ITGfdc-1, Fuel dispenser control system

ITGfdc-1 system provides fuel tanking only to specially marked vehicles as well as data acquisition of relevant fueling parameters by using RFID (Radio Frequency Identification) technology to identify vehicle, driver and other information about vehicle and it's owner. It can be applied to most of the existing fuel dispensers, from which system collects information about volume of tanked fuel.

The system prevents non-authorized fueling and provides secure and reliable administration of fueling procedure, thus minimizing human errors and saving time.

System is intended for several user categories:

a. Users which have their own gas station, like transport companies;
b. Gas stations which issue loyalty cards;
c. Gas stations with cashless payment;

Fueling scenario is defined according to user category and rules of operation.

System consist of vehicle identifier, driver's and pump attendant's ID cards, dispenser controller **ITGkp-02,** master computer and application software for monitoring fueling.
Vehicle identifier (RFID transponder) has disk shape (20mm diameter and 2mm thick) and has been mounted in appropriate way (Patent pending) near the fill pipe. Identifier has relevant data about vehicle, such as: license and/or garage number, fuel type which vehicle is using, etc. Identifier has its read/only ID number (32 bits long) and 256 bytes of EEPROM memory ("read-write" memory type).
Hitag-S RFID transponders are used as transponders throughout the system: vehicle identifier, driver identification cards (ID cards) and pump attendant ID card. Pump attendant is an option, as the system can be set up with unattended gas stations as well. All transponders are passive elements, without power supply, what minimize maintenance requirements.

Gas pump controller ITGkp-02 was developed as dedicated control/monitoring computer, based on microcontroller. It supports RFID transponder readers with several antennas, gas pump interface and communication channel to monitoring computer (standard PC). Antenna which is used to identify vehicle, is mounted on the dispensing nozzle spout and consists of inductor coil, passive electronic components, sealed in special material approved for use in hazard environments (Fig 1).
Antenna is connected to RFID reader with special cable. Second antenna is used to read driver's and pump attendant's ID cards. Antenna of the reader is placed behind glass, and it is unreachable from outside. Actually, antenna is placed in glass box of the gas pump, near counters (Figs 2 and 3). Reader controls antennas and pump operation like allowing/forbidding fueling as well as storing all relevant data in it's memory, such as:

- unique serial number of the driver ID card;
- unique serial number of the pump attendant ID card ;
- unique serial number of the vehicle identifier;
- fuel type and amount which has been tanked into vehicle;
- Date and time of the operation.

If during fueling pump nozzle is pulled out from vehicle filling pipe so that vehicle identifier disappears from identification's antenna field, fueling is aborted.

One possible scenario in which fueling will be allowed is:

- system has detected and read vehicle identifier
- system has detected and read driver's and pump attendant's ID cards
- having these parameters and current date and time, system has consulted Authorization Table and got approval to start fueling.

Authorization Table contains list of vehicle IDs, pump attendants and drivers IDs as well as time schedule of approved fueling. System administrator creates and updates the Authorization Table.
Cashless payment system (prepaid or postpaid) i.e. loyalty cards solution, with ITGfdc-1 provides high quality of service as well as safe and secure administration.

ITGkp-02 is connected to monitoring computer (IBM PC compatible) over RS232, RS485 or TCP/IP interface. Application software packet **ITG-TankControl** was developed using Microsoft tools. It is used to set up working parameters of the ITGkp-02, to create and update Authorization Table, to read log from controller and to generate
reports.

Step-by-step system operation:

- Driver drives his vehicle to the fuel station;
- Driver and pump attendant identify themselves with their ID cards, according to procedure set up by fuel station authorities;
- Pump attendant puts pump nozzle in vehicle filling pipe;
- Antenna is activated automatically (digital input determinates which antenna should be activated and which fuel type should be tanked) and starts looking for transponder in their own area;
- Transponder sends its serial number to antenna, which sends that number further to controller;
- Controller checks validity of the received serial number, controller writes that serial number in reader's memory;
- Transponders sends data from its memory (vehicle's license number, fuel type, etc.) to antenna, which sends them further to a reader;
- Controller checks received data and if they are valid (ID numbers of vehicle, driver and gas employee are in the Authorization Table), permits fueling and writes data with time and date in own memory;
- Fueling is done as long as vehicle ID transponder is within the range of antenna on pump nozzle spout, whereby driver's ID card is placed on identification place;
- When fueling is over, all parameters (transponder's serial number, amount of tanked fuel, time and date of beginning and ending of fueling) are written to controller ITGkp-02 memory;
- Pipe is set back on its place, digital input switches off the antenna;

All administration is paperless, considering that all parameters are kept in electronic form and are sent to computer of the authorization person.

If all parameters from transponder are invalid, or transponder is not mounted on the vehicle, or attempt of wrong type fueling is made, or fueling is not allowed for specific vehicle or driver and/or pump attendant do not have fueling permission, alarm is turned on (sound and light signal).
In accident situations, when for example fuel needs to be tanked into canister, burrell or into something similar, to be taken for field operation, a special (supervisor) card is used by an authorized person. Rules for supervisor card usage are determined by company.

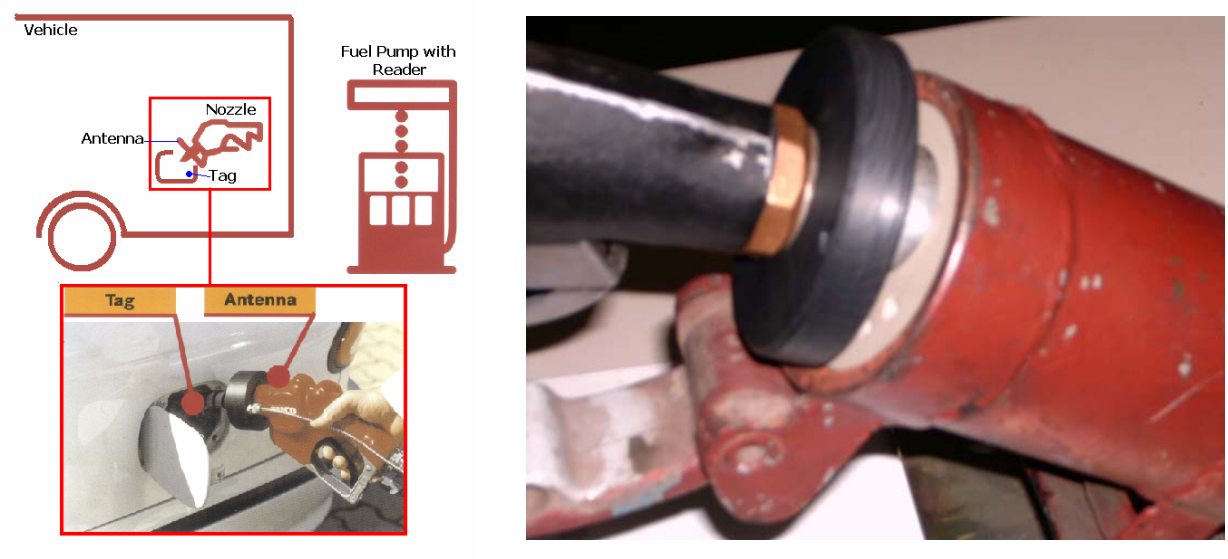

Fig. 1 ITGfdc-01 (Fuel Dispenser Control System)

Fig.2 Pump nozzle with antenna for vehicle identification

Fig. 3 ID card reader`s antenna

Fig. 4 Detailed view of ID card reader`s antenna

Fig 5. Gas station of the company JGSP"Novi Sad"