recording, reporting and control hardware to a Master Control Panel (101) via a network. According to one or more example embodiments, said recyclable waste container embedded digital media (102) may be read by a digital reader (25) at the hopper door portal (32), which may send digital information via a local area network to a Master Control Panel (101). The Master Control Panel (101) may send directional control information to a recycling waste sorting device (111), which may divert recyclable waste container (22) to a respective waste portal (117A) and to a respective larger intelligent waste receptacle such as collection element (115A).

[0052] According to one or more example embodiments, the recyclable waste container (22) travels down a chute towards a separating element such as recycling waste sorting device (111) which may be controlled by the Master Control Panel (101) also acting as a sorting controller. The path of the digitally encoded recyclable waste container (22) may be determined

by a unique digitally encoded embedded readable/writeable digital media device (15) which may be reported to the Master Control Panel (101) acting as an interpreter of the reported unique digitally encoded data and directing the recycling waste sorting device (111) to alter the path of the digitally encoded recyclable waste container (22) into a respective genre's waste bin. The uniquely digitally encoded waste containment element (22) is represented by character A whose destination is bin A or collection element (115A), which thereby comprises a plurality of homogeneous uniquely digitally encoded recyclable waste containers (22) in the same collection element (115A).

[0053] Figure 6 shows one or more example embodiments comprising an aggregate of homogeneous recyclable waste containers (22) in a respective intelligent larger waste container, such as collection element (115A and 115B), which comprises a plurality of disposable recyclable waste containers (22) whereby the Master Control Panel (101) may store event logs of every disposal transaction at every hopper door portal (32) showing each embedded instruction digital media in a database (103) comprising, but not limited to:

[0054] :ID may be the Transaction ID assigning an event number to every floor transaction.

[0055] :DateTime refers to the Transaction date + time of transaction.

[0056] :User may be a registered user of the system. This field comes from a user app that connects the BoxID to the UserID through a database procedure. This field may not be relative to the information sent from the digital reader (25) Figure 4.

[0057] :PhoneID may be a registered phone number of the registered user of the system. This field comes from a user app that connects the BoxID to the PhoneID through a database procedure. This field may not be relative to the information sent from the digital reader (25) Figure 4.

[0058] :RFID may be a factory preset UID assigned for unique identification and may be stored in a read only memory (ROM).

[0059] :BoxID may be a written ID stored in Programmable Read Only Memory (PROM) In first lblock :Selection of genre of waste corresponding to each aggregate of homogeneous recyclable waste containers respective to their genre's color, UID, BoxID and SelectionID which may be uploaded to a wide area network.

[0060] :LevelID may show the fill capacity of the bin.

[0061] Respective to this dataset are the geo-coordinates of the larger bins (115) relative to bin positioning locations within, but not limited to, structures, street bins and other bin type locations where aggregates of waste are disposed.

[0062] Figure 7 shows one or more example embodiments comprising a mobile device (45) of a user which receives reception notification of a waste disposal event from a database stemming from the local area network Master Control Panel (101) which was uploaded to a database in a wide area network (43) and then relayed to a mobile device from a wide area network server. The BagID and BoxID embedded within the disposable recyclable waste container (22) are posted to the Master Panel (1014) which uploads said BoxID and BagID to the network (43) and are cross-referenced to the mobile app user information (49) residing on a mobile device (45). Said mobile device having created the account information (41) which received the notification from a network server in the wide area network (43) which received the notification of the BoxID belonging to said owner of the user account information (41) stored in a database (47) which cross referenced from the Master Control Panel (101) database (103)

[0063] Figure 8 shows one or more example embodiments comprising a map (104) with pin drops corresponding to coordinates in a database (103A) residing on a Master Control Panel device (101) which may upload a coordinate data position (103B) to said network server

of a said Master Control Panel (101) physical location/s. The database comprising a plurality of homogeneous recyclable bin locations of specific genres identifying the fill status of each bin type. This information will make it possible to search for specific SelectionID bin genre such that sequencing efficient automatic routing to a specific genre of recyclable waste may be available for pickup using a maps Application Programming Interface (API).

Search Map API (Prefix(int)) Recyclable Paper;

Result:

Latitude	Longitude	Genre	Fill Status
24.381535116755xx,	54.517290248273xx,	Paper	Full
24.3618332232697xx,	54.519865168962xx,	Paper	Full
24.357298226063xx,	54.539606227582xx,	Paper	Full
24.340095035443xx,	54.55282415378xx,	Paper	Full
24.3350900320496xx,	54.53050817447xx,	Paper	Full

[0064] Search results may show all geo-locations for a paper genre which are full and ready to be picked up. From here the bins (115) at each location on the map (104) may be revealed.

[0065] Figure 9 shows one or more example embodiments comprising a plurality of homogeneous waste locations on a map (104) with efficient routing (110) showing a distance in the database, or distance data (103C), and a weight (103D) providing analytical data for the recycling materials. The map (104) provides a visual routing option comprising the efficient routing (110) for the pickup drivers moving from each homogeneous waste , the coordinates of which correspond to a Master Control Panel (101) location providing efficient directions showing distance data (103C) between each location and providing an aggregate of total distance for the complete route.

[0066] Each location shown in the map (104) with a P symbol represents an efficient routing (110) where BoxID and BagId have identified their geo-position through the Master Panel App which properly identified the SelectionID (genre) to be of the respective recyclable material to be picked up.

[0067] Figure 10 shows one or more example embodiments comprising a flow of the digitally embedded data homogeneous recyclable waste container (22) from User Purchase to End of the embedded data homogeneous waste container Cycle where a BoxID comprises a plurality of BagIDs of a singular or plurality of SelectionIDs which are placed into an inventory. The user may first download an app and do a onetime registration to their mobile device. This app will provide the user with the ability to acquire a plurality of digitally embedded data homogeneous recyclable waste container (22) which are distributed in a specified multi-recyclable waste container enclosure (13) with an affixed BoxID. The box may be sent to the user and the user may receive said Box multi-recyclable waste container enclosure (13) with a BoxID having a peel – tab covering the BoxID to protect from any possible fraudulent scanning. The user app may have the ability to scan the BoxID into the user account adding said BoxID and its content of a plurality of BagIDs of a specific recyclable waste genre. After the BoxID is scanned, all contents are now in the user's inventory. The user fills a transparent, or at least partially transparent, digitally embedded data homogeneous recyclable waste container (22) with the respective recyclable waste materials and when full, may now discard said transparent digitally embedded data homogeneous recyclable waste container (22) into a waste portal (29) by electronically scanning the embedded readable/writable digital media device (15) at the portal electronic digital reader (25). This will grant access to the waste portal (29) and allow the user to dispose of the recyclable materials. The transparent digitally embedded data homogeneous recyclable waste container (22) scanned data on the embedded digital storage device (15) digital BoxID and SelectionID

sent to a Master Control Panel (101) which automatically controls the diversion path with a mechanical diverter such as recycling waste sorting device (111) to a respective genre bin such as collection element (115A). According to one or more example embodiments, a bin sensor detects the bin level of each deposit transaction event and constantly updates the Master Control Panel (101) to determine when said bin is full and requires automated pickup notifications. This generates coordinate and waste statistical data for logistics and sends automated pickup requests to be deployed to the requesting bin location residing at, but not limited to, a building structure, street or parking lot location. The pickup crew may unload to a recycling plant scanning the tags on each bag.

[0068] According to one or more example embodiments, the use of a “transparent” bag is very important as the color coding would reside on the tie strap and the bag may be of a transparent color in order to visually assess the recyclable contents of the transparent digitally embedded data homogeneous recyclable waste container (22) to determine more efficiently if the contents are of a proper homogeneous rating. This unique feature will prevent more of the bags from having to be emptied and sorted if the sorting facility can see if it is of a more homogeneous than a heterogeneous content.

[0069] In one aspect of one or more example embodiments, a transparent recyclable waste container which has an affixed or embedded read/writeable digital storage and retrieval device whose digital information comprises sufficient information to automatically direct waste flow control devices to divert said transparent recyclable waste container to a respective homogeneous waste processing plant where said embedded read / writeable digital storage and retrieval device has a corresponding machine-readable optical label which matches the data written in the read / writeable digital storage and retrieval device that pertains to user participants in order to utilize logistics and statistical data to discern participation analytics. Said embedded read writeable digital storage device may be unrestricted to waste access portals

where data residing on said embedded read writeable digital storage device is used in a network for simultaneous control automation and analytics.

[0070] While one or more example embodiments have been particularly shown and described above, it will be apparent to those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the following claims.

What is Claimed is

1. A container comprising:
a machine-readable optical label whose optically converted data corresponds to a plurality of flexible recyclable waste containers; and
a radio frequency readable and writeable identification device comprising a memory.
2. A container according to claim 1, wherein the optically converted data comprises a unique container identification, and
wherein the machine-readable optical label is unique.
3. A container according to claim 2, wherein the radio frequency readable and writeable identification device comprises corresponding data matching the unique container identification to show association of the container's origin and historical ownership data.
4. A container according to claim 3, wherein the radio frequency readable and writeable identification device comprises a homogeneous recyclable genre identification data element.
5. A container according to claim 3, wherein the radio frequency readable and writeable identification device comprises a heterogeneous waste identification data element.
6. A container according to claim 4, wherein the homogeneous recyclable genre identification data element is configured to control a destination and a flow path from disposal to end of recycling cycle.

7. A container according to claim 5, wherein the heterogeneous waste identification data element is configured to control a destination and a flow path from disposal to end of waste disposal cycle.

8. A flexible recyclable waste container comprising:
an embedded read / write element comprising encoded information configured to guide the flexible recyclable waste container from a waste disposal portal to a controlled path utilizing electronic and mechanical hardware which alters and controls a travel course of the flexible recyclable waste container to respective locations that pertain to processing of homogeneous and heterogeneous waste.

9. A flexible recyclable waste container according to claim 8, wherein the embedded read / write element comprises at least one data element configured to electronically define and transmit homogeneous waste identification data to a receiving hardware.

10. A flexible recyclable waste container according to claim 8, wherein the embedded read / write element comprises at least one data element configured to electronically define and transmit a container identification data to a receiving hardware.

11. A flexible recyclable waste container according to claim 9, wherein the homogeneous waste identification data is configured to determine a physical route of the flexible recyclable waste container using electronic and mechanical hardware control mechanisms.

12. A flexible recyclable waste container according to claim 10, wherein the flexible recyclable waste container identification data corresponds to a machine-readable optical label residing on a first initial container to identify origin or ownership.

13. A transparent recyclable waste container comprising:
a read write element; and
a machine-readable optical label configured to allow visual external inspection of homogeneous or heterogeneous waste.