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Intelligent Digital Fuel Gauge Along With Engine Locking System Using Arduino

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ABSTRACT

Currently, we are constantly hearing about petrol bunk frauds and the vehicle theft. In this fast running world, everything is going to be digitalized and people expect result with high accuracy. Most of the petrol bunks today have manipulated the pumps such that it displays the amount as entered but the quantity of fuel filled in the customer's tank is much lesser than the displayed value. I.et the pumps are tampered for the benefit of the petrol bunks owner. On the other hand, most of the public has their vehicle; hence the snatching of the vehicle has been increasing rapidly. In this project, we focus on creating a module which would solve the above mentioned problems. This module is designed with float sensor, LCD display, Ethernet Shield, GPS with the help of Internet and limit switch. The project focuses on creating digital display to have accurate fuel quantity, amount and also to provide security for the vehicle from theft.

Keywords: Arduino, Float sensor, LCD display, Ethernet Shield, GPS with Interne, Limit switch.

1. INTRODUCTION

In this modern and fast running world everything is going to be digitized to be easily understandable and also to give exact calculation. Considering this idea we started a project named Intelligent Digital fuel gauge, which shows the exact amount of fuel remaining in the fuel gauge as compared to the previously used gauge meter in which a needle moves to give a rough estimate of the fuel left. A float sensor is used to indicate the level of the fuel contained in the tank. Commonly used in cars and bikes, these may also be used in any tank including underground storage tanks. During such cases without knowing the fuel level it will be difficult for the driver to travel with an assumption about the fuel present inside the tank. Fuel quantity is one of the undetermined factors in two wheelers. As far as now fuel level in two wheelers are indicated through analog gauge. Analog gauge cannot provide accurate value of the fuel in the tank. So we are using digital gauge to find the accurate value of the fuel.

In addition to this, Automobile thefts are increasing at an alarming rate all over the world. So to escape from these looting most of the vehicle owners have started using the theft control systems. The commercially available anti-theft vehicular systems are very expensive. Currently GPS vehicle tracking ensures their safety as travelling. This vehicle tracking system found in clients vehicles as a theft prevention and rescue device. Vehicle owner or Police follow the signal emitted by the tracking system to locate a robbed vehicle with the help of GPS. Using Internet we can easily lock the engine. Authorized person need to send the password to the module to restart the vehicle. This is more secured, reliable and low cost.

2. PROPOSED SOLUTION

This project focuses on creating a digital display of the exact amount of fuel contained in the vehicles tank and also helps in cross checking the quantity of fuel filled at the petrol bunk. Finally once the fuel is filled at a bunk the device also sends a SMS to the vehicle owner indicating the amount and quantity of the fuel.

The vehicle tracking and locking system is used to track the theft vehicle by using GPS with the help of Internet. This system puts into sleeping mode while the vehicle handled by the owner or authorized person otherwise goes to active mode, the mode of operation changed by in person or remotely. The controller issues the message about the place of the vehicle to the vehicle owner or authorized person. When send SMS to the controller, issues the control signals to the engine motor. Engine motor stops the vehicle immediately. To restart the engine, authorized person needs to enter the passwords. In this method, tracking of vehicle can be easily identified.

3. COMPONENTS

1. Arduino UNO
2. Power Supply Unit
3. Float sensor
4. GPS module
5. 16x2 LCD display
6. Ethernet Shield
7. Limit switch

3.1. ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328.

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

Single board microcontroller (ATmega328p),

Operating voltage-5V,

Input voltage 7-20V.

Figure1: Arduino UNO

3.2. POWER SUPPLY UNIT

Power supply unit is divided into four elements as below,

1. 230V/12V Step down transformer
2. Bridge rectifier with 4xIN4007 diodes

3. 470uF/35V capacitor as a filter
4. 7805 Voltage regulator IC

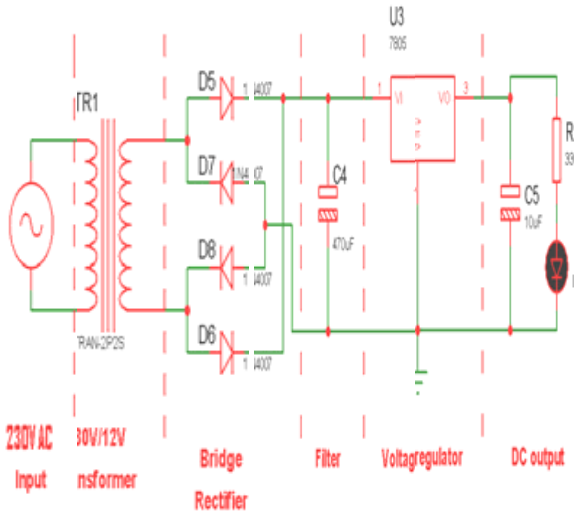

Figure 2: Power supply unit

Thus Transformer steps down the incoming line voltage depending on the needs of the power supply. This alternating voltage is then fed to the rectifier. The rectifier is a diode circuit that converts the AC to Pulsating DC. This pulsating DC is the applied to the filter circuit. The Filter is a circuit that reduces the variations of the DC voltage. Here the capacitor is used as a filter. The filtered DC is then fed to the voltage regulator stage. The voltage regulator is used to maintain a constant voltage at the power supply output. It also provides further smoothing of the DC voltage.

3.3. FLOAT SENSOR CHARACTERISTICS

The Features of float sensor are as follows,

1. Sensor with integral float magnet attached
2. Sensor operates when float rises from end stop position
3. Choice of contacts
4. of connector
5. Some of the benefits of float sensor are as follows,
6. No standby power required
7. Hermetically sealed, magnetically operated contacts continue to operate long after optical and other technologies fail due to contamination
8. Simple installation with M8 thread and nut Level detection of liquids is often done with a float-type liquid level switch. The float transfers on a mechanical arm or sliding pole and activates a switch when the level moves towards upward direction. Sometimes the float itself contains a small magnet that varies the state of a switch when the liquid level gets moving up and moves into the original position. This type of level

sensor comes with many advantages like it is very simple, highly accurate, and best suitable for various products.

3.4. 16x2 LCD DISPLAY

1. LCD is a type of display used in digital watches and many portable computers.
2. LCD displays utilize to sheets of polarizing material with a liquid crystal solution between them.
3. 16 Characters x 2 Lines.
4. 4-bit or 8-bit MPU Interface.
5. HD44780 Equivalent LCD Controller/driver Built-In.
6. LCD’ s are economical and easily programmable.
7. It interfaces with Arduino to display the status of the tank.

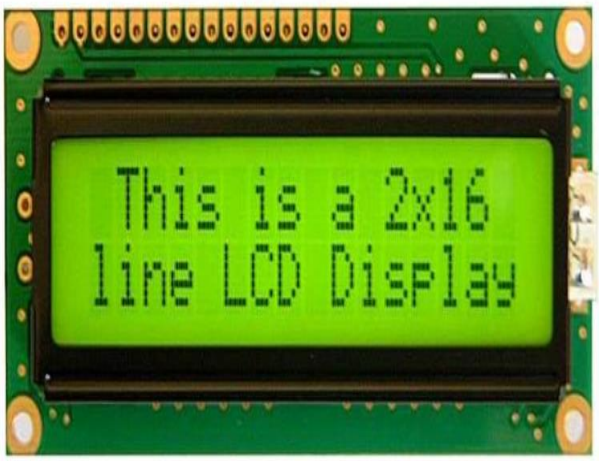

Figure4: LCD display

3.5. ETHERNET SHIELD

The Arduino Ethernet shield allows an Arduino board to connect to the internet using the Ethernet library and to read and write an SD card using the SD library. This shield is fully compatible with the former version, but relies on the newer W5500 chip. Depending on the shield version you have, you need to use the proper library, as documented in the Ethernet library page.

Figure 5: Ethernet shield

3.6. LIMIT SWITCH

A limit switch is a switch operated by the motion of a machine part or presence of an object. They are used for controlling machinery as a part of a control system, as safety interlocks, or to count objects passing a point. It is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection. They were first used to define the limit of travel of an object; hence the name limit switch.

Figure 6: Limit Switch

4. SYSTEM DESIGN

1. The Arduino is interfaced with the flow sensor of the vehicle. Every vehicle has a separate number, which is given by the corresponding authority.
2. The amount of fuel is stored in memory of the Arduino. Using Arduino IDE we can send the SMS through internet to that particular mobile number and wait for the response if any.
3. On other end the vehicle owner will receive the data in the form of a fuel existing before refueling, fuel added while refueling and the total amount of fuel in the tank.
4. Using internet we can get the response very fast due to which time is saved.
5. After sending the readings to the vehicle owner, the owner can request for the location of the vehicle by sending an SMS.
6. The vehicle owner at any point of time can request for the amount of fuel and the location of the vehicle.
7. After all this process the Arduino will reset the memory to get the fresh readings during the next refueling.

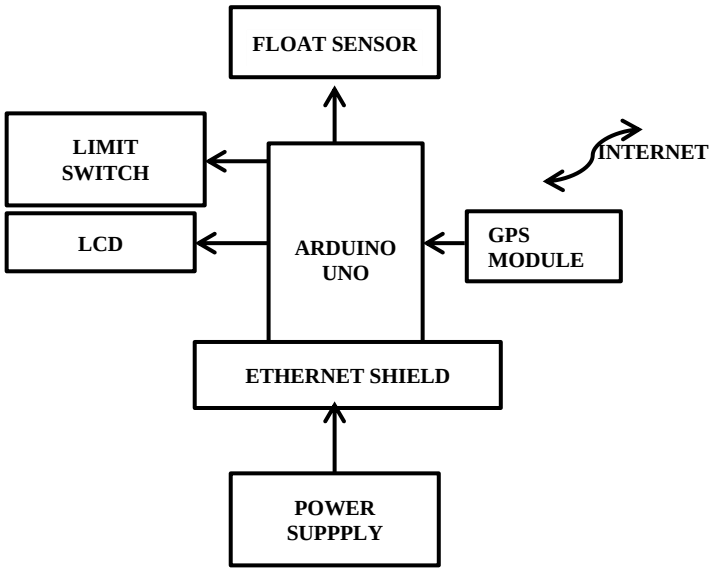

Figure 7: Block Diagram

4.1. ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features:

1. 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that uses the AVR, which operate with 5V and with the Arduino. Due that operate with 3.3V. The second one is a not connected pin that is reserved for future purposes.
2. Stronger RESET circuit.
3. Atmega 16U2 replace the 8U2.

Features of Arduino UNO are as follows,

1. Operating Voltage:5V
2. Input Voltage (recommended):7-12V
3. Input Voltage (limits):6-20V
4. Digital I/O Pins:14 (of which 6 provide PWM output)
5. Analog Input Pins:6
6. DC Current per I/O Pin:40 mA
7. DC Current for 3.3V Pin:50 mA
8. Flash Memory:32 KB (ATmega328) of which 0.5 KB used by boot loader.
9. SRAM:2 KB (ATmega328)
10. EEPROM:1 KB (ATmega328)
11. Clock Speed:16 MHz

4.2. DISPLAY UNIT

A 16 x 2 character LCD (HD44780) is interfaced with the Arduino port using 4 data wire mode. Different meter readings like current month kWh, total kWh, voltage, current, date, time, etc. are sequentially displayed here. LCD

is a type of display used in digital watches and many portable computers. LCD displays utilize to sheets of polarizing material with a liquid crystal solution between them.

4.3. PERMANENT DATA STORAGE UNIT

If power fail occurs, the content of the RAM must be stored in EEPROM so that when power is back, the meter can start from its last state. An I2C EEPROM (ATmega328) of 32KB size is used for this purpose. Also, different billing slabs containing rates for peak and off peak hour, meter ID etc. are stored here.

4.4. REGULATOR (7805)

This series of fixed-voltage integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5 A of output current. The internal current-limiting and thermal-shutdown features of these regulators essentially make them immune to overload. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents, and also can be used as the power-pass element in precision regulators.

4.5. RECTIFIER

A rectifier is an electrical device that converts alternating current (AC) to direct current (DC), a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals.

5. CONCLUSION

The implementation of the system was very smooth, easy and very effective at a very low cost compared to all other techniques. The results were stored in Arduino to keep track of the efficiency. The accuracy of this system is close to 95% - 98%.The Digital fuel indicator is designed with more accuracy, more reliable, and cheaper than other analog meters, and will allow for added features that benefit both the customer. In the near future, the different vehicle company manufacturers will implement this kind of fuel system which also provides security for the vehicle owners. Not only will the measurement be more accurate, but, the consumers also will not be cheated for their hard earned money.

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