Apsis Remote Fuel Monitoring System and Vehicle Tracking Using GPS Technology

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Abstract- In today's world, actual record of fuel filled and fuel consumption in vehicles is not maintained. It results in a financial loss. To avoid this we are implementing a microcontroller based fuel monitoring and vehicle tracking system. We have used the reed switch which works according to the principle of Hall Effect for sensing the amount of fuel filled in the vehicle and amount of fuel consumed. Then this record is stored in the system memory. This system stores the record for several logs. We have used the MSP430F149 microcontroller for our system. It is a ultra low power, 16 bit RISC architecture controller [7]. It contains inbuilt 12 bit ADC, serial communication interface [1]. Real Time Clock (RTC) is also provided to keep the track of time. Also we have used the GPS technology to track the vehicle. In this paper, the implementation of embedded control system based on the microcontroller is presented. The embedded control system can achieve many tasks of the effective fleet management, such as fuel monitoring, vehicle tracking. Using GPS vehicle tracking technology and viewing interactive maps enable us to see where it was losing money, time and wasting fuel (such as on duplicated journeys).

Keywords: Fleet Management, GPS, ReedSwitch, MSP430F149.

I. INTRODUCTION

The challenges of successful monitoring involve efficient and specific design, and a commitment to implementation of the monitoring project, from data collection to reporting and using results. Fleet tracking is the use of GPS technology to identify, locate and maintain contact reports with one or more fleet vehicles.

The location history of individual fleet vehicles allows precisely time-managed, current and forward journey planning, responsive to changing traveling conditions. Storage tanks are artificial containers that hold liquids, compressed gases (gas tank) or mediums used for the short- or long-term storage of heat or cold. Large above ground storage tanks filled with hydrocarbon and hazardous liquids such as oil, oil derived products, chemicals and process plant liquids are in widespread use in the UK, Europe and throughout the world.

The tanks are generally spread across a large area and use manual detection and measurement methods which are still under development. This makes it more laborious and time consuming to monitor the tank levels . Remote monitoring and data collection systems are necessary to collect information from the tanks and monitor the same.

So it is necessary to build a system which can be accurate, fast in measurement and simple to install and handle, but has an intelligence which takes decisions in real-time and alerts and communicates when necessary. The data acquisition is done by the sensors used to sense the changes in the liquid level of the tank and is stored in the system's memory.

A server collects the information sent from the onboard microcontroller through a GSM modem in the tank; saves it to a database and displays it on a website graphically. Such intelligent monitoring systems help in effective management of tanks, by assessing the status of the tanks periodically allowing optimized logistical supply of product and minimized inventory holding Efficient utilization of the low power modes of the microcontroller reduces power consumption and extends the longevity and reliability of the system with less maintenance cost .

Applications of commercial vehicle tracking solutions in the fields of transport, logistics, haulage and multi-drop delivery environments can include optimized fleet utilization, operational enhancements and dynamically remote-managed fleets. Fleet tracking is scalable by design and interfaces with the logistics industry's leading back-office systems.

Rising fuel costs constantly challenge fleet operators to maintain movement of vehicles and monitor driver behavior to avoid delaying traffic conditions by either, combining deliveries, reconfiguring routes or rescheduling timetables.

This aims to maximize the number of deliveries while minimizing time and distance. Escalating oil prices are increasing costs for many businesses, particularly those with large vehicle fleets, adding a powerful financial impetus to the search for fuel efficiencies. Implementing real-time vehicle tracking as part of a commercial company's mobile

II. LITERATURE SURVEY

Contactless Liquid-level Measurement Frequency-Modulated Millimetre Wave Through Opaque Container Tatsuo Nakagawa et al (2013):

Describe a non-contact method for measuring liquid level by an opaque container is proposed. A millimeter-wave Doppler sensor is to detect by a target container developed, and measures the liquid level on the basis of the absorption of millimeter waves in the liquid 4 Vehicle Monitoring and Theft Prevention System Using ARM Cortex NurulHutha.S et (2013): Vehicle theft by professional thieves a persistent problem throughout the world and a greater challenge comes been. A modern vehicle uses remote keyless entry system and an immobilizer system as the main weapon against vehicle theft. But these systems do not prevent unauthorized access of the vehicle to some degreeSmart gravitational lock is used to prevent the theft by the air gesture keys used by the keychain of the vehicle, which provides a high level Time Vehicle Theft Identity and Control System Based on ARM D. Narendar Singh et al (2013):

Describes Due to the insecure environment, the ratio of vehicle theft increases rapidly. Due to this, manufacturers of luxury automobiles have to ensure the authorization for owners and also in built the anti- theft system to prevent the vehicle from theft.

The tanks are generally spread across a large area and use manual detection and measurement methods which are still under development. This makes it more laborious and time consuming to monitor the tank levels [1]. Remote monitoring and data collection systems are necessary to collect information from the tanks and monitor the same.

So it is necessary to build a system which can be accurate, fast in measurement and simple to install and handle, but has an intelligence [2] which takes decisions in real-time and alerts and communicates when necessary. The data acquisition is done by the sensors used to sense the changes in the liquid level of the tank and is stored in the system's memory.

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Innovative solutions to tackle emergency applications need to be designed for critically sensitive application and can be achieved by developing effective embedded software, WSN architectures and communication protocols, which are robust, thereby increasing the lifetime of the network [5]. Analog to Digital Converters (ADC's) can be used to interface the sensors, which are used in data acquisition and sensing the parameters, to help in building sensor interface to the control unit (microcontroller) [6]. The data which is collected needs to be distributed and can be done by WSN nodes which consume low power and can have the intelligence for self-organization [7]. Scalability is another important parameter and determines the longevity of the system. A system thus developed should be scalable without major changes to the working system [8]. There are systems which have been implemented for specific liquids like water.

Typically, the measurements of liquids are done using various sensors which need physical contact with the liquid. These might induce wear and tear and introduce maintenance costs and decrease the longevity of the system [9]. Ultrasonic sensors can be used to INTERNATIONAL JOURNAL ON SMART SENSING AND INTELLIGENT SYSTEMS VOL. 8, NO. 1, MARCH 2015 28 sense the liquid level by placing the sensors at a specified portion in the tank, calculating the level of liquid by time of flight of the ultrasonic wave and correlation with respect to the dimension of the tank, to get a more accurate value [10].

The values thus collected needs to be sent to a server using a wireless communication medium, so that this can be correlated at the server for display on the tank software system [11]. The data collected at the server end is displayed on a GUI , thus communicating to the user about the level of liquid, in real time and also evaluating the variation of liquid levels over a period of time [12].This would accommodate efficient storage, dispensing of liquids and chemicals inside the tanks. As GSM technology is used, it helps the system to be installed in industries, liquid storage fields, oil-tank and trucks.

These measurements are sent to a server via a GSM module [13] through GPRS. The GPRS is activated and the TCP/IP sockets are used to communicate to and from the server. The server stores the values in memory and ensures that fluid inventory levels are maintained, and helps in identifying problems such as tank leaks and fluid theft [14].

III. SYSTEM STRUCTURE

Basically the system is composed of central control system, communication system, sensor system and power system. The system structure is shown in figure.

i) Communication System: System can communicate with remote server through three ways. The first channel uses radio transceiver through RS232 interface; the second one is the optical fiber communication system which can transmit serial data signals by RS485 interface and cameras' video image at the same time. The last one uses wireless sensor net (WSN) to exchange information while a WSN node is attached to the server. When WSN is used, WSN's nodes should be deployed along with the vehicle properly and communication distance can be extended greatly.

ii) Sensor System**:** Sensors system is composed of fuel level sensors. i.e. reed switch

iii) Power System**:** The central control system is powered by DC power supply with proper specifications. The communication system i.e. GPS and sensor system are also powered by this power supply.

iv) Central Control System: This is the heart of the monitoring system. It consists of microcontroller with appropriate interfacing with other devices. It performs all the control actions required for proper operation of all the system.

A. Basic Structure of System

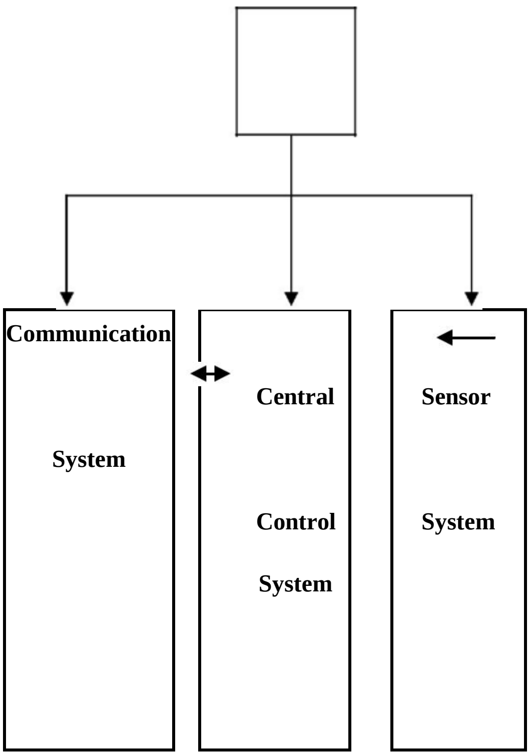

Fig. 1: Basic Structure of system

B. Structure of a unit

The unit is placed inside the vehicle to sense the fuel level at various time instances and it also tracks the vehicle with help of GPS. To achieve these things the system is equipped with reed switch sensors along with signal conditioning circuits and microprocessor as main building blocks of our system.

IV. PRELIMINARIES

This process has to deal with the message received from the GPS. The default communication parameters for NMEA (the used protocol) output are 9600 bps baud rate, 8 data bits, stop bit, and no parity. The message includes information messages as shown in Table 1.

i) Process I

The sequential behavior of the system appears in the flow chart of Figure 5. Initially, a flag C is cleared to indicate that there's no yet correct reception of data$GPRMC: **<time>,** <validity>, **<latitude>,** latitude hemisphere, **<longitude>,** longitude hemisphere, **<speed>,** <course over ground>, <date>, magnetic variation, checksum [5], [6].

$GPGGA, **<date>,** latitude, latitude hemisphere, longitude, longitude hemisphere, <GPS quality>, <# of satellites>, horizontal dilution, <altitude>, Geoidal height, DGPS data age, Differential reference, station Identity (ID), and check sum. This information is stored in memory for every position traversed. Finally and when the vehicle reaches its base station (BS), a large number of positions is downloaded to indicate the route covered by the vehicle during a time period and with a certain download speed.

TABLE I: The parameters sent by the GPS

NAME	Description
HPGGA	Global Positioning system fixed data
GPGLL	Geographic position-latitude/longitude
GPGSA	GNSS DOP and active satellites
GPGSV	GNSS satellites in view
GPRMC	Recommended minimum specific GNSS data
GPVTG	Course over ground and ground speed
GPMSS	Radio-beacon Signal-to-noise ratio, signal Strength
GPZDA	fPPS timing message (synchronized to PPS)

ii) Memory

The suggested memory blocks are addressed by a 12-bit address bus and stores 8-bit data elements.

This means that the memory can store up to 4 KB of data. The memory controller navigates the proper memory addressing. Multiplexers are distributed along with the controller to make the selection of the addressed memory location and do the corresponding operation.

iii) Communication Protocols:

The I2C bus is a serial, two-wire interface, popularly used in many systems because of its low overhead. It is used as the interface of process 1 and process 2 with the shared memory. It makes sure that only one process is active at a time, with good reliability in communication.

IV. PROPOSED SYSTEM

The proposed system is to determine the amount of fuel that has been stolen and also to determine whether the vehicle has been accessed by any unauthorized person using the technologies like GSM, Float level sensor and Wireless device with GPS Sensor. The float level sensor is used to calculate the height of the tank up to which the fuel is available. Based on height it is possible to calculate the amount of fuel. The GSM provides the periodic information about the fuel level.

A password is provided to access the fuel tank lever and this is authenticated only by the driver and the owner. Once if the fuel tank is opened an alert is sent to owner through a SMS including the timing details.

V.IMPLEMENTATION

A. Reed Switch Circuit

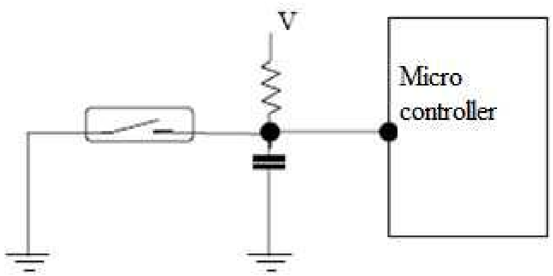

Fig. 3: Interfacing of Reed Switch to controller

A magnetic field (from an electromagnet or a permanent magnet) will cause the reeds to come together, thus completing an electrical circuit. The stiffness of the reeds causes them to separate, and open the circuit, when the magnetic field ceases. Another configuration contains a non-ferrous normally-closed contact that opens when the ferrous normally-open contact closes. Good electrical contact is assured by plating a thin layer of non-ferrous precious metal over the flat contact portions of the reeds; low-resistivity silver is more suitable than corrosion-resistant gold in the sealed envelope. There are also versions of reed switches with mercury "wetted" contacts. Such switches must be mounted in a particular orientation otherwise drops of mercury may bridge the contacts even when not activated [2].

VI. CONCLUSION AND FUTURE SCOPE

The proposed system will help us to fuel theft and unauthorized access of the vehicle to solve problem. Our system will periodically inform and vehicle access information on the fuel level. Hence the larceners results rather than the fuel or to the vehicle theft by chance in the situation and provide the overall protection. The messages are provided to the owner in relation to the fuel level in the vehicle in periodic manner.

VII. REFERENCES

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