IOT Based Toll Booth Management System

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Abstract:

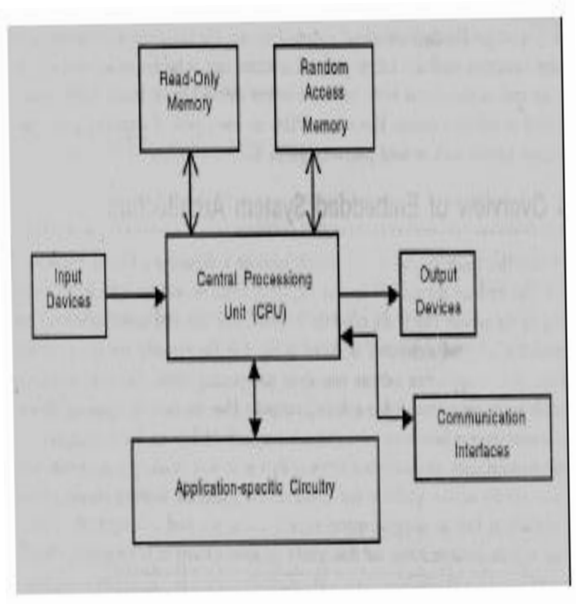
This study focuses on an RFID-based toll booth management system that is monitored via the Internet of Things. The database stores all of the information about user accounts, as well as their balances. Each vehicle owner has a unique RFID (Radio Frequency Identification) based card that stores their RFID number and is put on their vehicle. When a vehicle arrives at a toll booth, the toll booth management system will monitor the cards scanned. After that, the system connects to the database to determine whether the card is legitimate and, if so, what the balance is. If the user's balance is sufficient, the toll amount is deducted, and the card scanner system informs the motor that the user has been invoiced, along with the billing information.

1.Introduction:

The ever-increasing number of automobiles on the road nowadays has resulted in massive traffic and lengthened travel times. This slow-moving traffic is a problem not only in cities, but also on highways, where people line only to pay the toll price to join the highway. This automated toll booth management system is more efficient and well-organized since passengers are not caught in large lines, reducing wait times. The RFID-based toll system has the potential to eliminate corruption in highway revenue administration while simultaneously lowering operating costs. Implementing this approach could be a cost-effective solution to keep track of your finances.

A literature review was conducted on the various current toll collection systems. Comparing different toll systems aids in the selection of the best toll system. The toll collection mechanism in paper [8] is a manual system. The user is charged a one-way or roundtrip toll depending on the kind of vehicle and whether it is a heavy or light weight toll. The user must physically pay the toll, for which he will be given a bill slip. This approach necessitates a huge manual workforce and is time-consuming, among other things. The majority of toll plazas use this approach, which lacks transparency. In paper [2,] the toll collection system is implemented using barcodes. Though these barcodes are less expensive to apply, they have a limited store capacity.

Every embedded system is made up of bespoke hardware that is based on a Central Processing Unit (CPU). This hardware also includes memory chips, which are used to store the software. Firmware refers to the software that runs on the memory chip. Any computer, including a desktop computer, can use the same architecture. There are, nevertheless, substantial distinctions. Every embedded system does not need to have an operating system. There is no need for an operating system for small appliances such as remote control units, air conditioners, toys, and so on, and you may build simply the software that is particular to that application. An operating system is recommended for applications that require extensive processing. You'll need to interface the application software with the operating system in this situation.



The Central Processing Unit (processor, in short) can be any of the following: microcontroller, microprocessor or Digital Signal Processor (DSP). A micro-controller is a low-cost processor. Its main attraction is that on the chip itself, there will be many other components such as memory, serial communication interface, analog-to digital converter etc. So, for small applications, a micro-controller is the best choice as the number of external components required will be very less. On the other hand, microprocessors are more powerful, but you need to use many external components with them. D5P is used mainly for applications in which signal processing is involved such as audio and video processing.

MEMORY:

The memory is categorized as Random Access 11emory (RAM) and Read Only Memory (ROM). The contents of the RAM will be erased if power is switched off to the chip, whereas ROM retains the contents even if the power is switched off. So, the firmware is stored in the ROM. When power is switched on, the processor reads the ROM; the program is program is executed.

INPUT DEVICES:

Unlike the desktops, the input devices to an embedded system have very limited capability. There will be no keyboard or a mouse, and hence interacting with the embedded system is no easy task. Many embedded systems will have a small keypad-you press one key to give a specific command. A keypad may be used to input only the digits. Many embedded systems used in process control do not have any input device for user interaction; they take inputs from sensors or transducers 1’fnd produce electrical signals that are in turn fed to other systems.

OUTPUT DEVICES:

The output devices of the embedded systems also have very limited capability. Some embedded systems will have a few Light Emitting Diodes (LEDs) to indicate the health status of the system modules, or for visual indication of alarms. A small Liquid Crystal Display (LCD) may also be used to display some important parameters.

COMMUNICATION INTERFACES:

The embedded systems may need to, interact with other embedded systems at they may have to transmit data to a desktop. To facilitate this, the embedded systems are provided with one or a few communication interfaces such as RS232, RS422, RS485, Universal Serial Bus (USB), IEEE 1394, Ethernet etc.

APPLICATION-SPECIFIC CIRCUITRY:

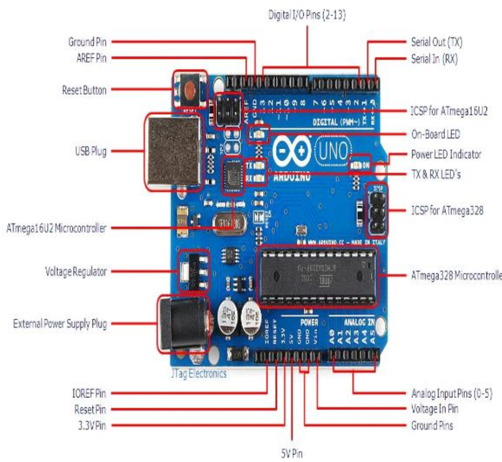
Sensors, transducers, special processing and control circuitry may be required fat an embedded system, depending on its application. This circuitry interacts with the processor to carry out the necessary work. The entire hardware has to be given power supply either through the 230 volts main supply or through a battery. The hardware has to design in such a way that the power consumption is minimized

2. Apparatus:

HARDWARE DESIGN: This chapter provides a quick overview of the Hardware implementation of. It goes over each module's circuit schematic in great depth.

ARDUINO 4.1:

The Arduino Uno is the most popular Arduino model. When most people refer to an Arduino, they're referring to this board.

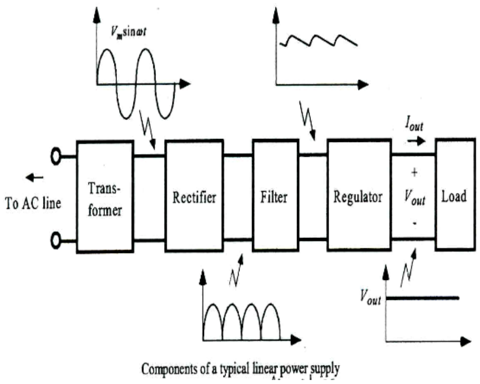


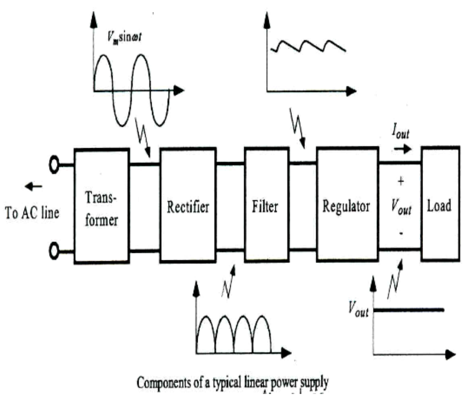
The Arduino Uno is an excellent choice for beginners and one of the most popular boards in the Arduino series. There are several revisions of the Arduino Uno; the most recent revision (Rev3 or R3) is detailed below.

The Arduino Uno is an ATmega328-based microcontroller board. It features 14 digital input/output pins (six of which can be used as PWM outputs), six analogue inputs, a 16

MHz ceramic resonator, a USB port, and a power supply.

External Power Supply Plug & USB Plug:





Every Arduino board must be able to connect to a power supply. The Arduino Uno is powered via a USB cable connected to your computer or a barrel jack-terminated wall power supply. The power source is automatically selected. You'll also use the USB connection to upload code to your Arduino board. Please see my other post, Installing and Programming Arduino, for more information on how to programme with Arduino.

NOTE: The board can be powered from a 6 to 20 volt external supply. If less than 7V is given, the 5V pin may supply fewer than five volts, making the board unstable. If more than 12V is used.

Ground Pins:

There are several GND pins on the Arduino, any of which can be used to ground your circuit.

Pin IOREF:

The voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

Input and Output Pins:

Each of the 14 digital pins on the Uno can be used as an input or output. They operate at 5 volts. These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of

20-5k Ohms. In addition, some pins have specialized functions.

Serial OUT(Tx) & Serial IN(Rx):

Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

External Interrupts :

Pins 2 and 3 can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM – You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). Think of these pins as being able to simulate analog output (like fading an LED in and out).

SPI – Pins 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). SPI stands for Serial Peripheral Interface. These pins support SPI communication using the SPI library.

Analog Input Pins – Labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read. By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF Pin (Stands for Analog Reference. Most of the time you can leave this pin alone). Additionally, some pins have specialized functionality:

TWI – Pins A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.Pins that have been ground On the Arduino, there are multiple GND pins that can be utilised to ground your circuit.

Pin Reset:

To reset the microcontroller, set this line to LOW.

Typically used to add a reset button to shields that are in the way of the board's reset button.

Indicators with LEDs:

LED Power Indicator – On your circuit board, there's a little LED next to the word 'ON' just beneath and to the right of the word "UNO." When you plug your Arduino into a power source, this LED should light up. There's a strong likelihood something is wrong if this light doesn't turn on. It's time to double-check your wiring!

LED On-Board – A built-in LED is connected to digital pin 13 by a wire. The LED is turned on when the pin is HIGH, and it is turned off when the pin is LOW. This is useful for immediately determining if the board is in good working order

6.Conclusion:

The "IoT Based Toll Booth Management System" is a toll system prototype that uses RFID to allow vehicles to pass through the toll with ease and without fuss. The method is designed to minimise long lines at toll booths as well as cumbersome manual labour. The proposed system also communicates the user transaction data, allowing the transaction to be open and free of corruption. The information such as the vehicle number, toll gate number, and the timings at which the vehicle passes is stored in the cloud, which aids in analysis in the event of an unforeseen event in the future. The government will also benefit from the easy availability of real-time total toll revenue collecting data statistics via the IoT cloud platform.

7.References:

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