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SMART GAS LEVEL DETECTION AND BOOKING

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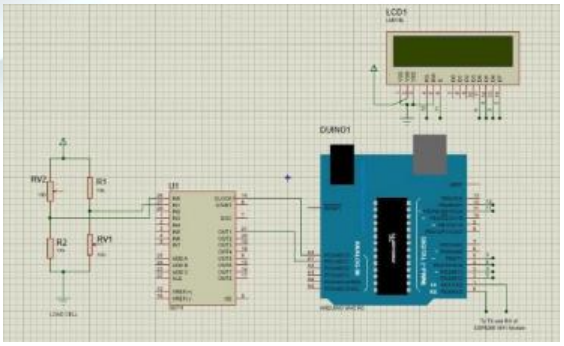
Abstract

Home automation gives us access to control various devices in our home from a mobile application. This project is a part of home automation; in which we are going to access our device using mobile application. This is a simple and unique device to measure the gas level in the canister. We often calculate the number of days a canister will last, according to our basic or rough estimation of usage. Using this device, user can measure the amount of gas left in the canister and also help the user to set different values, below which the user will get a notification through his mobile application. This application allows the customer and the vendor to login. Using this, user can book the next canister and vendor sends the booking status back to the customer. Usually houses will have at least 2 canisters, one as a backup. By using this device, people don't have to spend their money buying 2 canisters at a time.

Introduction

Fast growing urbanisation is changing our lifestyle every day. In this world where technology is conquering each nuke and corner of our life, which simplifies each point of our life by bringing everything at our finger tips. Home automation is used in electrical appliances, which give people the access to control the electrical appliance using mobile applications. Now-a-days houses are almost fully automated and people are ready to use this technology. Our smartphones are becoming a gateway to control most of the appliances through mobile application. In Delhi and other metropolitan cities people get gas through pipeline connections. But major part of India is still using old conventional way of gas distribution, which uses gas canisters. We face problems when it comes to knowing the level of the gas canister that we use for cooking. Most of the people who use gas canister always have to rely on the second canister that they bought as a backup or lend a canister from neighbours. We never know when the canister is about to finish. People calculate the usage of gas canister by weighing the canister by simply lifting or by assuming the previous time period of usage, this goes same for commercial places like hotels, mess and restaurants. Our device is new and unique than the previous ideas that it attracts the market (including residential and commercial places). Because of its ease of usage and accessibility, the user will find it as a better solution to the problems in the conventional method. Mobile application helps the user to access and control the device in their busy schedule. This application is user friendly and also allows the vendor to see the customer details and update the user regarding their booking. Majority of Indian population uses conventional gas canisters. Even though conventional method is a very common way but it has drawbacks like, we can't see the amount of gas left. Booking of gas canister takes time, delivery of the canister may take time which is a problem to us. This can be curbed by this device, so our device has a good market value since it is easy to use. Therefore, our project has a wide market in residential areas and commercial areas that covers hotels, restaurants and other places that uses gas canisters.

Methodology used



Weight of the canister is measured and converted to electrical signals using a load transducer and it is send to the programmable microcontroller. Using a Wi-Fi module, the information is passed to the mobile application. This application allows the user to set a

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marginal value to set an alert and also acts as platform to book and also to keep in track of the status of the booking. Vendor also keep an organized list of booking and status.

Load cell

Through a mechanical construction, the force being sensed deforms strain gauge. The strain gauge measures the deformation (strain) as a change in electrical resistance, which is a measure of the strain and hence the applied forces. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. Load cells of one strain gauge (quarter bridge) or two strain gauges (half bridge) are also available. The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer can be scaled to calculate the force applied to the transducer. Sometimes a high resolution ADC, typically 24-bit, can be used directly.

Strain gauge load cells are the most common in industry. These load cells are particularly stiff, have very good resonance values, and tend to have long life cycles in application. Strain gauge load cells work on the principle that the strain gauge (a planar resistor) deforms/stretches/contracts when the material of the load cells deforms appropriately. These values are extremely small and are relational to the stress and/or strain that the material load cell is undergoing at the time. The change in resistance of the strain gauge provides an electrical value change that is calibrated to the load placed on the load cell.

Strain gauge load cells convert the load acting on them into electrical signals. The gauges themselves are bonded onto a beam or structural member that deforms when weight is applied. In most cases, four strain gauges are used to obtain maximum sensitivity and temperature compensation. Two of the gauges are usually in tension can be represented as T1 and T2, and two in compression can be represented as C1 and C2, and are wired with compensation adjustments. The strain gauge load cell is fundamentally a spring optimized for strain measurement. Gauges are mounted in areas that exhibit strain in compression or tension. When weight is applied to the load cell, gauges C1 and C2 compress decreasing their resistances. Simultaneously, gauges T1 and T2 are stretched increasing their resistances. The change in resistances causes more current to flow through C1 and C2 and less current to flow through T1 and T2. Thus a potential difference is felt between the output or signal leads of the load cell. The gauges are mounted in a differential bridge to enhance measurement accuracy. When weight is applied, the strain changes the electrical resistance of the gauges in proportion to the load. Other load cells are fading into obscurity, as strain gauge load cells continue to increase their accuracy and lower their unit costs.

ADC Amplifier

The conversion involves quantization of the input, so it necessarily introduces a small amount of error. Furthermore, instead of continuously performing the conversion, an ADC does the conversion periodically, sampling the input. The result is a sequence of digital values that have been converted from a continuous-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude digital signal.

An ADC is defined by its bandwidth and its signal-to-noise ratio. The bandwidth of an ADC is characterized primarily by its sampling rate. The dynamic range of an ADC is influenced by many factors, including the resolution, linearity and accuracy (how well the quantization levels match the true analog signal), aliasing and jitter. The dynamic range of an ADC is often summarized in terms of its effective number of bits (ENOB), the number of bits of each measure it returns that are on average not noise. An ideal ADC has an ENOB equal to its resolution. ADCs are chosen to match the bandwidth and required signal-to-noise ratio of the signal to be quantized. If an ADC operates at a sampling rate greater than twice the bandwidth of the signal, then perfect reconstruction is possible given an ideal ADC and neglecting quantization error. The presence of quantization error limits the dynamic range of even an ideal ADC. However, if the dynamic range of the ADC exceeds that of the input signal, its effects may be neglected resulting in an essentially perfect digital representation of the input signal.

An amplifier is an electronic device that can increase the power of a signal (time-varying voltage or current). An amplifier functions by taking power from a power supply and controlling the output to match the input signal shape but with a larger amplitude. In this sense, an amplifier modulates the output of the power supply based upon the properties of the input signal. An amplifier is effectively the opposite of an attenuator: while an amplifier provides gain, an attenuator provides loss.

An amplifier can either be a separate piece of equipment or an electrical circuit contained within another device. Amplification is fundamental to modern electronics, and amplifiers are widely used in almost all electronic equipment. Amplifiers can be categorized in different ways. One is by the frequency of the electronic signal being amplified; audio amplifiers amplify signals in the audio (sound) range of less than 20 kHz, RF amplifiers amplify frequencies in the radio

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frequency range between 20 kHz and 300 GHz. Another is which quantity, voltage or current is being amplified; amplifiers can be divided into voltage amplifiers, current amplifiers, transconducta nce amplifiers, and trans resistance amplifiers. A further distinction is whether the output is a linear or nonlinear representation of the input. Amplifiers can also be categorized by their physical placement in the signal chain

The first practical electronic device that could amplify was the triode vacuum tube invented in 1906 by Lee Dee Forest, which led to the first amplifiers around 1912. Vacuum tubes were used in almost all amplifiers until the 1960s–1970s when the transistor, invented in 1947, replaced them. Today most amplifiers use transistors, but vacuum tubes continue to be used in some applications.

Arduino

Arduino is a computer hardware and software company, project, and user community that designs and manufacture microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public Licence (LGPL) or the GNU Lesser General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

Arduino board designs use a variety of boards. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an Integrated Development Environment (IDE) based on the Processing language project.

The Arduino project started in 2005 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors. This is the new Arduino Uno R3. In addition to all the features of the previous board, the Uno now uses an ATmega16U2 instead of the 8U2 found on the Uno (or the FTDI found on previous generations). This allows for faster transfer rates and more memory. No drivers needed for Linux or Mac (info file for Windows is needed and included in the Arduino IDE), and the ability to have the Uno show up as a keyboard, mouse, joystick, etc.

The Uno R3 also adds SDA and SCL pins next to the AREF. In addition, there are two new pins placed near the RESET pin. One is the IOREF that allow the shields to adapt to the voltage provided from the board. The other is a not connected and is reserved for future purposes. The Uno R3 works with all existing shields but can adapt to new shields which use these additional pins.

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, MaxMSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux).

Microcontroller

A microcontroller (or MCU for microcontroller unit) is a small computer on a single integrated circuit. In modern terminology, it is a system on a chip or SoC. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessor used in personal computers or other general purpose applications consisting of various discrete chips.

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed Signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. Some microcontrollers may use four-bit words and operate at frequencies as low as 4 kHz, for low power consumption (single-digit milliwatts or

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microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just nanowatts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption. The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

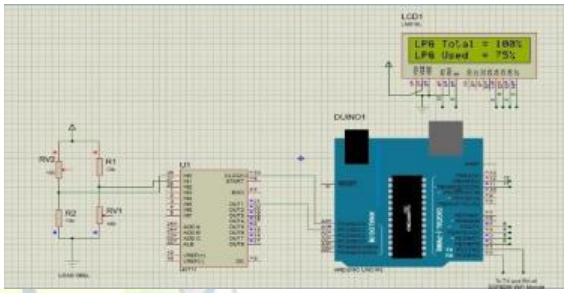
LCD display

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as pre-set words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs are used in a wide range of applications including televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma display, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television set.

Since LCD screens do not use phosphors, they do not suffer image burn-in when a static image is displayed on a screen for a long time (e.g., the table frame for an aircraft schedule on an indoor sign). LCDs are, however, susceptible to image persistence. The LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery-powered electronic equipment more efficiently than CRTs can be. By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolete for most purposes.

Simulation and working



The weight of the canister is measured by the load cell. Here we are using 30kg load cell and using it for measuring the weight of the canister. The output pins of the load cell is connected to the 26,27th pin of Hx711. The amplified output from the adc amplifier is given to the Arduino board. Arduino board is connected to the microprocessor. The output is send to the display and shows the required result. The output is also send to an open source where the values are shown in a dial which has a different set of colors which shows the availability of gas in percentage and also another dial which shows the weight of the canister in kilogram. There will be a notification which comes when the gas value goes down a marginal value. This notification also includes the permission to book the next canister. This option can also be postponed for later if the user is not ready to get the next canister at the current moment. This is very helpful for the people who are working and also to the residential people to avoid last moment rush.

Conclusions

Our device is new and unique than the previous ideas that it attracts the market (including residential and commercial places). Because of its ease of usage and accessibility, the user will find it as a better solution to the problems in the conventional method. Mobile application helps the user to access and control the device in their busy schedule. This application is user friendly and also allows the vendor to see the customer details and update the user regarding their booking.

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