Android Based Smart Metering System

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***Abstract*—In the public transport system, the use of this system can be employed for not only cross checking the meter reading, hence guiding the passengers but also fight against corruption and malpractices in the society. In this paper we outline this proposed system for social benefits of all with the basic idea of its contribution in public transport**.

Keywords: Tampered, Meter, Microcontroller, Bluetooth.

I. INTRODUCTION

An auto rickshaw or taxis are vehicles for hire, and it is one of the chief modes of transport in India. A large number of people use these vehicles for their daily transportation and every time they pay extra amount as fare because there is no check on the reading of meter available. Hence, it is necessary that we should have something that can cross check the reading of the meter and guide us the right fare amount. Initially analog meters were used to calculate the fare in auto rickshaws and taxis but as we know that it is easy to tamper analog meter by changing the gears ratio, they are getting replaced by digital meters.[1]

Fig. 1: Digital meter

Fig 1. Showing the digital meter says that in the digital meters, the calculation of fare amount is calculated on the basis of number of wheel rotations of the vehicle. There is no such system available which can check whether the calculation shown by the meter is correct or not. If the driver has tampered the meter, the fare amount shown will be high. But as no facility to cross check the meter readingisavailable, the passengers are forced to pay the extra money. The digital meter which have been used, uses electricity to determine how far you have traveled. This is done with the help of the car's transducer cable which contains a sensor that provides data to the speedometer and odometer. It sends a pulse to the meter at specified distance intervals, such as a half-mile. When the taxi meter is installed, an engineer drives the car a perfectly measured mile to teach it how to record distance correctly.The meter measures time in precisely the same manner, receiving pulses at specific intervals, such as every two seconds. This is how you get charged for time spent waiting in traffic or for quick stops where the driver sits idle. [1]

If distancepulses willoutnumber the time pulses, such as when you are moving at a decent speed, the meter counts these as dominant and charges the rate per mile or fraction of a mile. If the time pulses outnumber the distance pulses, the meter knows to calculate this part of your travel at the "waiting" rate, if applicable. The calculation of fare amount is calculated on the basis of number of wheel rotations of the vehicle. There is no such system available which can check whether the calculation shown by the meter is correct or not.

This proposed system will have a circuit inbuilt in the existing meter and will send the count of wheel rotation on Bluetooth frequency with the help of Bluetooth modem. This data can be received on the mobile of passenger after pairing their mobile with the Bluetooth device of the meter with the help of the meter id printed on the meter.

Already, day by day prices of the commodities are on sky high. The common man is working very hard to run his house, saving his expenses for future need, and under this extreme condition common man sheds extra money because of tampering of the meter,whichgives rise to corruption and malpractices in the society. Corruption is already one of the biggest problems faced.

This paper is structured as follow, Section 1 introduces the paper, Section 2 explains the working of the meter, Section 3 is about proposed system, section 4 explains block diagram, Section 5 explains flowchart,

and Section6 is about future modification, Section 7 concludes the paper.

II. WORKING OF METER

2.1 Measures distance

The meter uses electricity to determine how far you have travelled. This is done with the help of the car's transducer cable which contains a sensor that provides data to the speedometer and odometer. It sends a pulse to the meter at specified distance intervals, such as a half-mile. When the taxi meter is installed, an engineer drives the car a perfectly measured mile to teach it how to record distance correctly. [2]

2.2 Measures time

The meter measures time in precisely the same manner, receiving pulses at specific intervals, such as every two seconds. This is how you get charged for time spent waiting in traffic or for quick stops where the driver sits idle. [2]

2.3 Discerns between rates

If distance pulses outnumber the time pulses, such as when you are moving at a decent speed, the meter counts these as dominant and charges the rate per mile or fraction of a mile. If the time pulses outnumber the distance pulses, the meter knows to calculate this part of your travel at the "waiting" rate, if applicable.[2]

2.4 Determines the price

The meter tabulates the price and displays it in real time. You can watch how it steadily increases during the course of your ride. The final price will be the total after all tabulations are made and the cab stops. This is the amount the driver will ask you to pay. ([1], [2])

2.5 Preset cost information

The prices are programmed into the meter. Drivers have their meter tested and calibrated to ensure they charge the amount set by the Cab Company or local regulations. Totals can include taxes and any preset minimumtripcharges. [2]

III. PROPOSED SYSTEM

Bluetooth is a specification (IEEE 802.15.1) for the use of low-power radio communications to link phones, computers and other network devices over short distances without wires. The name Bluetooth is borrowed from Harald Bluetooth, a king in Denmark more than 1,000 years ago.Bluetooth networks feature a dynamic topology called a piconet or PAN. Piconetscontain a minimum of two and a maximum of eight Bluetooth peer devices. Devices communicate using protocols that are part of the Bluetooth Specification.[3]

Bluetooth is a wireless communication protocol mainly used for short distance and in devices with low power consumption. Because Bluetooth is capable of communicating in an Omni-directional manner of up to 30 feet at 1 Mb/s it is far superior to infrared. Where infrared requires a distance of a few feet or less and requires a direct line of site for transmissions. Wi-Fi typically can transmit up to 300 feet at 11 Mb/s. Bluetooth was developed for small data transfers and/or voice communications, this makes it an excellent candidate for peripherals devices such as wireless microphones, headsets, mouse, and keyboards and of course mobile handsets. Wi-Fi in general was developed to transmit large amounts of data and to serve as an extension of an existing network such as LAN. [3]

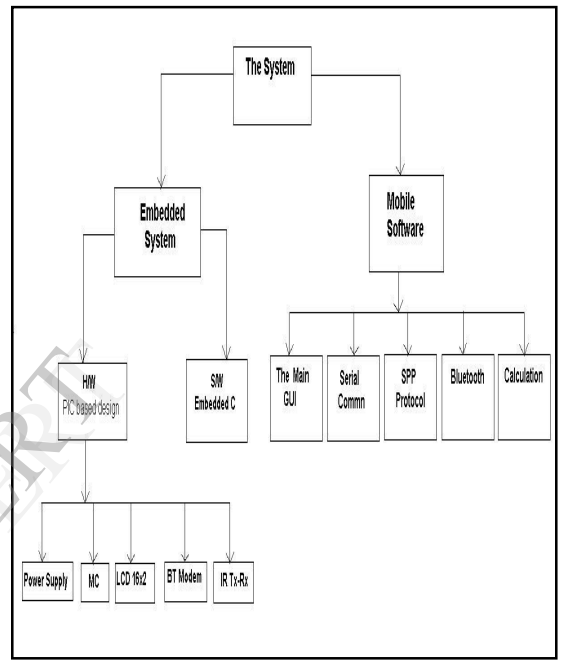

Fig. 2: Illustrating the division of the proposed system

The Bluetooth modem used in this project is WT12.WT12 is a next-generation, class 2, Bluetooth 2.0+EDR (enhanced Data Rates) module.WT12 is a highly integrated and sophisticated Bluetooth module, Containing all the necessary elements from Bluetooth radio to antenna and a fully implemented protocol stack. By default WT12 module is equipped with powerful and easy-to-use iWRAP firmware. iWRAp enables users to access Bluetooth functionality with simple ASCII commands delivered to the module over serial interface-it's just like a Bluetooth modem.[3]

This proposed system will have a circuit inbuilt in the existing meter and will send the count of wheel rotation on Bluetooth frequency with the help of Bluetooth modem. Bluetooth modem is a device that acts as mediator between any embedded system and the Bluetooth communication medium. It has built-In protocol for serial communication i.e. serial port profile.This data can be received on the mobile of passenger after pairing their mobile with the Bluetooth de-

vice of the meter withthehelp of meter id printed on meter [3]
The software in the mobile will calculate the fare amount on the basis of the data received by the meter. Now passenger can cross check the fare amount between mobile reading and the meter reading.
The software will display the meter reading. LCD will provide interactive user interface. This block requires +5V DC for its proper operation. If there is difference then one can easily point out that there is tampering in meter. The passenger will pay as per mobile reading only.

IV. BLOCK DIAGRAM

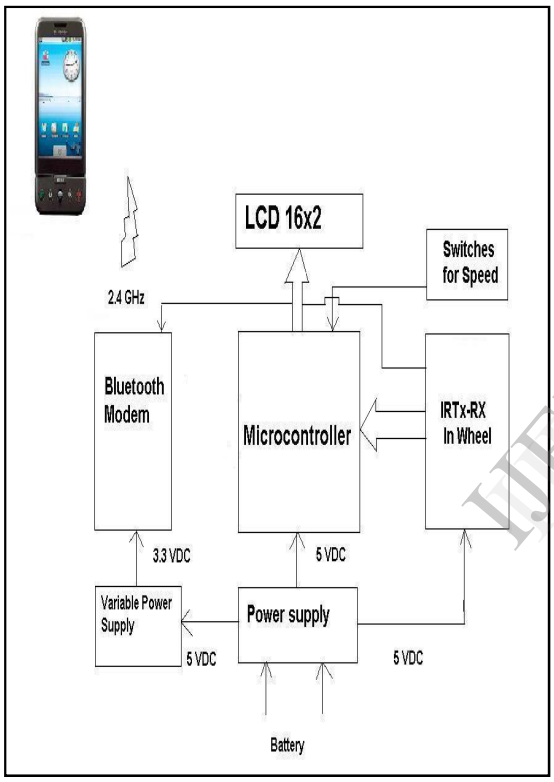

Fig. 3: Block diagram of the proposed system

4.1 Power supply
The power supply block will supply the required voltage to different sections. It will convert 9V DC from the batteries to 5V DC required for the operation of various sections. It will provide5V to PIC controller; IR TX & RX & LCD and the Variable power supply will receive 5V DC voltage from the power supply and provide 3.3 V DC voltages to the Bluetooth modem

4.2 IR Tx and Rx
IR Tx is basically infrared transmitter that emits light in the range of 10^-6 – 10^-3 wavelength (m). This light is not visible by human eye. This block requires +1.5 VDC for its operation.
IR receiver is nothing but a photodiode that break down the diode junction when exposed to IR rays. This block requires +1.5 VDC for its operation.IR Tx& Rx will generate pulses on the rotation of wheels which will be given to the Bluetooth modem and microcontroller

4.3 Microcontroller
This block is the heart of the complete system. It is actually responsible for all the process being executed. It will monitor & control all the peripheral devices or components connected in the system. In short we can say that the complete intelligence of the project resides in the software code embedded in the microcontroller. The controller here used will be of PIC 16FXXX family. The code will be written in Embedded C and will be burned or programmed into the code memory using a programmer. This block requires +5V DC for its proper operation. It will simulate the pulses received from the IR Tx& Rx and provide the meter reading to the LCD display. ([4], [5])

4.4 Bluetooth Modem
Bluetooth modem is a device that acts as mediator between any embedded system and the Bluetooth communication medium. It has built-In protocol for serial communication i.e. serial port profile. This block requires +3.3 VDC for its proper operation. It will transmit the pulses to the mobile at 2.4 GHz for further simulation

4.5 LCD Display
It is called Liquid crystal display. It is 16x2 characters LCD. It is connected to microcontroller. It will display the meter reading. LCD will provide interactive user interface. This block requires +5V DC for its proper operation.

4.6 Switches
Switches are used for demonstration purpose. Four switches are connected to microcontroller. Speed of incrementing the meter reading will vary according to switch position. Thus switches are basically used to tamper the meter.

4.7 Mobile
The mobile must have the following features-
Bluetooth
JAVA
It will receive the pulses from the Bluetooth modem. The code written in J2ME will simulate the pulses and mobile will display the meter reading. ([6], [7])

V. FLOWCHART

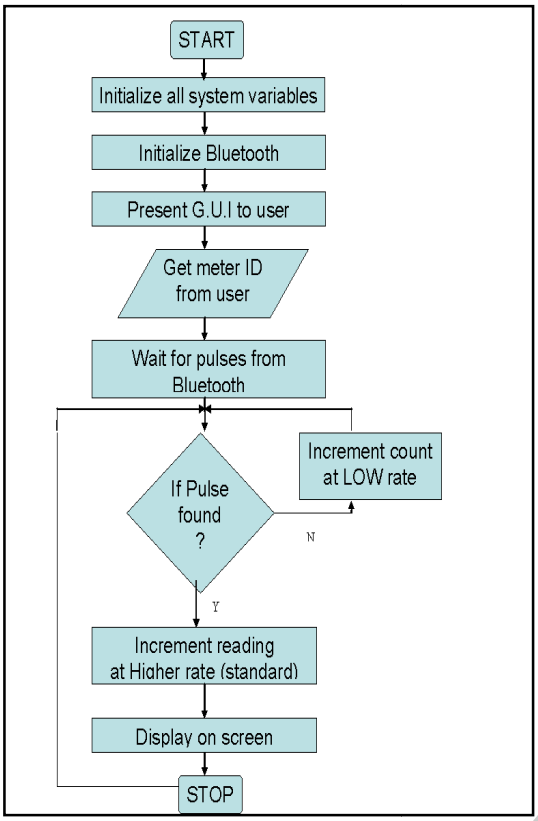

Fig. 4: Flowchart

Fig. 4 shows the flowchart of the fare share system. It explains the basic flow of operation in the proposed system in the systematic manner.
The user will first pair his Bluetooth of the phone with that of the meter, then wait for the pulses from the Bluetooth. If the pulse is found then the reading will be displayed on the screen of the mobile phone of the user, the user then can compare the amount displayed on the screen of the mobile with that of the meter ,if any difference in the amount has been noticed then it can be pointed that the meter has been tempered.

VII. FUTURE MODIFICATION

There is always chance to improve the any system as research & development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done
1) Automatic complains launching for tampered meter can be introduced.
2) FARE chart can be integrated.
3) Software needs to be upgraded when fare rates are changed.
4) The number plate of the vehicle can be feed on the screen of the mobile; this will help to track the vehicle, in case of any mishap.

VII. CONCLUSION

After studying the basic concept of the project with the help of its block diagram and flowchart, It therefore can be concluded that the implementation of the proposed system benefit the common man, who works very hard to earn money, but due to such malpractices he sheds extra money, which can be used for other beneficial purposes.
The proposed system will provide the facility to cross check the meter reading and the tampered meter can be found out. Most importantly it will reduces the burden of paying unnecessary extra fares on the middle class. It is very Simple to use and also less expensive. Compatible with any Bluetooth mobile. As the system is easy to use even a lay man can verify the meter reading and pay appropriately.

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