A system that manages inventory by monitoring the amount of liquid in containers. The monitoring system includes sensors to be placed underneath each container, a central database for storage of container information, a means for displaying the current amount of liquid in each container, and a means for indicating a container is near empty.
FIG. 2
Liquid Monitoring System

Field of the Invention

The invention relates to monitoring the amount of liquid remaining in containers, and more particularly, to a system that manages inventory by monitoring the levels of liquid in many containers.

Background of the Invention

Since many industries (restaurants, bars, automotive, etc.) dispense liquid from opaque containers, there is a need to know how much liquid is remaining in a container to know when to replace the empty container with a full one. Since storage in most buildings is limited and delivery of a full container is never immediate, an estimation of when a container will need to be replaced can lead to a large loss in sales. Therefore, there is a need for a system that can monitor the amount of liquid remaining in multiple containers simultaneously and alert someone when a container is near empty.

Description of the Prior Art


While the devices mentioned fulfill their particular objectives, the previously mentioned patents do not disclose the method used in the Liquid Monitoring System. The inventive device includes an electronic sensor where a container is placed atop, a database to hold all container information, a means for displaying the current amount of liquid in each container, and a means for indicating a container is near empty.

In these respects, the Liquid Monitoring System according to the present inventions substantially changes the conventional concepts and designs of the prior art, in so doing provide an unique apparatus primarily developed for the purpose of measuring liquid in a opaque container, indicating the amount remaining, and emitting an alert when a container is near empty.

Summary of the Invention

The purpose of this invention is to manage inventory by measuring the amount of liquid remaining in containers. A container is placed atop a load cell having an output voltage that varies according to the weight of the container. This voltage is transformed into a weight via a microcontroller. The microcontroller converts this weight into a percentage of liquid remaining and transmits the percentage to a computer which stores this information in a database.

The database is the center of information for all the containers. From this database information can be parsed and displayed on a web interface. Information can also be used to alert that a container is near empty.
Brief Description of the Drawings

FIG. 1 is a block diagram of the Liquid Monitoring System; FIG. 2 is a schematic diagram of the sensor.

Detailed Description

Referring to FIG. 1 and FIG. 2; the container rests atop a sensor to measure the amount of liquid remaining. The sensor is comprised of a load cell, three square pieces of Plexiglas, and metal rods to stabilize the Plexiglas. The load cell is located at the center of the middle piece of Plexiglas to obtain accurate readings of weight. Metal rods are mounted on the four corners of the bottom two pieces of Plexiglas for stabilization. The top piece of Plexiglas rests on top of the load cell. Metal rods again for stabilization, extend from the top piece of Plexiglas through the bottom two pieces of Plexiglas. Therefore, the top piece of Plexiglas is the sensor platform for which the container of liquid rests atop.

The load cell is comprised of four strain gauges arranged in a whetstone configuration. The load cell’s measurable weight range is from 0 to 100 pounds, which then gets translated to an analog voltage from 0 volts to 5 volts, with 0 volts corresponding to a weight of 0 pounds and 5 volts corresponding to a weight of 100 pounds. The maximum resolution of the load cell is 10mV.

The majority of the information processing is done by a microcontroller, as it is the central processing unit. Any microcontroller that includes the ability to process basic mathematical functions, a 9-bit A/D converter (so that the resolution of the converter will be greater than that of the load cell), and a UART will suffice. The microcontroller is powered by a 5V power supply.

The A/D converter takes the analog voltage from the load cell and converts it to a binary number representation – 0x000 representing 0 volts and 0x1FF representing 5 volts. The A/D converter constantly converts the analog value from the load cell to a digital value with a frequency depending on the microcontroller’s clock.

The converted value obtained from the A/D converter is the weight of the container plus the weight of the liquid in the container. To find the amount of liquid remaining in the container, the following equation is used:

\[
\text{amount remaining} = \frac{\text{current weight} - \text{empty weight}}{\text{full weight} - \text{empty weight}}
\]

Where current weight is the weight of the container and any liquid remaining in the container; empty weight is the weight of an empty container; full weight is the weight of a full container of liquid; and amount remaining is the percent of liquid remaining (between 0 and 1). All values are defined in the database which are initially set through a web interface.

Four LEDs connected to the microcontroller output the percentage of liquid remaining in the container. Each LED corresponds to at most a quarter of the container being full. When one LED is on, it specifies the container is 0 – 25% full. When two
LEDs, three LEDs, and four LEDs are on, it specifies when the container is at most 50% full, 75% full and 100% full, respectively.

The microcontroller is connected to a computer via serial connection using the RS232 standard. This connection allows for communication between the microcontroller and computer. Although information flows in both directions, the computer only communicates with the microcontroller to initialize the values of full weight, empty weight, and container ID. While the first two values have already been defined, container ID has not yet been defined.

For simplicity, each sensor is assigned an identification number (container ID). This identification number is used by the computer to know which sensor is sending information. Once a device has been configured, it will begin to send information to the computer. The information is in the format: container ID amount remaining.

The computer continuously listens for information from the sensor. As information is received, the computer parses the information and updates the corresponding containers amount remaining in the database.

The database stores information for each container: container ID, container name, full weight, empty weight, amount remaining, and alert amount. container ID is a positive integer, initialized automatically to one greater than the highest container ID when a new container is created. The values container name, full weight, empty weight, and alert weight are all initialized by a user when a container is created. amount remaining is continuously updated from information received from the sensor. The final value, alert amount, is set when a container is created that indicates a container is critically low and an indication should be sent to alert the container is near empty.

The web interface contains functionality to view the current amount of liquid in all containers being monitored, add/remove a container, and add/remove a user.

The current amount of liquid in each container is displayed in a matrix that is two columns wide and contains as many rows as there are containers defined in the database. The first column displays a container name and the second column displays the corresponding containers amount remaining.

The add/remove container functionality allows a container to be added/removed from the database. The information required to add a container is container name, full weight, empty weight, and alert weight. Upon successful addition of a new container to the database, the sensor is initialized and immediately begins to transmit the amount remaining.

The add/remove user functionality allows a user to enter their e-mail address to receive notifications, by e-mail, when a containers alert weight has been reached.

What is claimed is:

1. A Liquid Monitoring System comprising:
   a sensor positioned underneath each container to determine the quantity of fluid in the container and to provide an amount remaining to a central database;
   a database to store container information;
   a means for displaying the current amount of liquid in each container; and
   a means for indicating a container is near empty.
2. A sensor, according to claim 1, for determining the quantity of fluid remaining in a container comprising:
   a load cell configured to be placed under the container;
a microcontroller to transform the output of the load cell into a weight;
a LED module to display the amount of liquid remaining; and
a communication interface to send the current weight of the container to a computer.

3. A LED module, according to claim 2, further comprising four LEDs which
display the amount of liquid remaining in the container with a granularity of twenty five percent.

4. The database, according to claim 1, to store container information comprising:
an identification number for the container;
a name for the container;
a weight of a full container;
a weight of an empty container;
a current weight of a container; and
an amount remaining to trigger a notification of a near empty container.

5. The indication of a near empty container, according to claim 4, further comprising
an e-mail sent to notify that a container is near empty.

6. The means for displaying the current amount of liquid in each container,
according to claim 1, comprising:
a web interface; and
a chart consisting of two columns, where the first column lists a containers name and
the second column lists the amount of liquid remaining in a container.