

UNIVERSIDAD TECNICA DEL NORTE
FACULTAD DE INGENIERIA EN CIENCIAS APLICADAS
CARRERA DE INGENIERIA EN MECATRONICA



TECHNICAL REPORT

TOPIC:

Digital touch taximeter with anti-theft security incorporated

Author: Esparza Echeverría Jefferson Andrés

Director: Ing. Milton Gavilánez

Ibarra-Ecuador

2013

Digital touch taximeter with anti-theft security incorporated

Jefferson Esparza

Universidad Técnica del Norte
Ibarra, Ecuador
jaee777@gmail.com

Abstract .-The taximeter of this project is a prototype device designed specifically for taxis transportation service, with the objective of determining the cost of a taxi transportation service, and is embedded with several features to protect the vehicle from theft. Designed with touch technology to reduce space, with a graphical user friendly software and upgradeable firmware, this taximeter goes along with technological advances.

This project is attached to a GPS TRACKER by which you can make traces to the vehicle, receive alerts such as: door opening, high speed, battery disconnect, panic button activation, others.

An extra anti-theft method provided the taximeter with their GPS TRACKER is the interruption of fuel motor supply, allowing turn off in case of theft, only sending a text message from a registered mobile number to GPS TRACKER.

I. INTRODUCTION Y BACKGROUND

In Ecuador the taximeter use was obligatory only for some cities, but currently the use of this device is ruled by National Transit Agency and its use is obligatory in all cities of Ecuador. [1]

This device is designed attempting to modernize the payment system for the taxi service, in addition to provide crime protection, today the drivers creates uncertainty because for criminals, because current security systems are known and some are decaying or obsolete hence are vulnerable, for this reason want to insert this new modern and reliable taximeter to cost control of service, turn off control and turn on control vehicle motor, which will consolidate the trust that the only activating the motor will owner.

II. DEVELOPMENT OF CONTENTS

A. Taximeter

1) Policy: The taximeter is a device obligatory use for drivers of taxis in Ecuador. Violation of this provision is a contravention in the Traffic and Road Safety Trucking law.

2) Operation: The taximeter calculates the cost of the race assigning a start value and & Rate, from the speed of the vehicle the device determines: if the speed is less than 12 km / h, the taximeter does not take into account the distance traveled, but take into account the time, this will be useful in high traffic situations, while the vehicle equals or exceeds the threshold of 12Km / h will fail to take into account the waiting time for start taking into account the distance traveled. [2]

3) Rates: The taximeter can calculate the cost according with two rates implemented in national transit agency of Ecuador, which are specified in Table I.

The schedules of rates are: daytime rate from 05:00 to 22:00 and the nightly rate from the (22:00 until 05:00)

TABLE I
Rates set for taxi service in Ecuador [3]

	Daytime	Nightly
Startup cost	35 ctvs.	40 ctvs.
Minute waiting	0.06 ctvs.	0.06 ctvs.
Km traveled	0,26 ctvs.	0.30 ctvs.
minimum cost taxi service	1 USD.	1.10 USD.

4) Safety: The taximeter has a security system that inhibits the ignition of the traditional way. The key don't activate the motor vehicle, which now will be the taximeter which requests a security key 4 digits before displaying a new option that allows you to turn on the vehicle with a simple click on the taximeter touch screen.

The four digits user password is modifiable through the password change option in the main taximeter menu.

Income consecutive three wrong keys will cause the system to lock up, hiding the option of starting the motor. To exit lock status the taximeter will request a "Master Key", which is a 6 digits password.

B. Taximeter technology

The taximeter is based on a microprocessor system, which makes decisions based on data input by the user, the vehicle through input devices like sensors gives orders to the output devices that decisions are visible, such as in the case of entering the correct password, you can start the motor of the vehicle, or when the system is locked, you can display a warning message.

This Microprocessor system has as central element a PIC 18F4550 which belongs to the high-definition Microchip family.

To complete the objectives of this project the hardware is connected such that exist interaction between all physical parts and microcontroller, each interaction can be one-way or two-way, because there are input devices, output devices or bidirectional devices.

In order to show graphically the parties that this system contains, There are summed in representative blocks of different stages and processes, the arrows show the direction of data flow, this represent the type of physical device, which can be input output or bidirectional flow.

An example of system input device is the vehicle speed sensor (VSS) which sends digital voltage signals to the microcontroller, this information is the distance traveled by the vehicle's front wheels.

A very important output device in this prototype of taximeter is the graphic display in which to display the information needed to manage this device.

A bidirectional data module is the GPS TRACKER, which can receive and send data using the same antenna; this is called bidirectional data flow.

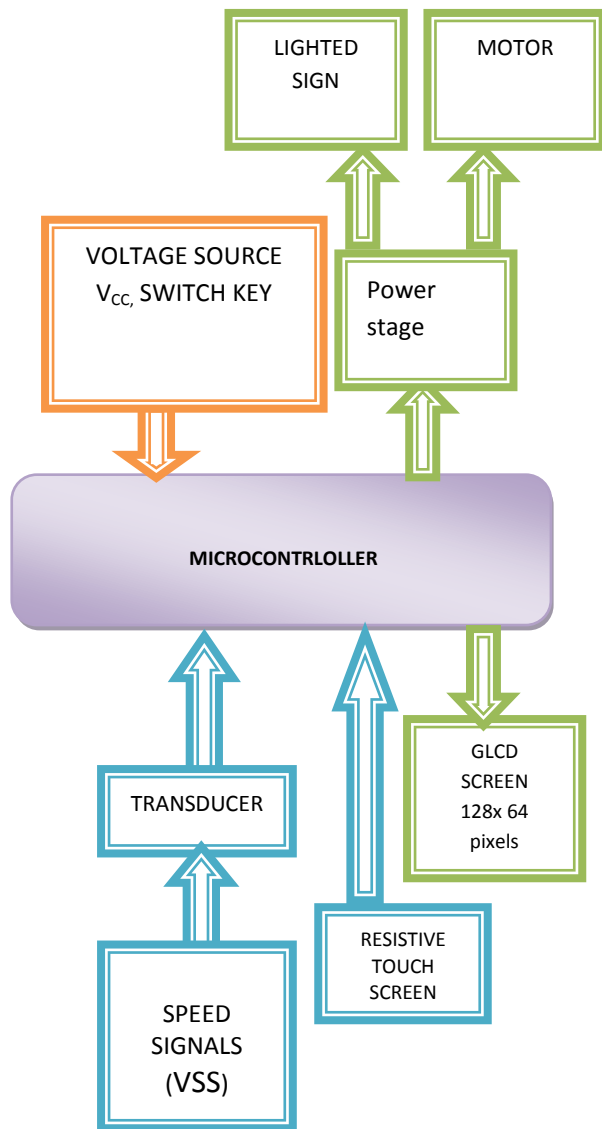


Fig. 1 Hardware interactions

C. GPS TRACKER

A module which the taximeter is coupled to complete the objectives of this project is GPS TRACKER module, which is responsible for determining the position of the vehicle using a satellite system GPS (Global positional system), and send this location through a GSM network (Global System for Mobile).

Another complement that the GPS TRACKER offer is the possibility of interrupt the vehicle fuel, this is an effective system to prevent the vehicle will theft.

To use the module functions will be necessary register 5 cell numbers authorized, next a 6-digit password which accompany all the commands to send via SMS (Short Message Service) to GPS Tracker.

To get the GPS position of the vehicle together with the doors sensors logic state, the battery backup switch, and the vehicle's ignition switch, the module requires one call from a registered cell phone, the module automatically end the call and send a SMS with the above information.

The shape of disable the fuel pump is send an SMS with the text Stop + USER KEY, immediately turn off the vehicle because the fuel don't flow. To active the fuel pump, will be necessary to send an SMS with the text Resume+ user key.

In the case of panic button alarm, door opening alarm, power failure alarm, the messages will be sent to all registered numbers in the Tracker, some alarm messages have a recurrence time. With the Tracker also can to listen what goes on inside the car.

D. Advantages of the taximeter

The meter has advantages over the traditional models because it is compatible with most vehicles automated or not in the world. However the taximeter software will remain unchanged, the difference looks on the odometer sensor connection and the signal transducer of which change from one vehicle to another.

Another advantage of the taximeter is to be coupled to any country, currency, and set tariffs, its useful to be installed anywhere in the world for taxi service.

The taximeter is manufactured by electronic elements ready, available and inexpensive, so it will be no problem servicing or maintenance.

The taximeter software can be customized, you can add more useful applications when driving the vehicle in which it is installed this device because it's very important to note that the "taximeter" is an application loaded in the device "taximeter" which has other functions such as system start-key, change key ignition, others.

Like most devices used today, it can adapt extra hardware elements which increase performance, simplifying some functions that the driver do manually as the lightly sign on the TAXI, speed limits, etc.

III. Installation Taximeter and GPS Tracker

The meter looks physically small, but its box can vary in shape and size to be adapted to either vehicle, however the screen size will not change.



Fig.2 Digital taximeter was installed in a Hyundai Accent 2010 car with digital odometer.

It's necessary to clarify that for each vehicle will require different signal transducers of speed and odometer system.



Fig.3 GPS TRACKER

The GPS TRACKER system seen Fig.3 had to be installed in an hidden place inside of the vehicle, the GPS antenna should be the side viewing to the sky, this will increase the signal quality, the GSM antenna may not be viewed sides, it depends on the signal percentage for sending and receiving data.

IV. Testing taximeter

The taximeter has software with various functions and set default access order, the taximeter functions are:

- Password input
- Change password
- Password Master input (if system lock)
- Ignition
- Start Taximeter application
- Career start
- Career pause
- Career continue
- Career reset
- Rate change

For each functions this prototype was tested with all combinations of possible situations, checking the quality of the security system and boot.

The "Taximeter" was submitted to the respective tests, which were corroborated by Google Earth software to simulate the vehicle travel during the career. In all of the tests gave satisfactory results in measures of distance and time for the taxi service. An example of these tests is the Fig 4.

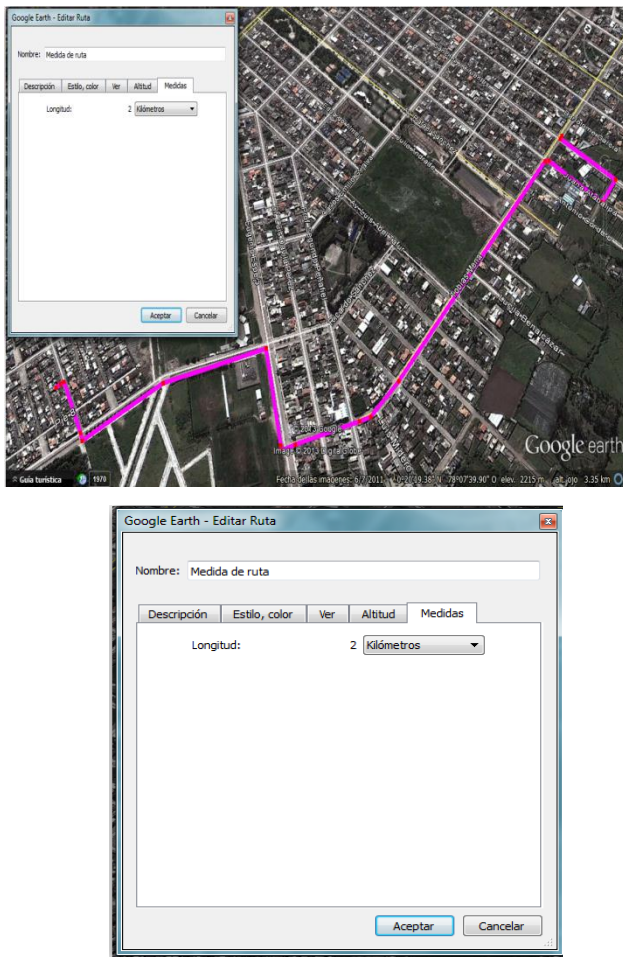


Fig. 4. Google earth route was traveled, and google Earth route measure. [4]

Table TAXIMETER values			
Start : Pílanquí, Calle de la Roca Finish: Tobías Mena y Sánchez y Cifuentes <i>The Google Earth route was traveled.</i>			
DISTANCE	TIME	RATE	COST
1.8 Km	00:02:59	Daily	0.99

TABLE II. TAXIMETER Fig. 4 values [5]

In this test the Google Earth distance was 2Km, this distance measurement by a small differs from the calculated distance to the taximeter, this is because the meter calculates the distance more than 12 Km / h, so that distance will be less than the total distance traveled.

In Ecuador any daily career in which the indicated cost in the taximeter is lower or equal to 99 cents. The cost to pay to be the minimum established on the transit law, mean one dollar, and if the taximeter cost is lower or equal to 1,09 USD the cost to pay will be 1,10 USD according with the TABLE II values.

To be sure of taximeter calibration this device was submitted to ten tests in Ibarra city, in which shown the exactly cost for each career.

V. GPS TRACKER Test

Like taximeter, The GPS Tracker was tested.

- Location test
- Alarm test
- Fuel lock test
- Panic button test
- Voice monitor test

In each test proved efficiency and reliability. The max error was less than 50 meter radius, which allows effective location of the vehicle in any case.

In 100% of the time the message alarm was received, was tested all GPS alarms.

Locking fuel and voice monitor mode operated correctly for all cases, and then the vehicle is anti theft.

VI. Conclusions

To use touch technology and graphical interface simplifies to use electronic devices such as the taximeter, being more intuitive operation and going on par with the new age of technology.

This project has a strong security method for automobile when turn on, because the password is required in the system and only the owner of the vehicle know them, this prevent someone can turn on the car.

The taximeter is very competitive because it offers more features than other ones on the market and has better cost to other taximeters currently.

VII. Recommendations

This Article is proposed as bibliographic material for other micro processed automobile systems.

This project can be supplemented or expanding with a billing system using a printer or other billing system physical or virtual.

REFERENCIAS

[1] ASAMBLEA_CONSTITUYENTE. (2011). *Ley Orgánica de Transporte Terrestre, Tránsito y Seguridad Vial*.

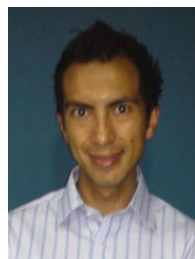
[2] Toscano, F. C. (7 de 12 de 2011). *El telegrafo*. Recuperado el 15 de 12 de 2012, de http://www.telegrafo.com.ec/?option=com_zoo&task=item&item_id=22994&Itemid=14

[3] Consejo Nacional de Tránsito y Transporte Terrestre del Ecuador. (2003). Resolución N° 001, (Art. 1, literal 1).

[4] Google Earth

[5] Value obtains of "taximeter" application

AUTHOR



Jefferson Andrés
Esparza Echeverría

Was born on December 3, 1987
Ibarra, Ecuador.

Studied Physics - Mathematics at
San Francisco high school.

Current Studies at "Universidad Técnica del Norte"
in Mechatronics Engineering.