Prepaid Toll Collection Using Barcode Reader

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ABSTRACT: This is an Automated Toll Collection system used to collect the road tax amount automatically.Barcode tags or stickers contain user's information and bank account details. When the vehicle passes the toll booth with the Automatic Toll Collection lane, then a certain amount of balance is deducted from the user's account automatically. The user need not stop his/her vehicle for this process. This system does not allow the passage of unauthorized vehicles and the vehicle is trapped. As the vehicles do not have to wait in the queue for the transaction, large amounts of fuel can be conserved by using this intelligent system. We are making the use of a concept called SoftPLC for controlling the process. SoftPLC is a software-PLC which makes use of the TWINCAT(Beckhoff Automation Pvt. Ltd.) programming system.

KEYWORDS: Automatic Toll Collection, Barcode Tag, SoftPLC, TWINCAT

I. INTRODUCTION

The main objective of this project is reduce the fuel consumption at the toll booths. The idea behind implementing Prepaid Toll Collection Using Barcode Reader is to automate the process of toll collection and decrease the illegal collection of money in the name of road tax. The barcode scanner which is going to be placed at the toll booth will scan the barcode sticker stuck on the vehicle. The vehicle need not stop during this process, hence reducing the queue and ultimately conserving fuel. The user should recharge his/her account according to his/her usage of the highways. For controlling the smooth functioning, the softPLC from Beckhoff Automation Pvt. Ltd. is used.

II. EXISTING SYSTEM

The system currently in use is the traditional toll collection system i.e. the manual toll collection system. Whereas in the metro cities, RFID technology is used.[1]RFID is an automated data-capture technology that can be used to electronically identify, track, and store instruction involved on a tag. A radio frequency reader scans the tag for data and sends the information to a database, which stores the data contained on the tag. The main technology components of a Radio Frequency Identification system are the tag, reader, and database. But there are certain disadvantages of the RFID technology, the ability to withstand the weather conditions is less. The cost of the RFID is comparatively higher than the barcode stickers. During heavy rains or snowfall
the Radio Frequency may go through various interruptions. The hacking of the RFID tags is easier. During heavy traffic conditions, if there are large amount of tags in the vicinity then there might a occur error as to which tag is to be scanned or read.Hence to overcome these disadvantages the use of barcode technology is made. The barcode system uses the laser technology for scanning and reading the data.
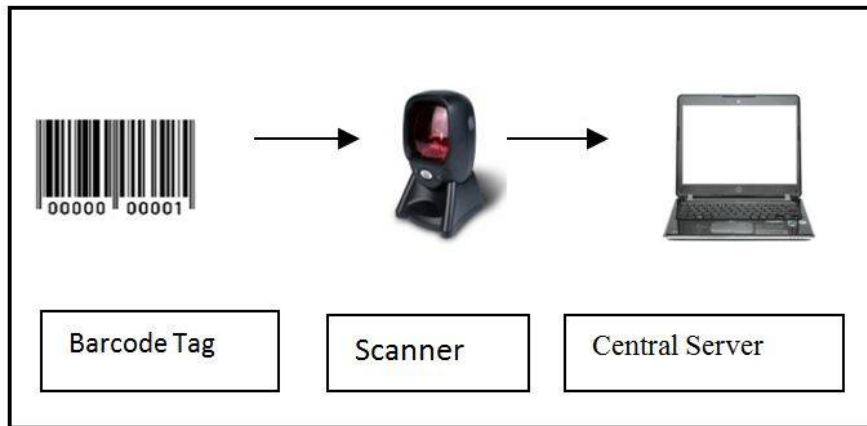
III. GENERAL SYSTEM

Fig-1: Basic Barcode Toll Collection System

A barcode is a series of parallel black bars and white spaces, both of varying widths. [2]The barcode simply provides a reference number that tells a computer to access information. A barcode reader is required to read a barcode. Barcode readers may be fixed, portable batch, or portable RF. Fixed readers are attached to a host computer and terminal, and transmit one item at a time as the data is scanned. Barcodes are simple to use, accurate, and quick.

a. Barcode Tag

A [3]barcode is an optical, machine readable, representation of data; the data usually describes something about the object that carries the barcode. Originally barcodes systematically represented data by varying the widths and spacing of parallel lines, and may be referred to as linear or one-dimensional (1D). Later two-dimensional (2D) codes were developed, using rectangles, dots, hexagons and other geometric patterns in two dimensions, usually called barcodes although they do not use bars as such.
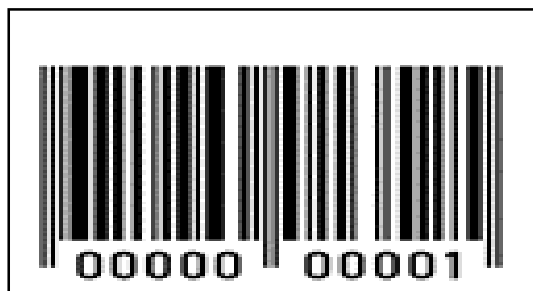

Fig-2:Barcode Sticker

b. Barcode Scanner

A barcode reader (or barcode scanner) is an electronic device that can read and output printed barcodes to a computer. Like a flatbed scanner, it consists of a light source, a lens and a light sensor translating optical impulses into electrical ones. OmniDirectional scanners have additional mirrors and other reflective devices to transform one laser line into many, all at different angles. OmniDirectional scanners provide faster scan rates with less aiming due to their wider reading areas and hands-free operation.

Fig-3: Omni Directional Barcode Scanner

c.   Central Server

A server is a computer program or a device that provides functionality for other programs or devices. The database of all the users or the clients will be stored in the central server. The database is created using the TWINCAT3 software. The amount will be deducted from respective users and they will be notified about it via a Short Message Service (SMS). If user has insufficient balance then the user is notified with a warning message and the user can use the online recharge portal or he/can use the manual toll collection lane. The central server is holds and stores all the necessary information like the user's name, address, mobile numbers, bank account details and the vehicle type.

IV.WORKING

When the vehicle enters the toll plaza, the barcode scanner placed in the barrier reads the barcode and it retrieves information and deducts the toll amount from owner'saccount (which is stored in the database). If there is insufficient balance in the owner's account even then the vehicle is not trapped as the barrier remains open, but a warning email or an SMS will be sent to the owner. If the owner does not recharge his/her account then a certain amount of fine will be imposed on the user and it will be deducted from his/her next transaction.The server checks whether the vehicle is an authorized user or not. If it is an unauthorized user then thebarrier is shut and the vehicle is trapped. The user can pay the toll mount manually and also has to pay a fine for breaking the lane. The registered owners have the barcode embedded in their vehicles at a specific height from ground.The barcode reader is placed on the barrier and it is connected to Central Server (backend database). The TWINCAT Software connects barcode reader and the Central server and the data coming from the tags stored in backend database. The TWINCAT Software provides the flow of information between the reader and backend database of central server. By using the TWINCAT software we can program any windows laptop to act as a PLC (Programmable Logic Device) which enables the smooth functioning.

3.   PLC

A programmable logic controller, PLC, or [4] programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines.PLCs are designed for multiple arrangements of digital and analog inputs and outputs, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact.

Many industrial processes have timescales easily addressed by millisecond response times, modern (fast, small, reliable) electronics greatly facilitate building reliable controllers, especially because performance can be traded off for reliability.
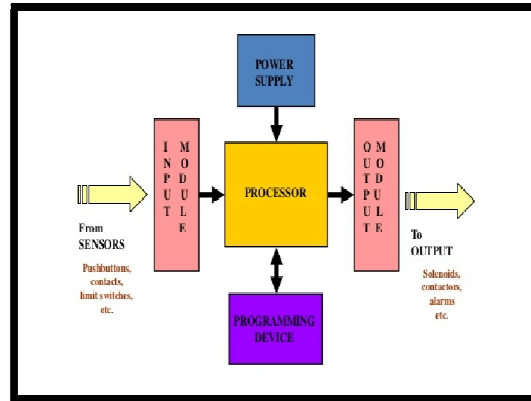
Fig 4.1: PLC Block Diagram

aTWINCAT

[5]TWINCAT3 is starting a new era for PC based control software. Nearly every kind of control application is possible with TWINCAT. Everything can automated using TWINCAT. The user can access different programming languages to implement the applications. With the programming done on the TWINCAT software, the application can be controlled. A Beckhoff controller (CX5020) is used as an interface between the SoftPLC and the motor which controls the lifting barrier.

System RequirementsSoftware: TWINCAT3

OS: Windows

Beckhoff Controller: CX 5020Language for Development: Ladder Logic, Structured Text

Barcode Scanner: TVS 301 Platina

cBenefits

1] The system does not require vehicles to stop whereas manual toll collection wastes time and raises

1] Vehicle operating costs.

2]Less operating complexity

3]The ability to make payments without using cash manually.

4] Smart Transportation.

5]Fast execution.

6]Electronic money transaction.

V. CONCLUSION

In this system, the Laser Barcode technology is used as a type of ETC system. Barcode is not a replacement for the RFID system but it a technology offering various benefits. Barcode technology can provide new capabilities as well as an efficient method to collect, manage, store, and analyse information. It is a completely automated process which rules out the manual intervention thereby reducing the errors. Barcode technology is an intelligent technology which leads to low operational costs and increased revenue.

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